International Conference on Technology in Education (ICTE 2018)
Hong Kong, January 2018
Proceedings
Jeanne Lam  Kam Cheong Li
Kim Mak  Fu Lee Wang
Kat Leung  Ivan Ka-wai Lai (Eds.)

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Technology in Education (ICTE 2018)
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Editors

Jeanne Lam  
HKU School of Professional and Continuing Education  
Hong Kong  
E-mail: jeanne.lam@hkuspace.hku.hk

Kam Cheong Li  
The Open University of Hong Kong  
Hong Kong  
E-mail: kcli@ouhk.edu.hk

Kim Mak  
Caritas Institute of Higher Education  
Hong Kong  
E-mail: kimmak@cihe.edu.hk

Fu Lee Wang  
Caritas Institute of Higher Education  
Hong Kong  
E-mail: pwang@cihe.edu.hk

Kat Leung  
Caritas Institute of Higher Education  
Hong Kong  
E-mail: kleung@cihe.edu.hk

Ivan Ka-wai Lai  
City University of Macau  
Macau  
E-mail: ivanlai@cityu.mo
Preface

We are pleased to publish the Proceedings of the 2018 International Conference on Technology in Education (ICTE 2018). Technology now plays a pivotal role in planning, implementing and evaluating education, covering broadly areas of curriculum design, pedagogy, assessment and learner support, as well as administration. For advances in education, it is important that we identify ways of employing technology and analyse effective practices through research. ICTE 2018 aims to work with paper authors to contribute to educational advances through sharing, and this book serves as a record of our sharing at the Conference.

The papers accepted for the Conference have been grouped under the following themes:

- Pedagogy, design, learning experience and learning engagement in blended learning
- Gamification, virtual reality and augmented reality in teaching and learning
- Mobile learning and ubiquitous learning
- Issues in e-learning: environment, assessment, evaluation and learning analytics
- Blended learning in practice
- Flipped classroom, future classroom and using social media in teaching and learning
- Massive open online courses and online educational resources
- Learning systems and educational administration through technology

In this volume, the papers are presented under the above themes. In addition, there were four keynote speeches at the Conference, which are included as the first section.

We extend our sincere thanks to members of the Programme Committee for their diligent and meticulous efforts in reviewing the papers submitted to the Conference. Grateful thanks also go to the ICTE 2018 Organizing Committee, especially Prof. Philips Wang and Dr Wai Shing Ho, for its help throughout the process of preparing this publication.

January 2018

Jeanne Lam
Kam Cheong Li
Kim Mak
Fu Lee Wang
Kat Leung
Ivan Ka-wai Lai
Acknowledgement

The Keynote Speeches in this Conference are part of a 3-year project ‘Development of Effective Pedagogical Practices and a Cross-institutional Online Sharing Platform for Hong Kong’s Vocational Education and Training (VET)’ funded by the Quality Enhancement Support Scheme (QESS). This project is a collaborative effort of Vocational Training Council (VTC), The Open University of Hong Kong (OUHK), Caritas Institute of Higher Education (CIHE) and Caritas Bianchi College of Careers (CBCC) with an aim to bring closer alignment of vocational and professional education and training (VPET) services to the industries. Adopting the concept of Open Educational Resources (OER), the deliverables of this cross-institutional project include 1) a series of teaching and learning packages from selected vocational modules to cater for the learning needs of students, teachers and workplace mentors, 2) an online learning and teaching platform to share teaching and learning packages exemplars, and 3) continuous professional development programmes and training to equip stakeholders with updated pedagogical strategies. For details of the Project, please visit https://vpetcity.vtc.edu.hk.

Hong Kong Pei Hua Education Foundation provides sponsorship to support Chinese scholars to attend this Conference. The generous sponsorship has been used to invite renowned Chinese scholars to join our conference as invited speakers, so that they can share their research experience and good practices with conference participants. Financial assistance is also provided to young Chinese scholars and postgraduate students to attend our conference, so that they can get the latest research information and exchange research ideas with other participants. For more information of the Foundation, please visit http://www.hkpeihua.com.hk/.
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Using Online Program Management Solutions for Delivering Quality Academic Programmes

Kai S. KOONG

Andrew F. Brimmer College of Business and Information Science, Tuskegee University, USA.

Abstract. An increasing number of universities are using Online Program Management (OPM) solutions to deliver education programs. OPM solutions are an integrated suite of online services that support university leaders, faculty, staff and students in the delivery of educational program offerings. Online Program Management has no boundaries as students from any geographical location can be recruited. This is a lucrative opportunity for tradition rich and geographically restricted campuses and programs needing accelerated numerical growth to engage. Solution components are offered in the form of a fully integrated system approach to online program management comprising of core services delivered under the brand of the university partners. Such services may include, but are not limited to, online enablement, academic services, marketing services, enrollment services, legal compliances (accreditation and multi-state or national certifications) retention services, faculty and other personnel support, program financing, and most recently data science and analytics support. Typically, Online Program Management companies market their solutions/partnerships as capable of helping universities launch, grow, and sustain quality degree programs within a short time period. Typically, the costs can range from 45 to 80 percent of tuition revenue generated from student enrollment and the average contract range is 5 to 7 years, depending on the vendors and the array of services selected.

As expected, cases of successful as well as failed partnerships have been reported in the literature and there are many lessons that can be learned from these joint ventures. Apart from providing sufficient insight about this growing practice in higher education, this keynote addresses strategic, tactical, and operational issues that administrators, faculty, and students must understand when using Online Program Management Solutions to launch, grow, and sustain degree programs. Specifically, this presentation based on several high profile cases will 1) demonstrate the necessities of having critical success factors and detailed preparations, 2) showcase best practices that have generated revenue, and 3) highlight costly mistakes and consequences that took years to remedy.

University administrators contemplating OPMs as a means of support, faculty members who are developing programs and courses for online delivery, and prospective students looking for quality degree programs online will find this keynote useful and interesting.
Deploying Peer-learning Community as the Pedagogy: Critical Success Factors for Bangkok Metropolitan Administration’ Schools

Kongkiti PHUSAVAT
Department of Industrial Engineering, Kasetsart University in Bangkok, Thailand.

Abstract. The study aims to identify the critical success factors for adapting Peer-learning Community (PLC). PLC represents one of several changes in the pedagogical practices for the secondary-level schools at Bangkok Metropolitan Administration (BMA). The initial assessment shows that PLC has improved the life skills for the students as well as has raised the level of students’ enthusiasm. The study is based on the observation over the period of 3 years from 2015 until the present. Three schools under BMA’s Department of Education decided to integrate PLC as part of the students’ problem-based learning. The teachers and students from these three schools have used the environment and ecology as the main premise on applying PLC. This premise represents how students view the environment and ecology nearby their schools and in their communities. The theme allows the students to learn either how to solve the environmental problems or how to live with their environment in a more sustainable way. As earlier mentioned, PLC is applied to help strengthen the pedagogy in the environmental and ecological subject. The success factors in PLC stems from external knowledge to give the actual illustration of PLC, careful planning with student’s involvement and the theme for projects or problems for students, the ability to sustain the motivation among teachers and students, use of ICT, and patience and trust. PLC does not only contribute positively to teachers but also stimulates students in a way that they feel that they have achieved in acquiring these life skills. Due to the success, these teachers have extended their experiences and are working with ten schools extensively outside Bangkok.
Learning Behavior and Interactive Pattern Analysis-
Methodologies, Tools and Practices

Gwo-Jen HWANG
College of Liberal Arts and Social Sciences,
National Taiwan University of Science and Technology, Taiwan.

Abstract. Learning analytics refers to the analysis and interpretation of data related to learners’ behaviors, interactive content and learning contexts recorded during learning process as well as their profiles and portfolios. The objective of learning analytics is to provide helpful information to optimize or improve learning designs, learning outcomes and learning environments based on the analysis results. In this talk, Prof. Hwang would review the current states of learning analytics research and the design considerations. To this end, the methodologies and tools for analyzing students’ online learning behavioral patterns and interactive patterns are introduced. Several relevant applications are presented to show how the methodologies and tools work. It is expected that this talk can inspire researchers to discover potential research issues of e-learning or blended learning and to apply the methodologies and tools to their studies in the future.
Five Principles of MOOC Design and Development: Lessons from Two MOOCs

Jianli JIAO
School of Information Technology in Education,
South China Normal University, Guangzhou, China.

Abstract. The Massive Open Online Course (MOOC) has been the latest disruption in online education and one of the fastest-growing segments of the education system in past ten years. It delivers open educational resources online and hence provides opportunity for people all over the world to learn anything they want to learn, anytime, anywhere. However, although MOOCs are gaining popularity in higher education, very few best practices or research in designing, developing and implementing MOOCs have been reported so far. This status quo makes it difficult for educators, course designers, and university administrators to make decisions around MOOC design and deployment given the lack of references.

Since April of 2016, the speaker and his team have provided K-12 teachers with two MOOCs: “English Teaching and the Internet” and “ICT Teaching Competencies for 21st Century Teachers: Big Five”. More than 50,000 learners have registered and participated in these two MOOCs. In the keynote speech, the speaker will report his work on the design, development and implementation of these two MOOCs, and share lessons he and his team learned from them. Based on learner needs, as well as a set of best practices in implementing the courses with a variety of instructional techniques supported with Web 2.0 technologies, he will propose five principles for MOOC developers and instructors. The principles cover aspects of Iterating, Engaging, Peer-coaching, Social, and Mixed.
In-game Card as Educational Reward (ICER) Moodle Plug-in: A Pilot Study

Rita KUO 1, Maiga CHANG 2, Cheng-Li CHEN 3

1 Department of Computer Science and Engineering, New Mexico Institute of Mining and Technology, USA
2,3 School of Computing and Information System, Athabasca University, Canada

Abstract. Reward plays an important role for engaging students in learning in traditional classroom. The research team has designed a Trading Card Game and uses the cards in the game as educational rewards to make the rewards more attractive to students. To ease and reduce teachers’ workload in giving students rewards, the research team designs the In-game Card as Education Reward (ICER) plug-in for Moodle. Teachers are able and only need to pre-define the criteria for awarding students based on their performance in Moodle. Moreover, the research team has conducted a pilot to understand the acceptance that teachers have toward the use of the plug-in in Moodle in a hands-on workshop jointly held in an advanced learning technology conference. The pilot shows that most of the participants believe that rewards can get students motivated in doing learning activities. In addition, participants who have used Moodle before believe that students can easily learn how to use the plug-in.

Keywords: Motivation, Learning Management System, Trading Card Game, Educational Game

1 Introduction

Rewards can positively affect students’ learning performance (Winefield & Barnett, 1984). Researchers have proved that giving rewards when students having good performance in the learning activities does improve their persistence of achieving the goals (Woolley & Fishbach, 2016). However, if the reward is unattractive to students, it cannot help engaging students’ learning motivation (Marinak, 2007). On the other hand, web-based learning application and research have grown rapidly (Cook, Garside, Levinson, Dupras, & Montori, 2010). Web-based distance learning environment allows people retrieve course content online from everywhere at any time. However, the use of rewards in the web-based distance learning situation becomes another issue.

This research aims to design a reward plug-in for the web-based learning environment. With the plug-in’s help, teachers can give rewards to students based on their learning activity performances in the web-based learning environment as what
they do in the traditional classroom. Students can also easily get the rewards through the reward plug-in to understand their performance in each learning activity. To get a better reward, students will work harder in the upcoming learning activities.

The next section introduces how game-based learning can adopt educational reward mechanism. The proposed reward Moodle plug-in is illustrated in Section 3. Section 4 describes the pilot designed for assessing teachers’ attitudes toward the plug-in. The data analysis results from the pilot are discussed in Section 5. Section 6 summarizes this research and talks the possible future works.

2 Related Works

Game-Based Learning has become a popular research topic because researchers believe that playing can hold students’ attention (Virvou, Katsionis, & Manos, 2005; Boyle, 1997). For example, Shakshouka Restaurant can be used to help students understand financial concepts and develop math skills (Barzilai & Blau, 2014). Researchers also use Age of Empires II: The Age of Kings to teach history in the social study class (Maguth, List, & Wunderle, 2015). Moreover, Weatherlings is used to teach weather and climate by defeating opponents through the prediction of weather based on the historical climate data (Klopfert, Sheldon, Perry, & Chen, 2012; Sheldon, Perry, Klofer, Chen, Tzuo, & Rosenheck, 2010).

Chen and colleagues have developed a discipline independent Trading Card Game as education rewards (Chen, Kuo, Chang, & Heh, 2009; Chen, Kuo, Chang, & Heh, 2017). Students get cards in the Trading Card Game after they complete the requirements in the learning activities (i.e., learning within an English vocabulary web-based learning system). Students can always play the game with their friends. With more rare and high level cards, students might win a match easier. They may, therefore, would like to collect more rare and high level cards from doing learning activities harder and actively.

Teachers can setup different criteria of awarding the cards for students. If students have a better performance in the learning activities, teachers can give them a higher level or rarer card which can help students having higher chance to defeat their opponents in the game. For students who do not prefer to compete with others, they
could collect the cards just as collecting coins and stamps; they might want to get all of the cards in their collection books. Fig. 1 shows the motivation enhancement cycle of the Trading Card Game.

3 In-game Card as Education Reward (ICER) Plug-in

The research team has designed the In-game Card as Education Reward (ICER) Moodle Plug-in for delivering the cards in the game “TCG” that Chen and his colleagues developed (Chen, Chang & Chang, 2016; Chen, Zhao, Luo, Chang, Qian, Kuo, & Chang, 2017). Teachers can set up the criteria of giving rewards (i.e., cards in TCG) according to students’ performance through the plug-in. The plug-in will also need students’ permission in sending reward request to the TCG. With the help of ICER plug-in, students’ private data in a course, such as student ID and marks, remain unknown to the game server and its players.

Here is an example of how to use the ICER plug-in. When a teacher signs in Moodle, he or she can see the Reward Module Block as Fig. 2 shows. The teacher can decide which learning activity he or she would like to have the reward mechanism applied. After the teacher selects a learning activity, such as Quiz in Fig. 2, he or she can determine the criteria of giving cards. In this example, the teacher decides to give a level 3 avatar card to the students who receive marks between 91 to 100, a level 3 trap card to those who get marks between 81 to 90, and a level 1 magic card to the ones who obtain marks between 76 to 80. Students who get marks lower than 75 are unable to receive any reward.

Fig. 2. Reward Module block for teachers to setup awarding criteria for the “Math” quiz
On the other hand, after students finish the learning activity, they should be able to receive the rewards. However, Moodle needs to have permission from the students to send request of giving students cards to the game server; in the meanwhile, student’s identity in both Moodle and the game server should remain anonymous for each other. Therefore, when students sign in Moodle, they can only see the request of authorizing permission for sending cards to the game server and the rewards they have gotten based on their performance in the learning activity. As Fig. 3(a) shows, the student can only see his or her performance for the Math quiz and understand what kind of rewards that he or she just got based on the awarding criteria predefined by the teacher.

![Fig. 3. My Reward block in Moodle: (a) before authorizing Moodle to give cards to the game server; (b) after the authorization.](image)

After the student clicked the Trading Card Game button in the My Reward block shown in Fig. 3(a), the ICER plug-in redirects the student to the Permission Granting page in the game server. The student can enter their username and password on the game server side and decide which permission he or she would like Moodle to have as Fig. 4(a) shows. In the authorization process, the student is required to enter the authorization code in Moodle so both of the game and Moodle can be convinced that the authorization is made by the player/student. As soon as Moodle is granted the permission of sending cards to the game server, the student can see the details of the card that he or she received for his or her efforts for a particular learning activity as Fig. 3(b) shows.

![Fig. 4. Authorizing Moodle the permission of accessing the student’s information in the game server: (a) granting particular permission for Moodle; (b) entering authorization code generated by the game server on Moodle.](image)
4 Research Design

To understand how teachers perceive the use of ICER plug-in, the research team has several hypotheses illustrated in Fig. 5.

- H1: Teachers’ gender may affect their perceived importance of educational rewards.
- H2: Teacher’s gender may affect their past experience in using Moodle and any trading card games.
- H3: Teacher’s gender may affect their attitudes toward the ICER plug-in.
- H4: Teachers’ past experience of using Moodle and any trading card games may affect their attitudes toward the ICER plug-in.
- H5: Teachers’ perceived the importance of educational reward may affect their attitudes toward the ICER plug-in.
- H6: Teachers’ perceived ease of use toward the ICER plug-in may affect their intention of using it.

To understand the acceptance that teachers have toward the use of the ICER plug-in, the research team collects their perceptions toward rewards and the plug-in with questionnaire in a hands-on workshop jointly held in an advanced learning technology conference in June 2017 in Beijing. Nineteen participants (7 males and 12 females) have participated in the workshop and been seen and taught the ICER plug-in. In the end of the workshop, the participants are asked to fill out a questionnaire which asks for their perceived importance of educational rewards, ease of use toward the ICER plug-in, and intention of using the plug-in in the future.

After collected the data, the research team found out that eleven participants (57.9%) have heard Moodle before, but only five participants (26%) have used Moodle.

| Table 1. Descriptive statistics of participants’ Moodle usage experience. |
|--------------------------|--------------------------|
| Have Heard Moodle | Have Used Moodle |
| **Yes** | **No** | **Yes** | **No** |
| # of Participant | 11 | 8 | 5 | 14 |
| % of Participant | 57.9 | 42.1 | 26.3 | 73.7 |

On the other hand, fourteen participants (73.7%) have heard what trading card games are, and there are also fourteen participants have seen other people playing trading card games.
games before. Only seven participants (36%) have played trading card games in the past.

Table 2. Descriptive statistics of participants’ trading card game playing experience.

<table>
<thead>
<tr>
<th></th>
<th>Have Heard</th>
<th></th>
<th>Have Played</th>
<th></th>
<th>Have Seen People Play</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td># of Participant</td>
<td>14</td>
<td>5</td>
<td>7</td>
<td>12</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>% of Participant</td>
<td>73.7</td>
<td>26.3</td>
<td>36.8</td>
<td>63.2</td>
<td>73.7</td>
<td>26.3</td>
</tr>
</tbody>
</table>

Table 3. Validity analysis result for the questionnaire.

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factor 1: Importance of Educational Reward</strong></td>
<td></td>
</tr>
<tr>
<td>I8: I believe students will work harder in the learning activities</td>
<td>.963</td>
</tr>
<tr>
<td>(e.g., doing homework, participating in discussion) if they can get rewards through working on them</td>
<td></td>
</tr>
<tr>
<td>I9: I believe students prefer they can get rewards from all learning activities</td>
<td>.844</td>
</tr>
<tr>
<td>I5: It is workable to set up the reward mechanism toward a specific learning activity</td>
<td>.754</td>
</tr>
<tr>
<td><strong>Factor 2: Intention of Using ICER</strong></td>
<td></td>
</tr>
<tr>
<td>I7: I would like to use ICER Moodle Plug-in in my course.</td>
<td>.915</td>
</tr>
<tr>
<td>I6: Once the student achieves the criteria of the getting rewards in the learning activity, he/she can get the cards from Trading Card Game as the reward.</td>
<td>.747</td>
</tr>
<tr>
<td>I2: The process of how students authenticate Moodle dispatching cards in the Trading Card Game as reward is straightforward.</td>
<td>.746</td>
</tr>
<tr>
<td><strong>Factor 3: Perceived of Ease of Use</strong></td>
<td></td>
</tr>
<tr>
<td>I3: The ways of getting cards in Trading Card Game through different learning activities are similar.</td>
<td>.951</td>
</tr>
<tr>
<td>I1: Using ICER Moodle plug-in in Moodle is ease to use.</td>
<td>.739</td>
</tr>
<tr>
<td>I4: I believe students can easily learn how to authenticate Moodle dispatching cards in the Trading Card Game as reward.</td>
<td>.728</td>
</tr>
<tr>
<td>Eigenvalue</td>
<td>3.359</td>
</tr>
<tr>
<td>% of variance</td>
<td>37.318</td>
</tr>
<tr>
<td>Overall α=0.775, total variance explained is 78.855%</td>
<td>2.180</td>
</tr>
<tr>
<td></td>
<td>15.58</td>
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<tr>
<td></td>
<td>24.223</td>
</tr>
<tr>
<td></td>
<td>17.314</td>
</tr>
</tbody>
</table>

In the next step, the research team uses SPSS 17.0 to verify the validity and reliability for the Importance of Education Reward, Perceived Ease of Use, and Intention of Using ICER factors in the questionnaire. The Cronbach’s Alpha value is 0.769, which sits on
“acceptable” range and shows the questionnaire is reliable (George & Mallery, 2010). The principle component analysis was also used to test the validity of the questionnaire and the result is valid as Table 3 shows.

5 Evaluation and Discussion

5.1 Findings

The research team used t-test to verify hypothesis H1 to understand whether or not teachers’ gender will affect their perceived importance of educational rewards. The results listed in Table 4 show that there is no significant difference between male and female teachers’ belief in terms of the importance of the educational rewards; both groups agreed students will perform better in the learning activities with proper educational rewards.

Table 4. Independent t-test result for teachers’ perceived importance of educational reward in gender.

<table>
<thead>
<tr>
<th></th>
<th>Descriptive Statistics</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
</tr>
<tr>
<td>Male</td>
<td>7</td>
<td>4.46</td>
</tr>
<tr>
<td>Female</td>
<td>12</td>
<td>4.18</td>
</tr>
</tbody>
</table>

Regarding to whether or not teachers’ gender will affect their past experience in using Moodle and any trading card games (hypothesis H2), the research team used Chi-square test to examine the data. The results showed that there is no significant difference between male and female teachers’ past experience of using both techniques. Table 5 and Table 6 list the analysis results of the Chi-square tests.

Table 5. Chi-square test result for teachers’ past Moodle usage experience in gender.

<table>
<thead>
<tr>
<th></th>
<th>Count</th>
<th>χ² test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Have Heard Moodle</td>
<td>Male</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>7</td>
</tr>
<tr>
<td>Have Used Moodle</td>
<td>Male</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>3</td>
</tr>
</tbody>
</table>

The research team also wants to know whether teachers’ gender will affect their attitudes toward the ICER plug-in (i.e., hypothesis H3). The t-test analysis is applied and the results are shown in Table 7. Although the results show that there is no significant between male and female teachers in their attitudes toward the ICER plug-in, male teachers are slightly more positive in terms of Perceived Ease of Use factor, but, on the contrary, female teachers have more positive on the intention of using the ICER plug-in in the future.
Table 6. Chi-square test result for teachers’ past trading card game usage experience in gender.

<table>
<thead>
<tr>
<th></th>
<th>Count</th>
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<td>No</td>
<td>Total</td>
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<td>Have Heard TCG</td>
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<tr>
<td>Male</td>
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<td>Have Played TCG</td>
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<tr>
<td>Male</td>
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<td>3</td>
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<tr>
<td>Have Seen Others Playing TCG</td>
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<tr>
<td>Male</td>
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<tr>
<td>Female</td>
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<td>3</td>
<td>12</td>
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</tr>
</tbody>
</table>

\[ \chi^2 = 0.029, \ df = 1, p = 0.634 \]

\[ \chi^2 = 0.172, \ df = 1, p = 0.526 \]

\[ \chi^2 = 0.029, \ df = 1, p = 0.634 \]

Table 7. t-test result for teachers’ attitudes toward the ICER plug-in in gender.

<table>
<thead>
<tr>
<th></th>
<th>Descriptive Statistics</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
</tr>
<tr>
<td>Perceived Ease of Use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7</td>
<td>3.810</td>
</tr>
<tr>
<td>Female</td>
<td>12</td>
<td>3.528</td>
</tr>
<tr>
<td>Intention of Using ICER</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7</td>
<td>3.810</td>
</tr>
<tr>
<td>Female</td>
<td>12</td>
<td>4.086</td>
</tr>
</tbody>
</table>

Teachers’ past experience in using Moodle and any trading card games might affect their attitudes toward the ICER plug-in (i.e., hypothesis H4). The research team used t-test to verify the hypothesis. The results in Table 8 showed that there is no significant difference in teachers’ past experience of using Moodle toward their attitudes of using the ICER plug-in. However, when the research team applied t-test in each item, the results showed that teachers who have (M = 4.00, SD = 0.00) and have not (M = 3.71, SD = 0.756) used Moodle before have significant difference in I2 (t(13) = 2.280, p = 0.040).

Table 8. t-test result for teachers’ attitudes toward the ICER plug-in in past experience in using Moodle.

<table>
<thead>
<tr>
<th></th>
<th>Descriptive Statistics</th>
<th>t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
</tr>
<tr>
<td>Have Heard Moodle EoU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>11</td>
<td>3.546</td>
</tr>
<tr>
<td>No</td>
<td>8</td>
<td>3.750</td>
</tr>
<tr>
<td>Intention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>11</td>
<td>4.000</td>
</tr>
<tr>
<td>No</td>
<td>8</td>
<td>3.959</td>
</tr>
<tr>
<td>Have Used Moodle EoU</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5</td>
<td>3.934</td>
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<tr>
<td>No</td>
<td>14</td>
<td>3.524</td>
</tr>
<tr>
<td>Intention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>5</td>
<td>4.134</td>
</tr>
<tr>
<td>No</td>
<td>14</td>
<td>3.929</td>
</tr>
</tbody>
</table>

EoU: Perceived Ease of Use; Intention: Intention of Using ICER
The results listed in Table 9 indicate teachers’ past experience in using trading card game has no significant difference in their attitudes toward the ICER plug-in. The research team also applies t-test to each of the items, and the results show that teachers who have (M = 3.71, SD = 0.469) and have not (M = 4.00 SD = 0.000) heard trading card games have significant difference in I2 ($t(13) = -2.280, p = 0.040$). There is also a significant difference ($t(13) = -2.280, p = 0.040$) between teachers who have (M = 3.71, SD = 0.469) and have not (M = 4.00 SD = 0.000) seen other people playing trading card games in I2.

Table 9. t-test result for teachers’ attitudes toward the ICER plug-in in past experience in using any trading card games.

<table>
<thead>
<tr>
<th>Have Heard TCG</th>
<th>EoU</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>$t$</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>14</td>
<td>3.572</td>
<td>0.659</td>
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</tr>
<tr>
<td>No</td>
<td>5</td>
<td>3.800</td>
<td>0.379</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>14</td>
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<td>0.480</td>
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<tr>
<td>No</td>
<td>5</td>
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<td>0.408</td>
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</table>

<table>
<thead>
<tr>
<th>Have Played TCG</th>
<th>EoU</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>$t$</th>
<th>df</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>7</td>
<td>3.716</td>
<td>0.487</td>
<td></td>
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<tr>
<td>No</td>
<td>12</td>
<td>3.583</td>
<td>0.668</td>
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<tr>
<td>Intention</td>
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<td>Yes</td>
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<td>4.029</td>
<td>0.361</td>
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</table>

<table>
<thead>
<tr>
<th>Have Seen Others Playing TCG</th>
<th>EoU</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>$t$</th>
<th>df</th>
<th>p</th>
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<tbody>
<tr>
<td>Yes</td>
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<td>3.691</td>
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<tr>
<td>Intention</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>14</td>
<td>3.976</td>
<td>0.480</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>5</td>
<td>4.002</td>
<td>0.408</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EoU: Perceived Ease of Use; Intention: Intention of Using ICER

To evaluate the hypothesis H5, the research team uses Pearson correlation to find out the linear dependence between the two factors as Table 10 shows. The analysis results show that there is no significant relation between the two factors.

Table 10. Correlation analysis between teachers’ perceived the importance of education rewards and their attitudes toward the ICER plug-in.

<table>
<thead>
<tr>
<th>Perceived Ease of Use</th>
<th>Intention: Intention of Using ICER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>0.117</td>
</tr>
<tr>
<td>Sig.</td>
<td>0.634</td>
</tr>
<tr>
<td>N</td>
<td>19</td>
</tr>
</tbody>
</table>

Pearson correlation is also applied to validate the hypothesis H6 and the result show that there is no relation between teachers’ perceived ease of use toward the ICER plug-in and their intention of using it, $r = 0.294, n = 19, p = 0.222$. 


5.2 Discussion

Based on the experiment results, we have the following findings:

- Most of the participants believe educational rewards are important.
  Participants have given high score ($M = 4.29$, $SD = 0.55$) for the Importance of Education Reward factor. The result shows that most of the participants believe educational rewards can enhance students’ performance in learning activities. However, participants have less intention of using the ICER Plug-in ($M = 3.98$, $SD = 0.45$) in their classes.

  One of the possible reason is only five of the participants (26.3%) have used Moodle before; teachers who are not using Moodle will have less intention of using the ICER plug-in. Another possible reason is participants believe the process of integrating the ICER plug-in could be more straightforward (Ease of Use factor: $M = 3.63$, $SD: 0.60$). If the research team is able to simply the process of integrating ICER plug-in in Moodle or providing the plug-in directly in Moodle, teachers might have more intention of using it in the future.

- Teachers who have used Moodle before believe students can easily learn how to use ICER plug-in in Moodle to get cards for their efforts done in learning activities.

  Although the analysis results show that there is no significant difference in H5, teachers who have used Moodle before ($M = 3.93$, $SD = 0.28$) are more positive in average than those who have not ($M = 3.52$, $SD = 0.65$) in terms of how ease students can learn to authorize Moodle to giving them cards in the game as rewards. The result shows that if teachers or students have used Moodle before, they can learn how to use ICER plug-in in Moodle easily.

- Teachers' past experience in any trading card games will affect their intention of using ICER plug-in.

  The analysis results show that teachers who have not heard about trading card games or have not seen other people playing such games believe the process of students authorizing Moodle to give cards in the game as rewards is straightforward comparing to those who have heard trading card games or have seen other people playing trading card games; however, there is no difference between teachers who have and have not played the games before.

  The possible reason is teachers who have heard about trading card games or have seen other people playing such games understand the way how people get cards in the commercial trading card games and they may feel the process of getting cards with the ICER plug-in in Moodle is more complex. However, first of all, the research team doesn’t want to make students capable of getting cards from anyone else (e.g., purchasing/exchanging cards from/with students who have higher academic achievement) but the teacher because the students need to work hard themselves in every learning activities to get cards. On the other hand, it would be extremely important for keeping students’ privacy while integrating any existing games/systems into Moodle.
6 Conclusion

The research team has developed an In-game Card as Educational Reward (ICER) Moodle Plug-in to integrate Moodle and an existing trading card game. Teachers can use the plug-in to define the criteria of how students get rewards through doing learning activities in Moodle; students can also understand which rewards they have received based on their performance in learning activities. The plug-in also keeps students’ private data in Moodle remaining unknown from the game server.

The research team has conducted a pilot to understand teachers’ perceptions toward the use of the plug-in. The pilot is done in a hands-on workshop jointly held in an advanced learning technology conference in June 2017 in Beijing with nineteen participants. The analysis of the data collected in the pilot show that most of the participants believe educational rewards are important. Although the ease of use in the plug-in is in moderate score, participants who have Moodle usage experience believe that the use of the plug-in in Moodle is easy to learn for students.

The next step of the research is to understand the students’ perceptions toward the plug-in. Moreover, the research team would like to know whether or not students believe the adoption of the plug-in in Moodle can help them understand their performance in learning activities better. We would like to know if students’ learning motivation can be increased with the plug-in’s help.

Acknowledgement

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References


Clinical Skills Training & Learning in Hybrid Way

Feng QIU
East China Normal University, Shanghai, China
18602172288@163.com

Abstract. Medical education is not an easy field for using ICT for training and learning, especially training for the clinical skills. In order to explore the ways for training clinical medical talents and to meet the demand of “the minimum basic requirements of global medical education”, this presentation focuses on how to use the modern educational technologies (virtual reality, multimedia and network communication) combined with traditional methods for realizing the effective ways for training and learning the clinical knowledge and skills, and discusses how to design a system platform for supporting the clinical training and learning. Some case studies are given.

Keywords: Medical education; Clinical skills; Technology supported; Hybrid learning
Empirical Research on Co-construction of Core Practices

Jianglian LI *, Xiaodong XU
School of Information Technology in Education, South China Normal University, Zhongshan Avenue West, Tianhe District, Guangzhou, Guangdong, China
* 735247228@qq.com

Abstract. With the turn away from a predominant focus on specific and necessary teaching knowledge toward teaching practices that entail knowledge and skill in the field of education. More and more researchers are taking up research teaching practices of "efficient" and "core" and its implementation approach. This research adopted empirical research paradigm and paid close attention to the set of teaching knowledge and skills effective teaching practice in the class, namely core practices. Firstly, the background, history and concept of core practices were introduced; secondly, under the research paradigm of positivism, the positivism research paradigm, researchers made three rounds of surveys to construct core teaching practices that is suitable for domestic education policy and teachers culture through finding – verbalizing practices by front-line teacher, clustering – field-dividing practices by expert teacher, defining – identifying practices by teacher educator, decompose and interpret each practice, so identified what teachers should learn and practice in teachers education; finally, researchers put forward the value and deficiencies of this research and future research directions.

Keywords: teacher education; co-construction; core practices

1 Sequence

1.1 Background

As of now, it is generally believed that an effective teacher is competent for a job required teacher knowledge, including subject knowledge, pedagogical knowledge, pedagogical content knowledge, practical knowledge, TPACK in the field of teacher education. However, we found that teacher education is undergoing a major transformation—from paying attention to specific and necessary teaching knowledge to focusing on teaching practices that needed specific knowledge and skills (Pam Grossman et al., 2009). Now more and more research on professional development of teachers focus on the "core" or "efficient" teaching practice approach (Francesca M. Forzani, 2014). Teacher educators (Franke et al., 2006) put forward that we need to rethink the content that Pre-service teachers need to learn at the beginning - by developing a set of high leverage practices for K-12 classroom (Morva McDonald et
so as to teach pre-service teachers and let them implement them in class. Ball D. L. (2009) pointed out that high leverage practices which teachers can carry out in class through mastery and can bring great progress to students. High leverage practices are also known as core practices. At present, many researchers are trying to describe core teaching practices to provide an operable objective system for teacher education so that teachers can clearly identify specific contents they should require in teacher education and professional development. Domestic research suggests that teachers’ knowledge is not technology oriented, but more based on practice (Lu Naigui & Cao Taisheng, 2010). It is necessary for pre-service teachers to train in a systematic way of “learning to teach” (Xu Xiaodong et al., 2011). Based on the above development trend, this study is devoted to the exploration of the core teaching practice which is in line with our country’s teacher culture and education policy.

1.2 Context of Core Practices Research

“Core practice” was first mentioned in 2006 by Franke, Grossman, Richert and Schultz (2006) in the literature. Lampert present three kinds of practices including developing a classroom culture, learning about student understanding and orchestrating classroom discussions that realize ambitious teaching in the monograph of “Teaching Problems and the Problem of Teaching” (M Lampert, 2001). Later scholars believed that these practices which can be seen as starting point of core practices research (Pam Grossman, 2009). Developing a classroom culture is itself composed of a number of more discrete practices and instructional routines that novice teachers must learn, including: developing productive and professional relationships with students; helping students develop positive relationships with each other; managing transitions between activity structures; and creating classroom routines. Learning about student understanding might include strategies like eliciting student thinking during interactive teaching, anticipating student responses and eliciting further thinking. Three component practices related to orchestrating classroom discourse include asking questions or posing problems to begin a discussion, monitoring student participation during discussion, and responding to student ideas. Each of these is critical to the practice as a whole and represents practices that novice teachers can begin to develop in teacher education and the early years of teaching (M Lampert, 2001).

A number of researchers (e.g., Franke, Grossman, Richert, & Schultz, 2006; Kazemi & Hintz, 2008; Kazemi, Lampert, & Ghouseeni, 2007; Sleep, Boerst, & Ball, 2007) recognize that core practices are practices that occur with high frequency in teaching, novices can enact in classrooms across different curricula or instructional approaches, novices can actually begin to master, allow novices to learn more about students and about teaching, preserve the integrity and complexity of teaching, are research-based and have the potential to improve student achievement (Grossman, Whitcomb J., Borko H., Liston D.). Well, can core practices be seen as simple segmentation of the classroom teaching practices according to time series? Researchers (F Janssen, P Grossman, H Westbroek, 2015) think that core practices, which at the middle and micro levels, are decomposed and recomposed to fine-grained practices.
Core practices of this study referred to interacting production by teachers, students and teaching content in the classroom. At the same time, we believe that each core practice can be divided into more sub-practices, including skills, strategies and specific teacher knowledge, but core practices are different from teacher knowledge, which belong to the knowledge, the former is the integration of specific knowledge, skills, specific teaching deeds that can bring great progress to the teachers by mastering. We hold that, on the one hand, core practices, which exist in the way of practice representation, are applicable pedagogical knowledge; on the other hand, they are pathway of using subject knowledge and pedagogical knowledge and can promote the development of knowledge, skills and professional identity of teachers.

In recent years, researchers at the University of Notre Dame, Stanford University, University of Michigan, University of Texas at San Antonio and other universities have carried out the research on core practices. Researchers (TeachingWorks, 2013a) of University of Michigan established nineteen core practices can be used in different disciplines, grade and context; M Kloser (2014) of University of Notre Dame describes a set of core practices in science teaching. Researcher (Bradley Fogo, 2014) put forward twelve core practices in history teaching in the same way at the Stanford University. J. Si Millican of University of Texas at San Antonio and Sommer Helweh Forrester of University of Massachusetts System (2017) achieved a strong consensus on three core practices in music teaching. Canadian Researchers (FJ Troyan, KJ Davin, R Donato, 2013) practice and study the application of core practices in foreign language teacher education.

Nonetheless, core practice is closely related to teaching and teacher culture, and abroad research results of core practices can’t be applied to domestic teacher education. In order to help pre-service teachers, adapt to their professional career as early as possible, we need to identify core practice that suitable for our teacher culture and teaching situation. Based on the study of individualized and sustainable teacher professional development model, this study is intended to construct native core practices through investigation method.

2 Method

This study, which under the empirical research paradigm, refer the method of identifying the core practice of University of Notre Dame and Stanford University - Delphi method. In order to increase the objectivity of investigation, we added a survey of finding core practices by front line teachers. There are three types of research subjects in this study: front line teachers, expert teachers and teacher educators. First of all, researchers distributed questionnaires to front line teachers to collect the crucial and important teaching practices in high quality class, coded teacher’s answers based on the stated rules of core practices, drew up a set of nominated core practices according to standard of them. What’s more, using Delphi method and semi-structured interview to collect recognized degree and supplement about core practices of expert teachers and teacher educator. Finally, analyzing data of survey result and establish a set of core
practices. The process of cooperative construction of three types of investigation objects is called "co-construction".

2.1 Respondents

In the first phase of survey, 210 respondents are from nine subjects (covering Chinese, English, Politics, History, Geography, Math, physics, Chemistry and Biology), five schools (including one junior school, two senior schools and two elementary schools) and three cities in Guangdong Province. Among them, 30 teachers were selected respectively in the subjects of language, Mathematics and English, and 20 teachers were selected respectively in the other subjects. They are cultivated target of the project of "experts enter class" and explorers and practitioners of educational reform and innovation and have strong learning and professional development desire. The basic data of the 210 teachers are shown in Table 1.

<table>
<thead>
<tr>
<th>Item</th>
<th>Gender</th>
<th>Seniority</th>
<th>Education Background</th>
<th>Teaching phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
<td>Male</td>
<td>Female</td>
<td>≤3 3-6 6-12 12-20 ≥20</td>
<td>A.D. B.D. M.D</td>
</tr>
<tr>
<td>Number</td>
<td>52</td>
<td>158</td>
<td>19 36 60 67 28 5</td>
<td>153 52 36 120 54</td>
</tr>
</tbody>
</table>

In the second phase of survey, 10 respondents, which have rich subject teaching experience, are expert teacher from different discipline in senior positions. They participated many kinds of teacher training projects, such as "research helps teaching", "experts enter classroom" and "top teacher’s workshop", in which they guide teaching practices of teacher as tutor to improve teaching performance according their theoretical knowledge and practical experience. The basic data of the 10 expert teachers are shown in Table 2.

<table>
<thead>
<tr>
<th>No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>TJ</td>
<td>FD</td>
<td>ZJ</td>
<td>LK</td>
<td>ZY</td>
<td>HS</td>
<td>DS</td>
<td>LY</td>
<td>LU</td>
<td>YW</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Male</td>
</tr>
<tr>
<td>Seniority</td>
<td>28</td>
<td>26</td>
<td>32</td>
<td>21</td>
<td>31</td>
<td>22</td>
<td>18</td>
<td>11</td>
<td>20</td>
<td>23</td>
</tr>
</tbody>
</table>

In the third phase of survey, 14 respondents are from different universities and research area in teacher education. They have long-term and close contact with the primary and secondary schools, not only have lots of teaching experience, also abundant experience of teacher education. As theoretical mentor, they help teachers rethink teaching practices and sum up experience as a theory in order to make the teachers acquire progress, having ability of keen insight into actual teaching demand and deficiency. The basic data of the 14 professors are shown in Table 3.
Table 3. Respondents in the third phase of survey

<table>
<thead>
<tr>
<th>NO.</th>
<th>Name</th>
<th>Gender</th>
<th>Seniority</th>
<th>Education</th>
<th>Research area and content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ZH</td>
<td>Female</td>
<td>9</td>
<td>M.D.</td>
<td>Mathematical teaching &amp; Teacher education</td>
</tr>
<tr>
<td>2</td>
<td>ZP</td>
<td>Female</td>
<td>30</td>
<td>M.D.</td>
<td>Chinese teaching &amp; Teacher education</td>
</tr>
<tr>
<td>3</td>
<td>CJ</td>
<td>Female</td>
<td>35</td>
<td>PhD.</td>
<td>Mathematical teaching</td>
</tr>
<tr>
<td>4</td>
<td>XX</td>
<td>Male</td>
<td>33</td>
<td>PhD.</td>
<td>Physics teaching, Psychology &amp; Teacher learning</td>
</tr>
<tr>
<td>5</td>
<td>GW</td>
<td>Male</td>
<td>11</td>
<td>PhD.</td>
<td>Mathematical teaching &amp; Statistics</td>
</tr>
<tr>
<td>6</td>
<td>CP</td>
<td>Male</td>
<td>27</td>
<td>PhD.</td>
<td>Classroom teaching</td>
</tr>
<tr>
<td>7</td>
<td>QY</td>
<td>Male</td>
<td>31</td>
<td>PhD.</td>
<td>Chemistry teaching &amp; Teacher education</td>
</tr>
<tr>
<td>8</td>
<td>FL</td>
<td>Male</td>
<td>8</td>
<td>M.D.</td>
<td>History teaching &amp; Teacher education</td>
</tr>
<tr>
<td>9</td>
<td>LH</td>
<td>Male</td>
<td>20</td>
<td>M.D.</td>
<td>Physics teaching &amp; Instructional technology</td>
</tr>
<tr>
<td>10</td>
<td>ZX</td>
<td>Female</td>
<td>15</td>
<td>M.D.</td>
<td>Biology teaching &amp; Teacher education</td>
</tr>
<tr>
<td>11</td>
<td>TJ</td>
<td>Female</td>
<td>11</td>
<td>M.D.</td>
<td>Chemistry teaching &amp; Instructional technology</td>
</tr>
<tr>
<td>12</td>
<td>ZA</td>
<td>Male</td>
<td>10</td>
<td>M.D.</td>
<td>Geography teaching &amp; Teacher education</td>
</tr>
<tr>
<td>13</td>
<td>ZY</td>
<td>Female</td>
<td>34</td>
<td>PhD.</td>
<td>English teaching, Teacher education &amp; English pedagogics</td>
</tr>
<tr>
<td>14</td>
<td>WY</td>
<td>Female</td>
<td>16</td>
<td>M.D.</td>
<td>Teacher education &amp; Instructional technology</td>
</tr>
</tbody>
</table>

First-line teachers were selected in the first stage of survey since core practices are a part of the professional life of teachers from teaching practices. Expert teachers were chosen in the second stage of survey because they participate in teaching research activities about visit to classroom and valuation on class chronically, having enhanced ability of classroom insight, classification, analysis and integration. Professors were opted in the third stage of survey due to highly abstract theoretical knowledge that make them can define teaching practices from abstract level. Thus, with the increase of experience and academic knowledge of respondents, their understanding will be closer to core practice. Core practices were constructed through this kind of mode of creative cooperation and knowledge construction.

### 2.2 Procedures

The procedures are composed of the following three phases: verbalizing of practices – front-line teachers discover and present teaching practices; territorializing of practices – clustering teaching practices described by expert teachers; conceptualizing of practice – teacher education define core practices. In the first phase of the survey, questionnaires were used to collect teaching practices that front-line teachers consider to be important and to describe them in the exact language. In the second phase of the survey, the Delphi method was adopted to collect the views of expert teachers on core practice. Based on the important teaching practices proposed by front-line teachers, the expert teachers further abstracted, selected and clustered core practices. In the third stage of investigation, the Delphi method was still adopted. Teacher educators further compared and analyzed core practice items with the core practice standards, and made more scientific and accurate definition of core practice. Researchers construct the connotation and expression of core practices in the light of survey result.
3 Result

3.1 Analysis of phase I survey results

A total of 210 questionnaires were distributed to front-line teachers in this stage, and 210 questionnaires were recovered, of which 210 were valid. First, researchers carefully analyzed the collected questionnaires and considered it necessary to encode the excerpts of the teacher's responses according to the standards and rules of core practices. In this study, we adopted open-ended code in grounded theory and firstly decomposed the excerpts to ensure that a sentence belongs to only one concept genus and then use the nodes in NVivo v8.0 software to tag excerpts and give them concepts that are in line with statements of core practices. Finally acquiring the following 19 teaching practices as shown in Table 4.

Table 4. Phase I survey results: important teaching practice frequency table

<table>
<thead>
<tr>
<th>NO.</th>
<th>Teaching practices</th>
<th>Frequency (n=684)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Creating good classroom atmosphere</td>
<td>125</td>
</tr>
<tr>
<td>2</td>
<td>Increasing students' participation</td>
<td>101</td>
</tr>
<tr>
<td>3</td>
<td>Stimulating students' motivation to learn</td>
<td>94</td>
</tr>
<tr>
<td>4</td>
<td>Adjusting teaching based on students' performance</td>
<td>52</td>
</tr>
<tr>
<td>5</td>
<td>Orchestrating group activities</td>
<td>37</td>
</tr>
<tr>
<td>6</td>
<td>Guiding students to review existing knowledge</td>
<td>36</td>
</tr>
<tr>
<td>7</td>
<td>Summarizes contents of the class by concentrating on the main points</td>
<td>33</td>
</tr>
<tr>
<td>8</td>
<td>Putting forward questions to inspire students to think</td>
<td>29</td>
</tr>
<tr>
<td>9</td>
<td>Creating learning context</td>
<td>28</td>
</tr>
<tr>
<td>10</td>
<td>Understand why students answered wrongly</td>
<td>23</td>
</tr>
<tr>
<td>11</td>
<td>Offer students timely feedback and comments on students’ expression</td>
<td>22</td>
</tr>
<tr>
<td>12</td>
<td>Teaching students how to solve problems</td>
<td>20</td>
</tr>
<tr>
<td>13</td>
<td>Guiding students to explore</td>
<td>20</td>
</tr>
<tr>
<td>14</td>
<td>Realizing teaching objectives required by the curriculum standards</td>
<td>18</td>
</tr>
<tr>
<td>15</td>
<td>Building scaffolding for students thinking</td>
<td>15</td>
</tr>
<tr>
<td>16</td>
<td>providing students with opportunities of full expressing</td>
<td>9</td>
</tr>
<tr>
<td>17</td>
<td>Listening carefully to the student's expression</td>
<td>9</td>
</tr>
<tr>
<td>18</td>
<td>Leaving students sufficient time to think after asking questions</td>
<td>6</td>
</tr>
<tr>
<td>19</td>
<td>Using information technology appropriately to assist teaching</td>
<td>5</td>
</tr>
<tr>
<td>20</td>
<td>Respecting students</td>
<td>2</td>
</tr>
</tbody>
</table>

3.2 Analysis of phase II survey results

In the first phase of survey, researchers found that front-line teachers have difficulty in articulating core teaching practices occurred in class because of the lack of
corresponding knowledge schema in their cognitive system (Xu Xiaodong, He Xiaoya et al., 2016). Above teaching practice is not in full compliance with core practice standard. Therefore, expert teachers are required to further refine and cluster existing practices.

Quantitative data analysis
Respondents were requested to make professional judgment about the importance of each core practice based on the Likert Scale Five (5 = strongly agree, 4 = agree, 3 = indefinite, 2 = disagree, 1 = strongly disagree). After descriptive statistical analysis of quantitative data, the researchers obtained the results (n = 10) as shown in Table 5.

<table>
<thead>
<tr>
<th>NO.</th>
<th>Core practices items</th>
<th>M</th>
<th>Mode</th>
<th>SD</th>
<th>Δ/top</th>
<th>Δ/prev</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Realizing teaching objectives required by the curriculum</td>
<td>4.80</td>
<td>5</td>
<td>0.422</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2</td>
<td>Guiding students to review existing knowledge</td>
<td>4.80</td>
<td>5</td>
<td>0.422</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>3</td>
<td>Creating learning context</td>
<td>4.60</td>
<td>5</td>
<td>0.516</td>
<td>-0.20</td>
<td>-0.20</td>
</tr>
<tr>
<td>4</td>
<td>Increasing students’ participation</td>
<td>4.60</td>
<td>5</td>
<td>0.516</td>
<td>-0.20</td>
<td>0.00</td>
</tr>
<tr>
<td>5</td>
<td>Creating good classroom atmosphere</td>
<td>4.60</td>
<td>5</td>
<td>0.516</td>
<td>-0.20</td>
<td>0.00</td>
</tr>
<tr>
<td>6</td>
<td>Building scaffolding for students thinking</td>
<td>4.50</td>
<td>5</td>
<td>0.527</td>
<td>-0.30</td>
<td>-0.10</td>
</tr>
<tr>
<td>7</td>
<td>Summarizes contents of the class by concentrating on the</td>
<td>4.50</td>
<td>5</td>
<td>0.527</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>main points</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Putting forward questions to inspire students to think</td>
<td>4.40</td>
<td>4</td>
<td>0.516</td>
<td>-0.40</td>
<td>-0.10</td>
</tr>
<tr>
<td>9</td>
<td>Understand why students answered wrongly</td>
<td>4.40</td>
<td>4</td>
<td>0.516</td>
<td>-0.40</td>
<td>0.00</td>
</tr>
<tr>
<td>10</td>
<td>Teaching students how to solve problems</td>
<td>4.40</td>
<td>4</td>
<td>0.516</td>
<td>-0.40</td>
<td>0.00</td>
</tr>
<tr>
<td>11</td>
<td>Offer students timely feedback and comments on students’</td>
<td>4.40</td>
<td>5</td>
<td>0.699</td>
<td>-0.40</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>expression</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Orchestrating group activities</td>
<td>4.40</td>
<td>4</td>
<td>0.516</td>
<td>-0.40</td>
<td>0.00</td>
</tr>
<tr>
<td>13</td>
<td>Adjusting teaching based on students’ performance</td>
<td>4.40</td>
<td>4</td>
<td>0.516</td>
<td>-0.40</td>
<td>0.00</td>
</tr>
<tr>
<td>14</td>
<td>Listening carefully to the student’s expression</td>
<td>4.40</td>
<td>5</td>
<td>0.699</td>
<td>-0.40</td>
<td>0.00</td>
</tr>
<tr>
<td>15</td>
<td>Stimulating students’ motivation to learn</td>
<td>4.40</td>
<td>5</td>
<td>0.699</td>
<td>-0.40</td>
<td>0.00</td>
</tr>
<tr>
<td>16</td>
<td>Leaving students sufficient time to think after asking</td>
<td>4.40</td>
<td>4</td>
<td>0.516</td>
<td>-0.40</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>questions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Guiding students to explore</td>
<td>4.40</td>
<td>4</td>
<td>0.516</td>
<td>-0.40</td>
<td>0.00</td>
</tr>
<tr>
<td>18</td>
<td>providing students with opportunities of full expressing</td>
<td>4.30</td>
<td>4</td>
<td>0.675</td>
<td>-0.50</td>
<td>-0.10</td>
</tr>
<tr>
<td>19</td>
<td>Using information technology appropriately to assist</td>
<td>4.30</td>
<td>4</td>
<td>0.632</td>
<td>-0.50</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>teaching</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Respecting students</td>
<td>4.20</td>
<td>4</td>
<td>0.632</td>
<td>-0.60</td>
<td>-0.10</td>
</tr>
</tbody>
</table>

As can be seen from above data, mean ≥4.20, mode ≥ 4, standard deviation <0.70, mean of every practice is high. The degree of recognition of importance of different experts for each practice in teaching tend to be consistent. But researchers did not directly make choice among these practices based on the quantitative data.
Qualitative data analysis.
Expert teachers refined and clustered core practices on the basis of response of frontline teachers. According to the results of the expert teacher questionnaire survey, researchers summarized the views of expert teachers as follows:

(1) There are two bases of teaching: prior knowledge, cognition and demand of students and curriculum standard. Curriculum standards, in addition to the three-dimensional goals previously emphasized, emphasis on core literacy. Teachers should know if misconceptions, difficulties, priorities and questions of students have been solved and methods and techniques of verification that goal attainment. Therefore, expert teachers believe that "realizing teaching objectives required by the curriculum standards" and "Understand why students answered wrongly" are crucial teaching practices in class.

(2) Nowadays, there is a shift in student learning goals from acquiring of concept to learning to think, question, learn and solve specific problems. Teaching is required that ask questions, organize inquiries and provide support to students based on the situation as real as possible. The process of problem solving should be similar to exploring process of subject specialist so that students can apply disciplinary-specific ways of thinking in their inquiries. This fully affirmed "creating learning context ", "teaching students how to solve problems" and "guiding students to explore". "Building scaffolding for students thinking" and "teaching students how to solve problems" can be reflected in "guiding students to explore", latter practice is more inclusive than previous two.

(3) Learning is a kind of social activity and good result usually comes from special social interaction: teachers and students construct and share knowledge by interacting with each other in the common situational activities. Sharing, discussion, communication and cooperation contribute to developing the disciplinary understanding of students and teaching should create opportunities and possibilities for these particular social interaction. "Orchestrating group activities", "providing students with opportunities of full expressing", "putting forward questions to inspire students to think", "leaving students sufficient time to think after asking questions", "offer students timely feedback and comments on students' expression", "adjusting teaching based on student performance" are parts of effective classroom interaction.

(4) To promote integrated teaching. The current integration can be divided into multi-dimensions: the integration of information technology and subject; the integration of different disciplines; the integration of subject knowledge; the integration of different student perspectives. "Guiding students to review existing knowledge", "summarizes contents of the class by concentrating on the main points" and "using information technology appropriately to assist teaching" embody the integration of different degrees. The first two can be clustered into "building connections between different knowledge” because the essence of them is linking between new knowledge and previous.

(5) Core practices are specific, executable and should be distinguished from the purpose of effective teaching. For example, "Increasing students' participation" and "stimulating students' motivation to learn " mean putting students in a productive learning state, a variety of teaching practices can be used as a way to achieve this goal,
such as "putting forward questions to inspire students to think", "creating good classroom atmosphere" and "guiding students to explore".

(6) Core practices are complete teaching practices with similar fine-grained levels. There are limitations in the study of fragmented and over-microscopic teaching behaviors, such as "leaving students sufficient time to think after asking questions" and "providing students with opportunities of full expressing", "listening carefully to the student's expression" and "offer students timely feedback and comments on students' expression" are four divided teaching behaviors, which should be clustered into a complete teaching practice: "listening to students carefully and responding effectively".

(7) Core practices are closely focus on supporting student learning. Practices that away from efficient teaching centers can’t be regard as core practice, for instance, "respecting students" is a basic practice, not core. Respondent10 in Table 2 mentioned: teachers generally accomplish the practice, basic but not central. Score of this practice is lower than others showed in quantitative data table. It is core that practices is stated since they are well-selected and refined practices best reflect the essence of effective instruction and educative fairness, not an accumulation of teaching practices. According to quantitative data and experts' viewpoint, researchers obtained core practices results of the second phase as shown in Table 6.

### Table 6. Phase II Survey results: core practice score statistics table

<table>
<thead>
<tr>
<th>NO.</th>
<th>Core practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Realizing teaching objectives required by the curriculum standards</td>
</tr>
<tr>
<td>2</td>
<td>building connections between different knowledge</td>
</tr>
<tr>
<td>3</td>
<td>Creating learning context</td>
</tr>
<tr>
<td>4</td>
<td>Creating good classroom atmosphere</td>
</tr>
<tr>
<td>5</td>
<td>Guiding students to explore</td>
</tr>
<tr>
<td>6</td>
<td>Putting forward questions to inspire students to think</td>
</tr>
<tr>
<td>7</td>
<td>Understand why students answered wrongly</td>
</tr>
<tr>
<td>8</td>
<td>listening to students carefully and responding effectively</td>
</tr>
<tr>
<td>9</td>
<td>Orchestrating group activities</td>
</tr>
<tr>
<td>10</td>
<td>Adjusting teaching based on students' performance</td>
</tr>
<tr>
<td>11</td>
<td>Using information technology appropriately to assist teaching</td>
</tr>
</tbody>
</table>

### 3.3 Analysis of phase III survey results

In this survey, researchers modified the questionnaire by changing the ambiguous term "importance" to "core practices standards" proposed by Grossman et al. (2009). The researchers carefully selected 14 teacher educators, all of whom are subject pedagogical professors, which participate in the training, including explaining on defining methods and presentation norms of core practices, lasted until respondents have master normative approach, designed by researchers referring to core practices standards. Afterwards, experts immediately made professional judgment for each practice presented on the evaluation scale only offered positive and agreeable dimensions. In
the same time, experts were required to write down their own views and essential characteristics of each practice. For example, you might find the practice to be too discrete or too general to be considered “core” and explain it. Or, you might cite empirical work and provide a brief description highlighting the core nature of this practice. A descriptive statistical analysis on quantitative data (n = 14) is shown in Table 8.

<table>
<thead>
<tr>
<th>NO.</th>
<th>Core practices standard</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Practices that occur with high frequency in teaching</td>
<td>HF</td>
</tr>
<tr>
<td>2</td>
<td>Practices that novices can enact in classrooms across different curricula or instructional approaches</td>
<td>AE</td>
</tr>
<tr>
<td>3</td>
<td>Practices that that novices can actually begin to master</td>
<td>BM</td>
</tr>
<tr>
<td>4</td>
<td>Practices that allow novices to learn more about students and about teaching</td>
<td>LM</td>
</tr>
<tr>
<td>5</td>
<td>Practices that preserve the integrity and complexity of teaching</td>
<td>IC</td>
</tr>
<tr>
<td>6</td>
<td>Practices that are research-based and have the potential to improve student achievement</td>
<td>RI</td>
</tr>
</tbody>
</table>

As can be seen from Table 8, the differences in each practice’s score in standard dimension is insignificant, indicating that experts’ professional judgment of core practices in all dimensions tend to be agreed. The score of “using information technology appropriately to assist teaching” in all dimensions is lower than other practices. Respondent4 in Table 3 viewed it:

<table>
<thead>
<tr>
<th>NO.</th>
<th>Core practices items</th>
<th>HF</th>
<th>AE</th>
<th>BM</th>
<th>LM</th>
<th>IC</th>
<th>RI</th>
<th>SD</th>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Realizing teaching objectives required by the curriculum standards</td>
<td>4.79</td>
<td>4.57</td>
<td>4.71</td>
<td>4.64</td>
<td>4.43</td>
<td>4.57</td>
<td>0.13</td>
<td>4.79</td>
<td>4.43</td>
</tr>
<tr>
<td>2</td>
<td>building connections between different knowledge</td>
<td>4.36</td>
<td>4.00</td>
<td>4.50</td>
<td>4.14</td>
<td>4.36</td>
<td>4.14</td>
<td>0.18</td>
<td>4.50</td>
<td>4.00</td>
</tr>
<tr>
<td>3</td>
<td>Creating learning context</td>
<td>4.64</td>
<td>4.50</td>
<td>4.36</td>
<td>3.79</td>
<td>3.79</td>
<td>4.29</td>
<td>0.36</td>
<td>4.64</td>
<td>3.79</td>
</tr>
<tr>
<td>4</td>
<td>Creating good classroom atmosphere</td>
<td>4.43</td>
<td>3.93</td>
<td>4.36</td>
<td>4.36</td>
<td>4.14</td>
<td>4.57</td>
<td>0.23</td>
<td>4.57</td>
<td>3.93</td>
</tr>
<tr>
<td>5</td>
<td>Guiding students to explore</td>
<td>4.71</td>
<td>4.43</td>
<td>4.50</td>
<td>4.64</td>
<td>4.57</td>
<td>4.50</td>
<td>0.11</td>
<td>4.71</td>
<td>4.43</td>
</tr>
<tr>
<td>6</td>
<td>Putting forward questions to inspire students to think</td>
<td>4.57</td>
<td>4.21</td>
<td>4.29</td>
<td>4.50</td>
<td>4.50</td>
<td>4.50</td>
<td>0.14</td>
<td>4.57</td>
<td>4.21</td>
</tr>
<tr>
<td>7</td>
<td>Understand why students answered wrongly</td>
<td>4.79</td>
<td>4.50</td>
<td>4.64</td>
<td>4.64</td>
<td>4.57</td>
<td>4.50</td>
<td>0.11</td>
<td>4.79</td>
<td>4.50</td>
</tr>
<tr>
<td>8</td>
<td>listening to students carefully and responding effectively</td>
<td>4.14</td>
<td>3.71</td>
<td>4.14</td>
<td>4.29</td>
<td>4.00</td>
<td>4.21</td>
<td>0.20</td>
<td>4.29</td>
<td>3.71</td>
</tr>
<tr>
<td>9</td>
<td>Orchestrating group activities</td>
<td>4.21</td>
<td>4.14</td>
<td>4.00</td>
<td>4.21</td>
<td>4.36</td>
<td>4.36</td>
<td>0.14</td>
<td>4.36</td>
<td>4.00</td>
</tr>
<tr>
<td>10</td>
<td>Adjusting teaching based on students’ performance</td>
<td>4.07</td>
<td>3.64</td>
<td>4.21</td>
<td>3.71</td>
<td>3.43</td>
<td>3.93</td>
<td>0.29</td>
<td>4.21</td>
<td>3.43</td>
</tr>
</tbody>
</table>

As can be seen from Table 8, the differences in each practice’s score in standard dimension is insignificant, indicating that experts’ professional judgment of core practices in all dimensions tend to be agreed. The score of “using information technology appropriately to assist teaching” in all dimensions is lower than other practices. Respondent4 in Table 3 viewed it:
Well, not so important, no matter what course ... ... this is too biased. Novices can actually begin to master...... Novice teacher can, but the old teacher can’t..... You can go to school to observe, information technology used by young teachers, it’s also very important for novice teachers. Preserve the integrity and complexity of teaching, this is not always. are research-based and have the potential to improve student achievement, study shows that information technology and usual teaching are same, there is no difference. It should be used with caution, not all disciplines are used, not all teachers use. Young teachers can use it, it mainly prompt teaching script and framework.

Table 9. Phase III survey: Scores of core practices statistical table

<table>
<thead>
<tr>
<th>NO.</th>
<th>Core practices items</th>
<th>M</th>
<th>Mode</th>
<th>SD</th>
<th>Δ/top</th>
<th>Δ/prev</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Realizing teaching objectives required by the curriculum</td>
<td>4.62</td>
<td>4</td>
<td>0.655</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>2</td>
<td>listening to students carefully and responding effectively</td>
<td>4.61</td>
<td>4</td>
<td>0.747</td>
<td>-0.01</td>
<td>-0.01</td>
</tr>
<tr>
<td>3</td>
<td>Putting forward questions to inspire students to think</td>
<td>4.56</td>
<td>5</td>
<td>0.786</td>
<td>-0.06</td>
<td>-0.05</td>
</tr>
<tr>
<td>4</td>
<td>building connections between different knowledge</td>
<td>4.44</td>
<td>4</td>
<td>0.808</td>
<td>-0.18</td>
<td>-0.12</td>
</tr>
<tr>
<td>5</td>
<td>Understand why students answered wrongly</td>
<td>4.43</td>
<td>5</td>
<td>0.745</td>
<td>-0.19</td>
<td>-0.01</td>
</tr>
<tr>
<td>6</td>
<td>Guiding students to explore</td>
<td>4.30</td>
<td>5</td>
<td>0.754</td>
<td>-0.32</td>
<td>-0.13</td>
</tr>
<tr>
<td>7</td>
<td>Creating learning context</td>
<td>4.25</td>
<td>5</td>
<td>1.012</td>
<td>-0.37</td>
<td>-0.05</td>
</tr>
<tr>
<td>8</td>
<td>Creating good classroom atmosphere</td>
<td>4.23</td>
<td>5</td>
<td>0.914</td>
<td>-0.39</td>
<td>-0.02</td>
</tr>
<tr>
<td>9</td>
<td>Adjusting teaching based on students' performance</td>
<td>4.21</td>
<td>5</td>
<td>1.016</td>
<td>-0.41</td>
<td>-0.02</td>
</tr>
<tr>
<td>10</td>
<td>Orchestrating group activities</td>
<td>4.08</td>
<td>5</td>
<td>0.903</td>
<td>-0.54</td>
<td>-0.13</td>
</tr>
<tr>
<td>11</td>
<td>Using information technology appropriately to assist teaching</td>
<td>3.83</td>
<td>5</td>
<td>0.701</td>
<td>-0.79</td>
<td>-0.25</td>
</tr>
</tbody>
</table>

Core practices are at meso-level and with similar fine-grained hierarchy. "Creating good classroom atmosphere" is a more inclusive practice, usually, teaching practice is too broad to conduct and be trained. Respondent13 expert in Table 3 said:

First of all, according to our pedagogical teaching method, good is a judgment word. Everyone have different opinion about it. Some people think it is good for students to be quiet. Some say that not only students should be quiet but questions should be asked to make students think quietly. Others hold not only let students think in silence, but tell them way to think ...

Secondly, this practice can be assumed as a dominant practice, and other practices to achieve practice indirectly. Doing research is slowly toward specific.

The core practice should be as specific and scientific as possible. Nevertheless, several teacher educators argued that some of core practices are ambiguous and should be further modified in description in order to articulating core practices with clear teacher behaviors and ways of achieving goals. Such as, "understand why students answered wrongly" was revised to" exploring students’ thinking", "adjusting teaching based on students’ performance" was modified to "making appropriate decisions to adjust teaching". Teaching aims at helping students to form disciplinary thinking in the process of knowledge obtain and fully understand the world in life owing to unique thinking ways of distinct discipline (Gardner, H., 1999). Teaching objectives of curriculum all point to cultivate students' disciplinary thinking and achievement of
teaching objectives needs to be based on teaching evaluation. In consequence "realizing teaching objectives required by the curriculum standards” was adjusted to "evaluating students' disciplinary thinking.” Experts considered that one of the most representative teaching activities that promote teacher-students and students-students interaction should be selected as core practice because of many forms of "orchestrating group activities" revised to "guiding students discussion”. In the end, core practices co-constructed are as follows:

Table 10. Phase III survey: co-constructed core practices

<table>
<thead>
<tr>
<th>NO.</th>
<th>Teaching routine genericity</th>
<th>Core practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lead-in in classroom</td>
<td>Creating learning context</td>
</tr>
<tr>
<td>2</td>
<td>Conversation in classroom</td>
<td>Exploring students’ thinking</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Putting forward questions to inspire students to think</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Listening to students carefully and responding effectively</td>
</tr>
<tr>
<td>5</td>
<td>Activity in classroom</td>
<td>Guiding students to explore</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Guiding students discussion</td>
</tr>
<tr>
<td>7</td>
<td>Improvise in classroom</td>
<td>Making appropriate decisions to adjust teaching</td>
</tr>
<tr>
<td>8</td>
<td>Evaluation in classroom</td>
<td>Evaluating students' disciplinary thinking</td>
</tr>
<tr>
<td>9</td>
<td>Summary in classroom</td>
<td>Building connections between different knowledge</td>
</tr>
</tbody>
</table>

4 Discussion

Through three stages of investigation, this study identified core practices that are in line with Chinese teacher culture based on the approach of co-construction. Stellan Ohlsson (2011) argues that interpretation of behavior must involve the interpretation of cognitive terms and hence each core practice were interpreted from cognitive and behavioral level. Researchers decomposed each core practice into sub-practices that are more conducive to acquisition and implementation and recomposed them through drawing on modularity.

4.1 Creating learning context

Knowledge, which comes from life, is non-static mental structure existing in learner's mind (Sawyer, 2005). Experts' knowledge is "contextual", including specific requirements for useful situation (Glaser, 1992). Creating context in teaching can be decomposed: starting with teaching needs and goals; presenting context: providing students with stimulating data materials, contextual information and physical operation related to disciplines, or simulating situation contacted with realistic social life experience by verbal descriptions; presenting and articulating elements of cognitive conflict in the context: deriving questions related to learning objectives and content from context; leading students to find effective memory retrieval clues through discourse; helping students selectively recall related knowledge and cognitive psychology research shows that understanding is not just a process of interpretation and
construction but needs to be chosen (Stellan Ohlsson, 2011); explaining content; inspiring students to think in response to current situations and to build assumption of problem in which by dialogue; leading students to sort out these assumptions; verifying hypothesis by application and migrating problem situation. This practice focuses on creating opportunities for students to produce contextual knowledge that enables students to skillfully extract knowledge related to a specific task in the face of similar tasks or problems.

4.2 Exploring students’ thinking

As a kind of testable teaching method, Confucius’s interactive conversational teaching and Socrates “Midwife” has an abyss of influence on modern teaching. At the same time, experts believe that one of the starting point of teaching is that students’ starting point and needs for learning, learning outcomes such as homework, test scores can’t reflect learning situation of student perfectly. It is necessary to explore students’ problem and the reason of a certain answer through conversation with the students, which is individualized teaching. Lampert (2001) also suggested that teachers need to understand the thinking of different students and to teach on the basis of which. Exploring students’ thinking processes is broken down: including explaining new knowledge to create cognitive conflicts for students; guiding students to think and come out with their opinions; thinking about what a student’s answer means; judging whether a student’s perspective is worth exploring; considering what’s the next question and how to present them, e.g. ask students to explain the problem further, you can say, “can you explain what you are saying?”; predicting students’ responses: teachers need to have a general grasp of the types and scope and students’ possible answers; learn the students understanding with proper way: to guide students to think and clearly express their ideas and reasoning process, so that teachers can understand the basic logic behind the point of view of students; being informed that how students to learn and evaluate; maintaining sensitivity to the mistakes usually made by students and knowledge Point needed to deepen understanding. This practice focuses on understanding individual cognitive level, learning rules, cognitive processes and ways of thinking to find the starting point for teaching and teach based on teachable point misconceptions, and provide basis for teaching students in accordance of their aptitude.

4.3 Putting forward questions to inspire students to think

Fleury, a famous Brazilian scholar of education, once said: “Without dialogue, there is no exchange, than no real education.” He believes that “dialogue teaching” can promote individualized development of students and the problem is key to it (Marylou Dantonio, Paul C. Beisenherz, 2000). Experts believe that “problems” are “triggers” that make students ponder. This practice includes generate problem based on the teaching content and students' learning situation; constructing the question space involved the object of question and arrangement of which, goals and strategy for the students etc. (Sawyer, 2005); characterizing problems in ways that students can accept and comprehend, that is, to make students clearly know what is asked; providing students with the necessary
information and qualifications to consider issues and in order to supporting for students; leaving students sufficient time to think deeply; using students’ answers to evaluate their reasoning; triggering student's further thinking and reasoning through questioning closely; encouraging students to express and query; stimulating students to discover, generate, analyze and think about problems. This practice focuses on encouraging students to think and reflect on their own answers spontaneously and promoting students to learn to think and learn.

4.4 Guiding students’ discussion

In a study, Schwartz (1995) showed that students participated in group cooperation were more likely to pick up useful information in conversation than individual learners. Okada and Simon (1997) studied simulation experiments in scientific problem solving of students and found that paired partners were better and more likely to generate generative conclusions than individual participants (Stellan Ohlsson, 2011). The foreign group discussion lies in mutual guidance among the members, and is an essential that monitoring and guidance of the teachers in domestic group discussion. Guiding students discussion involves group dynamics, subject knowledge, identity and fairness (H Ghousseini, 2015), including grouping strategically: to determine the scale and form of group (homogeneous or heterogeneous or other) and discussion style; ensuring that students in advance and equal access to relevant information; if this is the first time to organize the group discussion, it is necessary to demonstrate or explain to the students how to participate in the discussion, Bell Hook wrote, in my class, I will not allow students to try the danger I have not tried (Stephen D. Brookfield, 2005); illustrating the basic principles and norms to follow in the process of discussion; leading division of labor rationally to ensure that everyone can gain identity in the group; creating a suitable problem to initiate the discussion; activating students' past experience by directive words and questioning; monitoring performance of students; encouraging students to share ideas and methods; helping students build partnerships; guiding students to put forward different opinions critically on the basis of respect for others and giving conversational suggestions; transforming destructive behavior to be constructive in group discussion; reminding students to learn to listen; responding to questions raised by students; stimulating students’ thought; inciting students to share and exchange with classmates and report. This practice focuses on helping students establish partnerships, expressing ideas, exchanging views, interactive inspiring, collaborating and joint building knowledge in a small community.

4.5 Guiding students to explore

The famous scientists all think that science education should follow the real scientific research process (Hurd, 1970, N Council, 1996). During the expert consultation, researchers found that experts in natural sciences and humanities and social sciences all believed that it could be identified as core practice, but this practice is implemented in diverse ways in different disciplines. Natural science experts hold that guide students to participate in the study of physical world, including: guiding the students to find
problems and make assumptions autonomously; designing and executing the experience to verify the conjecture; collecting and analyzing data; establishing explanation and demonstration and exchanging views; heartening to question and correct ideas; finally solving the problem. This practice pays attention to creating learning environment conducive to explore for students. Social science experts believe that the practice is to guide students to participate in the inquiry of text, including, discovering problem; reading the text with it; clarifying logical relationship between contents; deducting logically combining historical background and realistic situation; inferring and summarizing; shooting problem. This practice pays more attention to the teacher’s guidance by rigorous and logical discourse and scientific and precise inquiry. To guide the students to participate in self and collaborative inquiry and emphasize experience of discovery to settlement of issue. In the process, students think and question constantly and approach correct conclusion, method of probing and related disciplines developed accordingly.

4.6 Making appropriate decisions to adjust teaching

The classroom is an open system. Shavelson (1973) have pointed out that any teaching behavior is a result of decision. As a complex interactive activities, teachers in the implementation of planned teaching need to response to unexpected results that students showed spontaneously. This practice can be divided: observing performance of students in class carefully; looking into the needs of them keenly; thinking and judging current situation instantly; recalling teaching conventions and cases in the memory to invoke existing knowledge and experience; choosing to use teaching routine or cases to explain new situation or applying teaching tact to generate a default solution (Lu Feng & Xu Xiaodong, 2013); rehearsing in mind, to predict possible results, Herbert A. Simon and Allen Newell (1958) stressed that thinking can be predicted; electing a optimal teaching decision making. This practice focus on informing of the situation of students by making full use of valuable “generation” in class, which includes questioning, students’ views and interactive performance. Adjusting, update and improve next teaching through judgment, thinking and prediction in order to ensure correct direction and impromptu guide the students to further study.

4.7 Listening to students carefully and responding effectively

Manabu Sato (2014) thinks that listening is the first step in democratic classroom. Listening is not only the sense of hearing, but also the interaction process of knowledge, thought and meaning's communication, feedback and relationship construction (Song Lihua, 2016). This practice incorporate: creating learning space and classroom atmosphere of free expression; producing cognitive conflict to stimulate students' expression; providing wealthy emotional support for students; abandoning fixed answers and thoughts in the mind; noticing to opinions that students want to express views of students; listening to the view, reason, expression even how they feel covering sound and silent language; guiding students to clearly express their real idea; accepting their personalized, immature, even seemingly incorrect speech; understanding frame of
mind behind the student's statement. Manabu Sato (2014) learned that a level of understanding is idea infiltrated but not mentioned in the discourse and ambiguous expression, another level of understanding is speakers mood, thoughts and emotional experience; being aware of connection between statement and subject content and different opinion; expressing empathy for conversationalist; giving them Positive reinforcement by praising; refining the key points of speech; questioning, supplement and perfect the speech, as I have different opinions...... I have a doubt... We add... The process of listening requires teachers to distinguish, analyze, select and judge the content expressed by students and provide feedback information.

4.8 Building connections between different knowledge

Teachers lead learners to existing knowledge and concepts serving as the starting point of teaching, and offer them more opportunities to learn and construct, so as to promote students' learning (Bransford, John D., 2000). It can be seen that when students access to new knowledge or concepts or face novel situations, they call on existing knowledge and concepts, which requires teachers to assist students in establishing connections between knowledge. Experts believe that, teacher should be committed to the establishment of the relationship between different knowledge for students in the whole class, especially in the part of summary, can’t sum up and the retell content simply, and should help students form in order schema, instead of a single memory node. This practice includes: discovering the common elements between the prior and new knowledge; using cases, analogy or metaphor and inference to construct connections between appearance and essence, concept and events effectively; making relation between knowledge explicit by language or other methods; guiding students to recall, recognize, extract and map preceding experience to the new situation; helping students to express their growing understanding and strengthen relationship between constructed knowledge in the process of assimilation and accommodation. This practice focuses on supporting students to connect new situation and prior knowledge and daily life, making them forming contextual knowledge structure that exists in schema mode, so as to afford the possibility of deep understanding of the physical world and concept and migration of problem situation and settlement of later problem.

4.9 Evaluating students' disciplinary thinking

Evaluation reflects the quality of students' thinking and specific content they have learned. Effective teachers notice opportunities to evaluate in classroom learning situations and constantly try to understand students’ thinking and understanding and make them related to their current learning tasks (Bransford, John D., 2000). Evaluation plays an important role in classroom teaching. Experts generally believe that focus on the evaluation of relevant disciplinary thinking, embracing formal and informal, can be decomposed into: resolving goals of disciplinary thinking corresponding to subject content, it means switch of teaching from expectation of changing dramatically of students to uninterrupted and sustainable cultivation (Manabu Sato 2014); communicating effectively with students; monitoring and looking into behavior of
students; collecting accurate information about their academic performance; selecting appropriate evaluation methods, as if teacher stressed the importance of understanding, can't test students on the facts and the process of memory; determining the knowledge structure model about certain concepts in the minds of students by various evaluation practices, such as question; thinking about cognitive theory that is hidden in behavior, covering the ability of reasoning, understanding, analysis and synthesis and solving problems; guiding future teaching based on known information. This practice focuses on teacher monitoring about teaching and learning process of and evaluation about academic performance and thinking development of students.

5 Conclusion

In domestic, some researchers tend to put the focus on teaching, and hope to explore the possible of teacher professional promotion by specific teaching situation (Lu Naigui & Cao Taisheng, 2010). This research constructed a set of core practices which is both theoretical and practicable through three rounds of investigation based on effective classroom teaching practices that is consistent with core practice standards that believe by front-line teachers, expert teachers and teacher educators. By studying and practicing above practices, preservice teachers are helpful to produce affluent practical knowledge.

At the same time, this paper referred to two levels of core practice: existing in the form of knowledge community in the brain; can be put into effect based on knowledge mode in service. This paper only focuses on the former, which can be seen the foundation of research on core practices. The latter is more crucial because teachers need to construct and enrich teaching knowledge during the practice (Lu Naigui & Cao Taisheng, 2010). The key of research on core practices is to implement into teaching practice and provide instruction and support for the training of novice teachers. Considering how to implement and what about the effect of core practices involving more complicate elements such as students and real situation, researchers will carry out empirical study about core practices in the following study, this is also the direction of future research.

Reference

Design and Implementation of Blended Learning for the Undergraduate Course “Education and Artificial Intelligence”

Jiyou JIA
Department of Educational Technology, School of Education, Peking University.
Yiheyuanlu 5, 100871, Beijing, China
jyy@pku.edu.cn

Abstract. For the ambitious aim toward world-class university, Peking University encourages the blended learning of information and communication technology with classroom teaching for undergraduates. This paper introduces the design and implementation of blended learning approach for the teaching of one undergraduate course “Educational and artificial intelligence”. Along with the traditional face-to-face classroom instruction including individual presentation, discussion and debate, the instructor used course management system Moodle to deliver course resources such as lecture notes and supplementary video clips, and to manage many kinds of learning activities like quizzes and assignments. One field trip was also organized to enrich the students’ hands-on experience. As an ongoing project, the temporary learning progress and performance of the students are analyzed.

Keywords: blended learning, instructional design, student engagement, student satisfaction

1 Introduction

The blended learning combines traditional face-to-face instruction with computer-mediated or online instruction (Bonk and Graham, 2006), links traditional classroom teaching to online learning that usually means the learning over the Internet or Intranet (Singh, 2003), or combines the effectiveness and socialization opportunities of the classroom with the technologically enhanced active learning possibilities of the online environment, rather than a ratio of delivery modalities (Dziuban, Hartman & Moskal, 2004). Many meta-analysis studies analyzed dozens, hundreds or even thousands of studies dealing with thousands of subjects, and found that blended learning generally can have a more positive effect on learning performance than traditional instructional approaches (Liao, 2007; Tamim, Bernard, Borokhovski, Abrami & Schmid, 2011; Spanjers, Konings, Leppink, Verstegen, de Jong, Czabanowska, van Merrienboer, 2015).

Caritas Institute of Higher Education, Hong Kong, January 2018.
Peking University, as a leading higher education institution in China, is aiming to rank among the world's best universities in the future. It highly emphasizes the undergraduate education and encourages the faculty members to blend information and communication technology with traditional classroom instruction. It also encourages faculty members to offer publicly selective courses on interdisciplinary research on emerging technology for all undergraduates to broaden their visions besides their majors.

“Education and Artificial Intelligence” is such a public elective course for undergraduate students in Peking University. Ten Juniors and seniors from Peking University were enrolled in this course in the first semester of the academic year from 2017 to 2018, starting in September and ending in December 2017. They came from various colleges and departments: physics, psychology, information management, biology, linguistics, economics and sociology. Three are males, and the others are females. Their common interest is artificial intelligence and its educational application, though their knowledge in education and computer science differs from each other. They all had their own notebooks and smart phones, and could use them in the classroom and in the dormitory for reading, writing and browsing Internet via campus-wide WLAN (Wireless Local Area Network) with their own student ids. In the classroom there is one desktop computer which is connected to Internet through wired LAN (Local Area Network) and also connected to a LCD TV set with 43-inch screen embedded in the blackboard. The equipment from the students and from the university provided adequate hardware infrastructure for blended learning.

2 Syllabus Design

To engage the student’s participation in the course activities, formative assessment was adapted for the course’s grading. To facilitate the students’ learning, latest literatures from international journals and supplementary materials were selected and provided to students. Individual presentation, guided reading in dyads, midterm assignment, discussion and debate, final content quiz and semester thesis were all required learning activities and implemented in the course management system Moodle. Besides classroom and campus instruction, field trip to high-tech company was also organized to enrich the students’ hands-on experience and enlarge their vision. In the following sections we introduce the syllabus design in details.

2.1 Grading

The formative evaluation approach was adapted to assess the students’ learning behavior and performance during the whole semester. The grading components and their scores are listed in Table 1.
Table 1. Course grading components and their scores

<table>
<thead>
<tr>
<th>Learning activity</th>
<th>Score (with 100 as full)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence and discussion</td>
<td>10</td>
</tr>
<tr>
<td>Presentation</td>
<td>20</td>
</tr>
<tr>
<td>Midterm assignment</td>
<td>20</td>
</tr>
<tr>
<td>Content quiz</td>
<td>20</td>
</tr>
<tr>
<td>Thesis</td>
<td>30</td>
</tr>
</tbody>
</table>

2.2 Course Management System

The instructor uses Moodle (http://www.moodle.org) V3.1, a world-wide used course management system (CMS), as a platform to design and implement the blended learning. This system can be easily installed and managed. Its interface is adaptive to client equipment from desktop computers, notebooks to tablet computers or smart phones. Through activity completion setting the students’ activity participation and resource review can be traced. In this platform one course “Education and Artificial Intelligence” was created. Each student was given one account to browse the course content and take part in the learning activities. Figure 1 shows the homepage of this course in the course management system.

![Course homepage on the course management system](image)

Fig. 1. The course homepage on the course management system

2.3 Learning Content

Considering remarkable achievements in artificial intelligence in the past few years and its application in education, this course is designed to help students to understand the
multilateral relationship among education, educational technology and artificial intelligence, to explore the potential of applying the emerging technology of artificial intelligence in education. The broad range of topics covers most areas in the field of artificial intelligence, including the nature of natural intelligence and artificial intelligence, the education system and its components, knowledge presentation and engineering, educational data mining, natural language processing, affective computing, robotics, intelligent tutoring systems, and an intelligent computer supported language learning system CSIEC developed by the instructor. Through this seminar, the students should learn the complicated relationship between education and artificial intelligence, and review the educational technologies through the lens of technical philosophy. Nine chapters were included in the course for the duration of 16 weeks in one semester.

2.4 Literature and Lecture Notes

Because both artificial intelligence and educational technology are emerging and interdisciplinary research fields, it seems impossible to find a single appropriate work about education and artificial intelligence as textbook for the students to read. Therefore the instructor searched the corresponding articles published in the past five years in internationally journals listed in SCI (Scientific Citation Index) or SSCI (Social Scientific Citation Index) from ISI-Institute for Scientific Information, the USA (http://apps.webofknowledge.com), and selected most best five to six papers according to their citation and content quality as recommended readings of the students. Because all the students have their own notebooks computers and smart phones, those readings were not printed, but put onto the course management system as learning resources for the students to download. In the weekly two-hour classroom session, the instructor introduced the course content in the chapter sequence using the corresponding lecture notes.

2.5 Supplementary Recourses

In addition to the referred literature, extra learning resources such as links to external websites and video clips were also supplied to facilitate the students’ learning and to improve their interest in the course.

For example, the award-winning 1964 American musical film “My Fair Lady” based on George Bernard Shaw’s Pygmalion is a perfect example to show the importance of human language and the behavioral pedagogy for language learning. Moreover, the humorous dialogue between the leading lady ELIZA Doolittle and other characters before the Ascot Racecourse might inspire the artificial intelligence researcher Weizenbaum to design the first human-computer dialogue program ELIZA (Weizenbaum, 1968). However, due to the lengthy running time of this film, c.a. 170 minutes and the difficulty of the English vocabulary spoken in this film, the undergraduate students might not have enough time to watch the whole film. So the instructor used the video recording and editing software Camtasia to produce three typical clips that are most relevant to the topic of the course “Education and Artificial
Intelligence”, each of whom lasts just around 10 minutes. They are "Why Can't the English Learn to Speak?” demonstrating the importance of language and language education, "The Rain in Spain Stays Mainly in the Plain" showing the difficulty of language learning and especially the speech recognition and synthesis, and "The Small Talk” exemplifying the key words matching mechanism of human dialogues. To facilitate the understanding of the students, the subtitles in Chinese were also added to those clips.

The three clips were supplied in the course management system, and the students are required to watch the film clips. Three questions were put onto the forum following this URL: How important are language and language education? What pedagogy does the phonetics professor use to teach Eliza the pronunciation of English words? How does Eliza use the words, phrases and sentences she learns from the professor to manage the dialogue with others? The students were required to put their answers to the forum and to discuss the film during the classroom session.

2.6 Discussion and Debate

Discussion and even debate was also designed to motivate the students after the students read the literatures. The online activity including discussion forum and Wiki were created in the course management system. The students could write their consideration about some topics. However, those activities were optional, but not obligatory.

A debate took place after the students read the literature about intelligent tutoring system and language technology. The students were divided into two groups, each with five, and argued the pros and cons of the possibility that the student would learn a foreign language with the help of advanced technology but without the teaching of a human teacher in the school. Every member of each group should use the empirical cases given in the literature to support its argumentation and to refute the opposite. This debate continued half one hour, and it inspired the students to read the literature in details and to get familiar with the empirical studies.

2.7 Individual Presentation

Every student is required to make a presentation for 20 minutes or so about one topic selected by himself or herself. The choices were made through a “Vote” activity in the course management system. The student should read the reference corresponding to this chapter before the class and write the presentation with Microsoft PowerPoint based on the reference. The student’s slides file was also uploaded to the course management system for others’ downloading and review.

2.8 Guided Reading in Dyads

Because the chapter “Intelligent Tutoring System” is the most important part in this course, and the references seem longer and more difficult than others, the students were divided into five dyads. The instructor put forward five questions for each dyad. The
two students in each dyad cooperated to read an article and introduced it in the classroom in responding to the instructor’s questions.

2.9 Midterm Assignment

After the concept of data mining and the tools for data mining had been introduced in the classroom at the end of October, the students were required to use Excel, SPSS, WEKA or other data mining software to analyze the log data retrieved from MOOCs (Massive Open Online Course) of Peking University, and to submit the analysis result to the midterm assignment in the course management system. The data set for each student came from different MOOC, and was different from each other. Therefore, every student should analyze the specific data by using the same tools.

Since the background of the students is various, the midterm assignment had obligatory requirement and optional requirement. The students were required to complete the correlation analysis and linear regression charts drawn by using Excel or other tools, and could further complete the clustering analysis by using WEKA, SPSS or other tools.

2.10 Learning Content Quiz

In order to examine the students’ reading and understanding of all lecture notes and recommended literature, one quiz with ten multiple-choice questions based on the lecture notes was designed and put onto the course management system in the last period of the course. Deliberate scoring mechanism was designed to discourage students’ guessing question answers. Only correct answers would be given positive and proportional scores, and false answers would be given proportional but minus scores. However, the minimum score for one question was zero. For example, if there was only one correct answer in one question, and the student submitted more than one answer, the student would not get any score. For those questions with just two correct answers, the student would get one quarter of the full score if he or she submitted one correct answer, but lose one quarter of the full score if he or she submitted one false answer.

The quiz could only be written once and the students should submit the answers within twenty minutes, otherwise the system collected all students’ answers automatically. Although every question has definite choices, the order of the choices for every question and the order of the questions in the quiz were shuffled randomly for every attempt of every student. This could make it harder for students to share answers. The questions should be completed within twenty minutes, and then open attempts were submitted automatically by the system. Once answers were submitted, the score and correct answers were shown to the students.

2.11 Field Trip

In order to get to know the latest development of artificial intelligence application in education, the main topic of this course, one field trip was also arranged during the semester. The instructor, the teaching assistant and the students visited one high-tech
company located in Hefei city, Anhui Province, IFLYTEK CO., LTD. (http://www.iflytek.com/en/index.html). It is “a national key software enterprise dedicated to the research of intelligent speech and language technologies, development of software and chip products, provision of speech information services, and integration of E-government systems.” Speech recognition and synthesis technology is the company’s core technology. The speech product is also embedded into educational products to facilitate language learning, for example “Changyan Intelligent Speech Teaching Aid System”, “Multilingual Intelligent Speech Evaluation System”, “Multilingual Intelligent Speech Evaluation System”, “Chinese-learning Portal for Foreigners”, and “Education Toys”. Moreover, this company also produces digital campus management system and course management system. The speech products occupy more than 70% of market share in the Chinese speech technology market, and the educational products also occupy more and more market shares in China. During one day’s visit in this company, the division managers for educational products introduced their achievements and answered questions from the students, guided the students through their research centers, and demonstrated their latest product in the exhibition hall. Through this onsite visit and hands-on experience of smart robots, AI home assistant and other advanced systems, the students were very surprised about this company’s excellent achievement in speech technology and educational products. Fig. 2. Shows the students were listening to the introduction of IFlyTeck products in the company’s exhibition hall.

Fig. 2. The students were listening to the introduction of IFlyTeck products
2.12 Final Thesis

The student was required to write an article based on the presentation and submit it as an attachment to the assignment “Final paper” activity in the course management system at the end of the semester. The student should use the specified template file to write the article. This article should include the research question, method, findings and conclusion of the referred literature, and have the length of at least three pages.

3 Student Performance

All the students took part in the classroom session, individual presentation, guided reading in dyads, discussion and debate. The students’ presentation slides were deliberately edited with the help of some templates. Only one student was absent to the field trip due to schedule conflict with other classes in the university.

All the students submitted their midterm work on time. Only one just completed the obligatory task, and all the others completed both the obligatory and optional tasks. One submission was selected by the instructor to submit to a Chinese journal and is now in the revision process.

All the students completed the content quiz online in the course management system. The average score is 12.1 of 20, or 60.5%, and the standard deviation is 4.4. The minimum score is 4, and the maximum is 19. The result seems unsatisfying, as three students’ scores were less than half of the full score. The reason for the unsatisfying result may be the strict scoring mechanism of the quiz.

The course theses will be collected and graded according to their qualities. The final course score will be given by summarizing all the grading components in January 2018.

The online participation can be analyzed through the progress tracing function in the course management system. For all the nine chapters’ lectures notes, eight of ten students (80%) downloaded them on average, with the minimum 1 and the maximum 10. For all the nine chapters’ literature readings, 5.3 of ten students (53%) viewed them on average, with the minimum 3 and the maximum 9. The students viewed other supplementary materials including other students’ presentation files very seldom, and took part in online discussion and wiki activities seldom, too.

4 Student Evaluation

The students are required by the university to submit their answers to the official course survey designed by the Office of Educational Administration. Those result will be shown to the instructor for self-reflection via university portal. No extra survey was designed for the students to fill in in order not to burden them. Upon receiving the survey data, the instructor will analyze them in depth.

However, one student wrote to the instructor to express her gratitude and thought: “We all devoted ourselves to this elective course, because you have designed so many interesting learning activities to motivate us. You selected so many excellent research
papers for our reference. Your excellent introduction in the classroom and clear guidance help us understanding the difficult learning content.”

5 Conclusion and Discussion

Struggling for becoming a world-class university, Peking University encourages the blended learning of information and communication technology with classroom teaching for undergraduates. The author designed and implemented blended learning approach for the teaching of one undergraduate course “Educational and artificial intelligence”. Along with the traditional face-to-face classroom instruction including individual presentation, discussion and debate, the instructor used course management system Moodle to deliver course resources such as lecture notes and supplementary video clips, and to manage many kinds of learning activities like quizzes and assignments. One field trip was also organized to enrich the students’ hands-on experience.

Despite the instructor’s great effort, the students’ learning progress and performance analysis at present shows that students just participated in the required online activities and onsite activities, and the content quiz performance was not satisfying. The reason should be further explored together with the students’ survey answers collected and delivered by the university in the coming month.

References

Instructional Design of Applied Disciplines based on CSCL and SaaS Teaching Platform - Take the Subject of International Logistics Management as an Example

Shuang WANG
School of Education, Peking University, Beijing, China
Tianjin Coastal Polytechnic, Tianjin, China
1601111371@pku.edu.cn

Abstract. This paper is focused on how to develop more motivating instructional models for applied disciplines in CSCL environments and SaaS teaching platform. Based on case studies and factor analysis in the subject of logistics management, the instructional model which is considered the factors of community learning, process-driven approached, integrated media use, interactive networked learning, flexible learning environments, more challenging and competitive game study, would attract more participants to get better learning performances. Finally, this paper presents an ideal instructional design model based on CSCL-SaaS pedagogical platform as per the results of antecedent analysis. With better instructional design integrated technique tools, CSCL would be more efficient and flexible to learners who is not available for F2F education.

Keywords: computer-supported collaborative learning(CSCL), e-learning, instructional design, applied disciplines

1 Introduction

Based on computer-supported collaborative learning (CSCL) and Software-as-a-Service (SaaS) teaching platform, learning system can integrate numerous industry cases and resources, provide interactive and international community learning environment, make instant software solution, present multimedia learning environment and develop competitive study from practical games. Apart from the technical solutions of CSCL and e-learning platform which make MOOC be prospective in most theoretical or technical subject, a perfect instructional design and making good use of the advantages of networked learning would provide more efficient and constructional performance to applied disciplines.
1.1 Comparison of instructional design models

According to Baturay’s (2008, P.472) definition that Instructional design is a systematic method including analyzing, designing, developing, evaluating and managing the instructional process in order to get the teaching and learning process more efficiently and productively. By far, many efficient Instructional Design Models have been developed. Those models could be categorized with different cateries. In order to classify the instructional design models with the purpose that selecting the most available model for education of applied discipline base on CSCL and SaaS platform. Hereof the comparison listed below are illustrated mainly the most popular Models with their structures, features and availabilities.

<table>
<thead>
<tr>
<th>Model name</th>
<th>structure</th>
<th>features</th>
<th>availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADDIE (Branson, 1975)</td>
<td>Analysis – design – development – implementation - evaluation</td>
<td>systematic or the constructivist approach</td>
<td>Designing and Developing a Blended Course</td>
</tr>
<tr>
<td>Dick, Carey &amp; Carey (Dick, Carey, &amp; Carey, 1978)</td>
<td>Identify Instructional Goal-Conduct Instructional Analysis-Analyze Learners and Contexts-Write Performance Objectives-Develop Assessment Instruments-Develop Instructional Strategy-Develop and Select Instructional Materials-Design and Conduct Formative Evaluation of Instruction-Revise Instruction-Design and Conduct Summative Evaluation</td>
<td>systems oriented model; components in designing are executed iteratively and in parallel</td>
<td>Instructional design model for beginner in production industry</td>
</tr>
<tr>
<td>ARCS Model of Motivational Design (John Keller, 1979)</td>
<td>Obtain course information-Obtain audience information-Analyze Audience-Analyze existing materials-List objectives and assessments-List potential tactics-Select and design tactics-Integrate with instruction-Select and develop materials-Evaluate and revise</td>
<td>Internal drive objective</td>
<td>Learner-centered instructional design</td>
</tr>
<tr>
<td>Seels &amp; Glasgow Model (Seels &amp; Glasgow, 1998)</td>
<td>Analysis - instructional design - implementation and evaluation</td>
<td>System based linear design</td>
<td>Project-oriented development; Especially for production industry</td>
</tr>
<tr>
<td>Smith and Ragan model (Smith and Ragan, 1999)</td>
<td>Instructional analysis -strategy selection - evaluation development</td>
<td>Learner centered design model Valid assessment serving for objectives.</td>
<td>Classroom-oriented instructional design model</td>
</tr>
<tr>
<td>Willis (R2D2) Model</td>
<td>Three main principles: recursion, reflection, and participation.</td>
<td>dynamic process that is affected by the context</td>
<td>Learner based instructional design</td>
</tr>
<tr>
<td>Model name</td>
<td>structure</td>
<td>features</td>
<td>availability</td>
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<tr>
<td>(Willis, 2009)</td>
<td>summative evaluation, final packaging, diffusion, and adoption of the design is completed during dissemination.</td>
<td>and the environment of the learner. Continuous iteration.</td>
<td></td>
</tr>
<tr>
<td>Morrison, Ross &amp; Kemp (Morrison, Ross, &amp; Kemp, 2010)</td>
<td>1. Identify instructional problems, and specify goals for designing an instructional program. 2. Examine learner characteristics that should receive attention during planning. 3. Identify subject content, and analyze task components related to stated goals and purposes. 4. State instructional objectives for the learner. 5. Sequence content within each instructional unit for logical learning. 6. Design instructional strategies so that each learner can master the objectives. 7. Plan the instructional message and delivery. 8. Develop evaluation instruments to assess objectives. 9. Select resources to support instruction and learning activities.</td>
<td>All elements are interdependent. All the elements can be performed simultaneously as the model is nonlinear and flexible. The user can start at any point in the process. Learning needs, goals, priorities and constraints determine the instructional solutions. All programs or projects may not require all nine elements.</td>
<td>Classroom-oriented instructional design model</td>
</tr>
<tr>
<td>SAM (Michael Allen, 2012)</td>
<td>Initial design (background analysis – brainstorm) – aggressive design (evaluation-design-sample) – iterative development(implementation-evaluation-development)</td>
<td>Agile development Continuous iteration; Cycle assessment;</td>
<td>Designing and Developing a Blended Course or project-oriented training</td>
</tr>
</tbody>
</table>

As the discussion of implementation methods, instructional design should be design-oriented, and should provide the instructional strategy which can realize the learning target. While the instructional strategy is for instructional environment and teaching objective to decide. So, the strategy is not universal efficient, but in situational relations. Situational feature tells that instructional design has to be varies from different teaching and learners.

Therefore, to select and modify an available instructional design model,

1.2 **Instructional Features of applied discipline**

Different from discipline of theoretical or philosophy, applied discipline is the use of scientific processes and knowledge so as to achieve a particular practical or useful result. Applied discipline is comprised of a broad range that related fields from
Engineering, Business, Medicine to Education. The instructional features of applied discipline are as follows:

- Practice-oriented. The main target of teaching or learning applied discipline is to grasp the practical skills which is useful in particular practical field.
- Continuous interactive. On instructional point of view, teacher and learner need more interaction on both sides than other discipline, so as to discuss or create new ideas or new solutions onto concrete project. On practical point of view, the skills learned in applied discipline need more interactive activities to improve and enhance those skills.
- Project task-based. Some instructional designer in applied discipline attends to construct a systematic gameplay like block contests to create an environment of competition and project-thinking.
- Theoretical applied. Most of the applied discipline ought to apply formal science such as mathematics, statistics, even physical or biological methods. Therefore, it is theoretical-based and practical-oriented.

Based on above features, instructional designers have to consider how to create the practical environment and tasks and how to logically connect the theoretical methods with practical projects as the means to make the education more efficient.

1.3 Combination of CSCL and SaaS

As a pedagogical approach, Computer-supported collaborative learning (CSCL) is emphasize social interaction and group learning when teaching-learning via using computer or through internet. By using technology as their primary means of communication or as a study resource, Sharing and construction of professional skills or knowledges among learners or participants is the main character of CSCL. CSCL can be implemented in the environment of e-learning or classroom learning. It can take place synchronously or asynchronously (Stahl, Koschmann & Suthers, 2006). The field of CSCL draws heavily attention and pedagogical theories. Interaction between learners, sharing knowledge, and building knowledge as a group will lead to more efficient instructional effects, creative idea and constructive cognitions (Resta & Laferrière, 2007).

Software as a service (SaaS), as a popular delivery model for many business applications, including many business software or applied software, is licensed on a subscription basis. SaaS is considered to be part of the nomenclature of cloud computing along with Platform as a Service (PaaS), mobile backend as a service (MBaaS), etc. Different from other *aaS, SaaS is the service of flexibility, easy use, and better customs experiences of interaction, which is oriented to board users.

The combination of CSCL and SaaS actually is take advantage of the technology in group learning/sharing knowledge, and the delivery model of services. Based on CSCL-SaaS pedagogical platform, instructional designer/teacher can create more constructive model for collaborative group learning-oriented learners and deliver it in easier and agile approach. As the same time, this platform also requires teachers have the capability of integrating tremendous learning resource and design the course with learner-centered. Project tasks-driven, problems-based, collaborative learning,
systematic design in learning process, and pay more attention to continuous assessment would be the better solution for instructional designers. To some extent, learning technology would be the real meaning of education technology.

2 Methodology and Demonstration

2.1 Factor analysis in the subject of logistics management

Selection of target samples.
In this study, one group of 30 students who registered on the CSCL-SaaS platform and had been studying the subject of “logistics management” for one semester were chosen to be the sample pool of the investigation. There are 8 core courses involved in this discipline. According to the mean value of each course, the courses can be sorted as follows:

<table>
<thead>
<tr>
<th>Pos.</th>
<th>core courses</th>
<th>means of performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>c1</td>
<td>transportation management</td>
<td>92.75</td>
</tr>
<tr>
<td>c2</td>
<td>logistics management-modeling and experiment</td>
<td>91.33</td>
</tr>
<tr>
<td>c3</td>
<td>storage and inventory management</td>
<td>88.27</td>
</tr>
<tr>
<td>c4</td>
<td>logistics Information system management</td>
<td>88.21</td>
</tr>
<tr>
<td>c5</td>
<td>international trade practice</td>
<td>86.75</td>
</tr>
<tr>
<td>c6</td>
<td>supply chain management</td>
<td>81.23</td>
</tr>
<tr>
<td>c7</td>
<td>international purchasing management</td>
<td>79.62</td>
</tr>
<tr>
<td>c8</td>
<td>import and export declaration and inspection</td>
<td>75.23</td>
</tr>
</tbody>
</table>

From the list, the top 2 courses – “transportation management” and “logistics management-modeling and experiment” should be the best performance. Then, author selected top 10 students each from top 2 courses to do the questionnaire survey. They have to answer the questionnaire based on the study experiences of each course. Some of the students in this two group are overlap. Nevertheless, considering the questionnaire is refer to special course, it won’t reflect the result of the investigation.

Factor analysis.
According to the features of instructional design of online courses in CSCL-SaaS platform, author designed 25 questions referring to multiple level experiences that learners can assess and which are conducted to determine factors affecting the performance of the instructional design. Analyzing from the data of the investigation, 6 of 25 components are invalid or lack of effective support, therefore, 6 components were deleted and the rest 19 components formed the final analysis (Yong & Pearce, 2013).

Loading the data of investigation to SPSS. By analyzing the data with factor analysis and principle components analysis, the KMO measurement is 0.764. It means this study is available and valid. According to the result of principle components analysis of total
variance of interpretation (as per Table 3 and Figure 1), the accumulation of first 7 variances is already more than 81%.

Table 3. Total variance of interpretation

<table>
<thead>
<tr>
<th>Cop.</th>
<th>Initial eigenvalue</th>
<th>Extracting square sum and loading</th>
<th>Rotated square sum loading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Variance %</td>
<td>accumulate %</td>
</tr>
<tr>
<td>1</td>
<td>3.834</td>
<td>20.18</td>
<td>20.18</td>
</tr>
<tr>
<td>2</td>
<td>2.974</td>
<td>15.65</td>
<td>35.831</td>
</tr>
<tr>
<td>4</td>
<td>2.143</td>
<td>11.281</td>
<td>59.567</td>
</tr>
<tr>
<td>5</td>
<td>1.573</td>
<td>8.277</td>
<td>67.844</td>
</tr>
<tr>
<td>6</td>
<td>1.341</td>
<td>7.058</td>
<td>74.902</td>
</tr>
<tr>
<td>7</td>
<td>1.197</td>
<td>6.303</td>
<td>81.205</td>
</tr>
<tr>
<td>8</td>
<td>0.885</td>
<td>4.658</td>
<td>85.863</td>
</tr>
<tr>
<td>9</td>
<td>0.746</td>
<td>3.929</td>
<td>99.792</td>
</tr>
<tr>
<td>10</td>
<td>0.701</td>
<td>3.687</td>
<td>93.479</td>
</tr>
<tr>
<td>11</td>
<td>0.44</td>
<td>2.314</td>
<td>95.792</td>
</tr>
<tr>
<td>12</td>
<td>0.385</td>
<td>2.024</td>
<td>97.817</td>
</tr>
<tr>
<td>13</td>
<td>0.234</td>
<td>1.23</td>
<td>99.046</td>
</tr>
<tr>
<td>14</td>
<td>0.114</td>
<td>0.602</td>
<td>99.649</td>
</tr>
<tr>
<td>15</td>
<td>0.053</td>
<td>0.276</td>
<td>99.925</td>
</tr>
<tr>
<td>16</td>
<td>0.014</td>
<td>0.074</td>
<td>99.999</td>
</tr>
<tr>
<td>17</td>
<td>0</td>
<td>0.001</td>
<td>100</td>
</tr>
<tr>
<td>18</td>
<td>1.29E-16</td>
<td>6.81E-16</td>
<td>100</td>
</tr>
<tr>
<td>19</td>
<td>2.45E-17</td>
<td>1.29E-16</td>
<td>100</td>
</tr>
</tbody>
</table>

Extraction method: principal component analysis.

Fig. 1. Screen plot
In order to abstract the main factors of all the components, conduct rotation of the component matrix. As per the result of the Rotational component matrix (Table 4), the following 19 components can be sorted as 7 main factors as the illustration of Table 5.

Table 4. Rotational component matrix

<table>
<thead>
<tr>
<th>Components</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>study according to project process</td>
<td>0.854</td>
<td>0.144</td>
<td></td>
<td></td>
<td></td>
<td>0.132</td>
<td></td>
</tr>
<tr>
<td>project-tasks is the main logical line</td>
<td>0.819</td>
<td>0.237</td>
<td></td>
<td></td>
<td>0.211</td>
<td>-0.247</td>
<td></td>
</tr>
<tr>
<td>operation of practical documents or project</td>
<td>-0.765</td>
<td>0.229</td>
<td></td>
<td>0.154</td>
<td>0.356</td>
<td>0.144</td>
<td></td>
</tr>
<tr>
<td>step by step to learn how to make solution</td>
<td>0.634</td>
<td>0.207</td>
<td>0.248</td>
<td>0.339</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>group discussion</td>
<td>0.157</td>
<td>0.913</td>
<td>-0.21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can communicate with other learner via learning platform</td>
<td>0.157</td>
<td>0.913</td>
<td>-0.21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>group learning or collaboration is possible we can make group game contest during study</td>
<td>0.247</td>
<td>-0.543</td>
<td>-0.299</td>
<td>0.185</td>
<td>0.416</td>
<td>-0.334</td>
<td>0.164</td>
</tr>
<tr>
<td>VR or software simulation</td>
<td></td>
<td>0.96</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>technical tools or game study</td>
<td></td>
<td>0.96</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lab environment</td>
<td>-0.128</td>
<td>-0.205</td>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>courseware and video study</td>
<td>-0.142</td>
<td></td>
<td>0.902</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>any course and partly content I can choose</td>
<td>-0.131</td>
<td>0.663</td>
<td>0.108</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>anywhere to learn</td>
<td>-0.33</td>
<td>-0.832</td>
<td></td>
<td>0.117</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can get instant respond via learning platform</td>
<td>-0.235</td>
<td>0.111</td>
<td></td>
<td>0.825</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can compare performance to other students</td>
<td>-0.449</td>
<td>-0.446</td>
<td>0.5</td>
<td>-0.397</td>
<td>-0.121</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can pose questions to teacher instantly</td>
<td></td>
<td></td>
<td></td>
<td>0.886</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>anytime to learn</td>
<td>0.492</td>
<td></td>
<td></td>
<td>-0.662</td>
<td>0.222</td>
<td></td>
<td></td>
</tr>
<tr>
<td>correct answer is automatically displayed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.131</td>
<td>-0.911</td>
</tr>
</tbody>
</table>

Extraction method: principal component.
Rotation method: orthogonal rotation method with Kaiser standardization.
The rotation is convergent after the 8 iterations.

Table 5 sorted the components into 6 main factors due to the Quantitative characteristics and practical significance of the investigation. They are community learning, process-driven approached, integrated media use, interactive networked learning, flexible learning environments, more challenging and competitive game study.

According to the following sample saliency test, the result can’t be influenced by individual characters of samples.
Table 5. main factor group

<table>
<thead>
<tr>
<th>study according to project process</th>
<th>factor</th>
<th>name of main factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>project-tasks is the main logical line</td>
<td>1</td>
<td>process-driven approached</td>
</tr>
<tr>
<td>operation of practical documents or project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>step by step to learn how to make solution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>group discussion</td>
<td>2</td>
<td>community learning environment</td>
</tr>
<tr>
<td>I can communicate with other learner via learning platform</td>
<td></td>
<td></td>
</tr>
<tr>
<td>group learning or collaboration is possible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>we can make group game contest during study</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VR or software simulation</td>
<td>3</td>
<td>competitive game study</td>
</tr>
<tr>
<td>technical tools or game study</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lab environment</td>
<td>4</td>
<td>multimedia integration</td>
</tr>
<tr>
<td>courseware and video study</td>
<td></td>
<td></td>
</tr>
<tr>
<td>any course and partly content I can choose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>anywhere to learn</td>
<td>5</td>
<td>flexible learning environment</td>
</tr>
<tr>
<td>I can get instant respond via learning platform</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can compare performance to other students</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I can pose questions to teacher instantly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>anytime to learn</td>
<td>6</td>
<td>interactive networked learning</td>
</tr>
<tr>
<td>correct answer is automatically displayed</td>
<td>7</td>
<td>instant response</td>
</tr>
</tbody>
</table>

### 2.2 Available instructional design models and modification

Above analysis both in comparison of instructional design model and in factor analysis of instructional design based on CSCL-SaaS pedagogical platform provide a logical structure of ideal instructional design model on such pedagogical pattern. Successive approximation model would be the basis to design thus ideal model. Because, it is more Agile, can be continuously iterated and cycle assessment. Considering the main factors which are of better performance in the investigation, author modify the ideal instructional design model as Figure 2.

From this model, instructional designers have to sufficiently consider the teaching environment and conduct the iterative development which can be improved instantly according to continuously assessment.

**Step 1. Preparation.** Designer should prepare for designing the course from three main aspects: learning community structure analysis, multimedia tools analysis, interactive methods analysis.

**Step 2. Aggressive design.** After proper preparation, designers can make aggressive design. It just like a trial for successful project-teaching design. It should be comprised of knowledge/technics/Accomplishment structure design, project-task structure design, sample project design involved multimedia, study game and possible technical online tools, and additional design for patterns and arts as well.

**Step 3. Iterative development.** When the sample chapter was burned, the real iterative design started. It should be cycling process of design, which is proceeded as implementation of sample project, evaluation of sample project, and develop new project. During the course, evaluation of the sample project is included not only the
efficiency of knowledge imparting, but also the holistic performance of registered learners, whether the website of courses are friendly use, whether the multimedia are properly integrated, whether the interaction in the learning community is efficient, and whether the course is of high user viscosity.

Besides, one more point should be emphasize that from step 1 to step 3 are also cycling processed.

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**Fig. 2.** Ideal instructional design model based on CSCL-SaaS pedagogical platform

### 2.3 Applicability and possible problems

As the name that is of, above ideal instructional design model based on CSCL-SaaS pedagogical platform is conducted in particular teaching environment and particularly for applied discipline. It helps to improve the performance and efficient of teaching-learning activity, and it helps designer to create a better instructional pattern to motivated learners to get better study experiences. Comparing with former study of instructional design, this model provides more detailed steps especially toward CSCL-SaaS pedagogical platform and applied discipline and is of more practical value.

Nevertheless, any study has its own limitations. Lacking of sufficient demonstration of above study, this ideal model might need further improvement to become perfect.

### 3 Conclusion

MOOK and light classroom pedagogical pattern is more and more popular to learners who is not available for F2F education. And it would become a trend that it forms a main part of current education market. More and more people including great amount
of campus pupils or students, who are prefer to learn knowledges or enhance skills via online education.

The online pedagogical platform which could provide group collaborative learning and instant teaching/consulting service is highly recommended particularly for applied disciplinary education. While, of course, teaching activities are naturally more complex than traditional education. How to create a more efficient instructional design seems of great importance.

This paper is right focused on how to develop more motivating instructional models for applied discipline based on CSCL environments and SaaS teaching platform. Based on case studies and factor analysis in the subject of logistics management, the instructional model which is considered the factors of community learning, process-driven approached, integrated media use, interactive networked learning, flexible learning environments, more challenging and competitive game study, would attract more participants to get better learning performances.

Finally, this paper presents an ideal instructional design model based on CSCL-SaaS pedagogical platform as per the results of antecedent analysis.

With better instructional design integrated technique tools, CSCL would be more efficient and flexible to learners who is not available for F2F education.

References

Game-based Vocabulary Learning in Hong Kong: Students’ Perceptions, Attitudes and Expectations of a Game-mediated Vocabulary Learning APP

Lucas KOHNKE 1, Di ZOU 2, Fu Lee WANG 3, Haoran XIE 2,*

1 The Hong Kong Polytechnic University, Hong Kong SAR, China
2 The Education University of Hong Kong, Hong Kong SAR, China
3 Caritas Institute of Higher Education, Hong Kong SAR, China
* hxie@eduhk.hk

Abstract. The presented research discusses students’ perceptions, attitudes and expectations of a game-mediated vocabulary app. Throughout the development of the mobile app, continuous focus group interviews with students were held. The collected data were coded and analysed to identify common features or points mentioned by the students. The results showed that students highly value features like the story plot, graphic, vocabulary list and types of definitions for the design of vocabulary learning APPs. Based on these findings, the APP was further improved by adding synonyms, sentence contexts and extended definitions of the words. Our followed-up interviews indicated that students rated the improved version of the APP higher than the preliminary one. Such findings are consistent with Zou’s (2016, 2017) arguments that the availability of various aspects of word knowledge are conducive to effective word learning as it promotes greater degree of elaboration on the target vocabulary.

Keywords: game-based vocabulary learning, word learning APPs, degree of elaboration

1 Introduction

The presented research reports the development of a game-mediated vocabulary app, Alphabet vs. Aliens@PolyU, developed by The Hong Kong Polytechnic University (hereafter, PolyU) English Language Centre (hereafter, ELC) to enhance learner motivation, interaction, and autonomy through the extended ubiquitous learning opportunities. Mobile devices can provide educational opportunities for students to improve on course content/outcomes (in this case their lexical range and sentence structure, as well as interact with teachers and other colleagues wherever they are located (Cavus & Ibrahim, 2008, 2009; Nihalani & Mayrath, 2010). These interactions using mobile devices are even more accessible by the inclusion of social media for communication and enhance learning (Rodriguez, 2011). Game-based language learning is conducive to English vocabulary development as it enhances learner
motivation, interaction, and autonomy through the extended ubiquitous learning opportunities. A tailor-made game application for vocabulary learning is therefore in need for students to enlarge their vocabulary for academic studies in university.

2 Literature Review

In the literature, there is a consensus that game-based learning applications are effective tools for ESL learners to acquire new vocabulary (Calvo-Ferrer, 2015; Chen & Chung, 2008; Ranking et al., 2006; Uzun et al., 2013). Most of the studies focused on vocabulary adopted a comparative methodology involving an experimental group and a control group and compared their performances in the pre- and post-vocabulary test. The experimental group was asked to play the game for a period of time in the classroom settings or in their own time whereas the control group learnt vocabulary with a paper-based drill-and-practice method. These studies have shown that the experimental group either significantly or substantively outperformed the control group in the post-test, suggesting that the educational games are more useful than the traditional method in helping students to learn and remember new vocabulary. For example, Rankin et al (2006) investigated the benefits of a massive multiplayer online role-playing game as a pedagogical learning tool for intermediate and advanced ESL learners and revealed that the vocabulary of the students who played the game increased by 40%.

There might be a variety of reasons for these improvements:

- First, games could provide considerable and enriched sources for ESL vocabulary learning. The multimodal representation of words in games provides learners with a visual context for understanding words and associating them with existing knowledge (Abrams & Walsh, 2014). In addition, understanding the instruction of the game offers players extended opportunities to learn words that are not in their course.
- Second, students’ satisfaction and motivation are enhanced by the opportunity to learn while playing games. According to Pensky (2004), digital games can engage students because of its profound tempting form in design to include specific elements such as a storyline, goals, interaction, outcome and immediate feedback. The incentives such as rewards, points and top score lead boards provide intense motivation to players unmatched by non-game activities and environments (Kapp, 2012). When students themselves own strong motivation to learn, the gaming system could offer satisfied learning mechanism for them (Chen & Chung, 2008). For those who lack intrinsic motivation, their interaction with the game characters could increase their interest and motivation in the game, and in turn, help them to learn and remember English words more efficiently (Abu Bakar & Nosratired, 2013; Bekleyen & Yilmaz, 2011). As pointed out by Calvo-Ferrer (2015), compared with intrinsic motivation, extrinsic motivation and students’ perceived learning gains has a great influence on students L2 vocabulary acquisition. Through games the conventional rote learning is shifted to a meaningful and enjoyable experience.
Third, students’ interaction and collaboration are stimulated and promoted while playing the game together with peers. They are forced to interact with the game and other players by using appropriate vocabulary and language. Psychologically, the interaction induced from the game is facilitative to players’ germane cognitive load and significantly increases vocabulary recall (Huang & Lin, 2014). Interpersonally, students help each other to complete the game and learn new words from each other, consequently, their interpersonal relationship, self-confidence, will for collaboration and group work are improved (Uzon et al., 2013). As suggested by Sylven and Sundqvist (2012), intra-communication between the players and inter-communication between the game and the players can facilitate the input-output transfer process and make comprehension easier so that vocabulary of the game can be acquired incidentally and naturally.

Fourth, digital-based game learning is conducive to problem-solving and self-directed learning. Prior research has suggested that game-based learning has an important role in increasing the level of learning and can promote imagination in learners. The concrete challenges are normally tailored to a player’s skill level. The increased difficulty can force the players to adopt new strategies to solve the problems and the immediate feedback can urge them to think critically (Abrams & Walsh, 2014). In addition, gaming creates an environment where the learners learn without the interference of the teacher, affording them more time to train and practice at a self-paced speed. More importantly, it creates anxiety-free conditions as they are left on their own and not judged (Uzon et al., 2013).

3 Method

Alphabet vs. Aliens@PolyU was developed to assist PolyU students to enhance interest, sustain motivation and foster participation in independent language learning. This app was extensively used in the Excel@English Scheme (EES) which provides supplementary English language enhancement support for students who enter PolyU with a relatively low level of English Proficiency (DSE3, or equivalent). Moreover, the mobile app will be promoted to Senior Year Admitted students (SYA) who are exempted from ELC courses so that they can have the opportunity to improve and enhance their language abilities through independent learning.

3.1 Features of Alphabet vs. Aliens@PolyU

Alphabet vs. Aliens@PolyU is innovative in the sense that it has the following features with learning content that suit the language levels and interests of PolyU students.

(1) Available on both iOS and Android platforms
(2) Moving level path
(3) Multiplayer mode
(4) Block features (letters)
(5) Social media connection/scoreboard
(6) Comprehensive word list
(7) Engaging story line

3.2 Educational benefits of Alphabet vs. Aliens@PolyU

Students can:
(1) expand the breadth and depth of their vocabulary range
(2) receive extended opportunities to pursue autonomous learning within a supportive context
(3) interact with other PolyU learners on the proposed game-mediated app while engaging in language learning
(4) stimulate collaboration while using and playing the games with peers
(5) increase imagination level of learning while playing the app
(6) Encourage students towards self-directed and independent learning.

The activities on the app are designed to be adapted-release (e.g. hint and clues) and responsiveness (e.g. immediate feedback) in order to cater to different level of learner characteristics and level of competence. Animation, multi-media, and scoring features will also feature in the app.

3.3 Pedagogical Model

The pedagogical model includes the following elements.
(1) Empower learners to gain new knowledge, skills, and experience
(2) Systematically position and review existing teaching plans
(3) Develop new approaches to improving English capabilities
(4) Challenge assumptions of language learning
(5) Give and receive feedback on performance

![Diagram](image)

Fig. 1. Task based model devised by Bo, 2005; Taylor, et al., 2006).
3.4 Users of Alphabet vs. Aliens@PolyU

Approximately one hundred students from PolyU used the Alphabet vs. Aliens@PolyU. These students aged between sixteen and eighteen. Thirty-two of them (twenty-one male and eleven female) participated in the focus group interviews and questionnaire surveys, which investigated their expectations and experiences of what is considered helpful and useful features of an application game for learning English. The interview results were coded and analysed to identify common features or points mentioned by the students concerning their perceptions, attitudes and expectations of an effective vocabulary learning APP.

3.5 Questions

The participants were asked to indicate to what extent they agreed with the following statements on a five-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree).
1. Alphabet vs. Aliens@PolyU is fun to play
2. Alphabet vs. Aliens@PolyU is a stress-free way to learn English.
3. Alphabet vs. Aliens@PolyU help me to become more confident in my learning.
4. Alphabet vs. Aliens@PolyU allows me to improve on my English on my own time.
5. Alphabet vs. Aliens@PolyU is more practical than using a vocabulary book.
6. Alphabet vs. Aliens@PolyU help me to remember English vocabulary better.
7. Alphabet vs. Aliens@PolyU give me confidence knowing I have an English language resource at hand at any time.
8. Alphabet vs. Aliens@PolyU will help me to succeed at University.
9. I will recommend Alphabet vs. Aliens@PolyU to others.

They were also asked to answer two open-ended questions.
1. What aspects of English vocabulary do you think you have improved by using Alphabet vs. Aliens@PolyU?
2. Please list three things you like and three things you dislike with Alphabet vs. Aliens@PolyU.

4 Results and Discussion

The participants’ evaluation of the nine statements as presented above is demonstrated in Table 1. It can be seen that very positive feedback has been received.

The participants’ answers to the two open-ended questions are: (1) their knowledge of the definitions, parts of speech, and spellings of vocabulary have been improved; (2) the like such features as many missions, hints, explanations, dictionary, and colors of the app.
Table 1. The participants’ evaluation of the nine statements

<table>
<thead>
<tr>
<th>Statement</th>
<th>The number of participants who</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly agree</td>
</tr>
<tr>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
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<td>4</td>
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<td>5</td>
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<td>7</td>
<td>20</td>
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<tr>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>9</td>
<td>20</td>
</tr>
</tbody>
</table>

The first round of interview results also showed that students highly value features like the story plot, graphic, vocabulary list and types of definitions for the design of vocabulary learning APPs, because they believed that rich information and contexts were conducive to word learning. Based on these findings, the APP was further improved by adding synonyms, sentence contexts and extended definitions of the words. Our followed-up interviews indicated that students rated the improved version of the APP higher than the preliminary one. Such findings are consistent with Zou’s (2016, 2017) arguments that the availability of various aspects of word knowledge are conducive to effective word learning as it promotes greater degree of elaboration on the target vocabulary. This research also shed lights on the development of word learning APPs and may integrate with personalized vocabulary learning systems (Xie, Lau, Wang, & Wong, 2016; Zou, Xie, Rao, Wong, Wang, & Wu, 2017) in the future development.

Acknowledgement

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References


An Effective Way of Learning Liberal Studies via Virtual Reality

Jeff K.T. TANG, Sui Chi KWAN, Anthony KONG, Wai-Man PANG

Caritas Institute of Higher Education,
2 Chui Ling Lane, Tiu Keng Leng, Tseung Kwan O, N. T., Hong Kong SAR, China

{jtang, sckwan, akong, wmpang}@cihe.edu.hk

Abstract. In recent years, Virtual Reality (VR) has been widely applied in entertainment, gaming and education. In particular to teaching and learning domain, researchers found that VR games could increase the students’ concentration and motivation in learning. Not the least, VR is also a good media for presenting abstract concepts and idea in an immersive way (i.e. in a first person viewpoint). In this paper, we implemented a virtual reality paradigm on liberal studies topics. By simulating the context in an immersive virtual reality environment, we found that the proposed method can improve students’ concentration and motivation in learning concepts in liberal studies.

Keywords: virtual reality, liberal studies, paradigm
Engaging Learners in a Flipped Information Science Course with Gamification: A Quasi-Experimental Study

Biyun HUANG, Khe Foon HEW, Peter WARNING
Faculty of Education, The University of Hong Kong
lucy99@connect.hku.hk; kfhew@hku.hk; pwarning@hku.hk

Abstract. In educational context, gamification is increasingly being adopted as a pedagogical tool to increase learner engagement and motivation. However, there is still a lack of evidence about the long-term benefits of using gamified interventions in flipped classroom. This study examined the effects of a gamified intervention on student engagement in a 10-week flipped information science course. Prior to the intervention, the authors systematically reviewed the motivation theories that are relevant to game psychology, and proposed a goal-access-feedback-competition-collaboration (GAFCC) design model to scaffold the invention design. Both quantitative and qualitative data were collected and analyzed to evaluate the impact of gamification. Results showed that the gamified group completed more out-of-class discussion activities than the control group within the expected time. Self-report data (i.e. survey data) indicated that more than half of the respondents in the gamified group felt gamification added fun to this course, and encouraged them to reflect on their learning strategies. This study provided evidence that gamification strategies guided by GAFCC model can enhance students’ behavior engagement and motivation in the flipped activities. The implications and limitations of this study, and future trend are discussed as well.

Keywords: gamification, flipped classroom, information science education, student engagement

1 Introduction

Gamification is gaining increasingly more attention as a pedagogical tool to increase learner engagement and motivation in K12 to higher education settings. Findings and reports indicated that gamified interventions have the potential to stimulate learners to participate more course activities (e.g. Huang & Hew, 2015), attempt higher difficulty tasks (e.g. Hew, Huang, Chu, & Chiu, 2016), and enhance student engagement in an ICT course (e.g. Çakıröglu, Başıbüyük, Güler, Atabay, & Memiş, 2017). Can gamification be a possible solution for increasing student engagement in flipped classrooms?

Several literature review studies reported (e.g. Betihavas, Bridgman, Komhaber, & Cross, 2016; Lo, Hew & Chen, 2017) that student disengagement is one of the major
challenges of flipped classroom. O'Flaherty and Philips (2015) pointed out that in flipped classrooms students were less likely to engage in out-of-class activities, which were deficient in interactivity and formative feedback mechanism. They further warned that the disengagement in out-of-class activities could lead to student unpreparedness, and result in increased student diversity in face-to-face learning session. That is, the students who are prepared may be even stronger and the less prepared students may feel much harder to keep up with other learners in flipped courses. He, Holton, Farkas, & Warschauer (2016) reported that students had bipolar perception on the value of flipped learning activities, some students favored flipped instruction and some students were quite critical of the flipped instruction. To ease the problem of student disengagement (i.e. behavioral engagement and emotional engagement), this study explores whether gamification could be a possible approach for encouraging student participation with the flipped activities, as well as adding fun to the learning process.

2 Relevant Studies

2.1 Gamification and Game Design Elements

Gamification was initially defined as the “use of game design elements in non-game context” to “design a gameful experience” (Deterding, Dixon, Khaled, & Nacke, 2011). This definition helped distinguish gamification from full-fledged games by stressing the characteristics of using “elements” in non-game context. The benefits of integrating game design elements with learning context was that it can potentially enhance engagement and promote learning, and it could be cost-effective comparing to developing a full-fledged game.

In gamification design, game design elements are the building blocks of games, and play an important role in designing a gameful experience (Deterding et al., 2011). However, there yet has reached a standardized definition of game design elements (Dicheva, Dichev, Agre & Angelova, 2015). Bunchball (2010) classified game elements into two levels, namely “game mechanics” and “game dynamics”. They refer “game mechanics” to the mechanisms for designing a gamified activity, such as points, badges, and leaderboards, and refer “game dynamics” to the motivations or desires enabled by gamification, such as self-expression, and altruism. Werbach and Hunter (2012) categorized game elements into three layers, dynamics (i.e. the big picture of a gamified system, such as emotions, constraints), mechanics (i.e. the processes that players engaged in), and components (i.e. the most concrete level of gameful design, such as badges, points).

Despite the differences in classifying the design elements, it seems commonly agreed that the most concrete level of game design elements are elements like badges, points, leaderboards, etc. In this study, we define game elements as the basic and concrete elements in gameful experience design, which could be directly visualized (Sailer, Hense, Mayr & Mandl, 2017). The examples of game elements include, points, badges, leaderboards, performance graphs, level, unlocking content, storyline, avatar, and quests (individual, or group quests) (Antin & Churchill, 2011, Sailer et al., 2017, Werbach & Hunter, 2012). The game elements entail various motivational functions,
and when appropriately implemented with the context, it could meet certain human needs and promote expected behavior (Bunchball, 2010; Antin & Churchill, 2011; Sailer et al., 2017).

2.2 Flipped Learning with Gamification

Flipped classroom is defined as an instructional approach where students read new materials or watch instructional videos outside of class, free up in-class time for explanation, discussion or problem solving activities, and finish some additional practices (if any) after class (Bergmann & Sams, 2009; Nederveld & Berge, 2015). See Fig. 1. for the flipped classroom model. In flipped classroom, students can learn at their own pace and have the autonomy in deciding when to access the learning materials (O’Flaherty & Philips, 2015), and it can reduce the course difficulty by exposing learners to self-directed learning materials before class (He et al., 2016). As a large chunk of learning where traditionally happens in class under instructors’ supervision has now inverted into students’ self-directed learning, the engagement in the out-of-class session becomes a key premise for guaranteeing the success of flipped learning (Dicheva & Dichev, 2016).

With the purpose of engaging learners in participating flipped activities, researchers suggested that instructors give marks to learners’ self-check quizzes (e.g., Tune, Sturek, & Basile, 2013) or their submitted questions (e.g., Albert & Beatty, 2014). While marks may enhance students’ participation in a way, students may feel pressure or anxiety in completing those flipped learning activities. Can gamification be used as a pedagogical tool to encourage active participation in the out-of-class activities without introducing much pressure? Though a handful of studies pioneered in integrating gamification with the in-class learning session in flipped classrooms, there is a scarcity of empirical studies exploring the impacts of utilizing gamification for the out-of-class flipped learning activities.

Mortensen & Nicholson (2015), to the best of our knowledge, is the first study empirically applied gamification in a flipped introductory equine science course. In their study, they used gamification to encourage learners participate in-class knowledge reinforcement activities, and reported that learners in the flipped course scored higher than the traditional group (i.e. non-flipped group) in academic and critical thinking tests. Their study demonstrated that gamification could be applied in the in-class
learning session to enhance students’ in-class learning experience. However, they did not use gamification for the out-of-class learning activities. The effect of using gamification for scaffolding out-of-class learning is not yet known.

Dicheva & Dichev (2016) recommended using a gamified mentored active learning model to facilitate the interplay between extrinsic incentives and the intrinsic motives of learners, with the ultimate goal of engaging learners in actively participating the pre- & post-class activities. The theoretical base of this model is self-determination theory and flow theory. Nevertheless, no empirical data was reported based on this model.

Yildirm (2017) integrated gamification strategies into an undergraduate level blended pre-service teacher education course. The study reported that in the gamified group students achieved better academic achievements and had better attitudes than the non-gamified group. In this design, gamification was used for both in-class activities and out-of-class activities.

Different from previous empirical studies, our study focuses on exploring effective ways of using gamification to scaffold out-of-class learning in flipped classrooms. The research questions are:

1. What is the effect of gamification on students’ behavior engagement in out-of-class discussion activities in flipped classrooms?
2. What are the students’ perceptions toward the use of gamification in a flipped classroom?

2.3 Underpinning Theories of Gamification Design

Gamification design is the process of using game-design and game psychology in non-game contexts to engage users and motive target behaviors (Ng, 2014). The most widely quoted psychological theory in gamification studies is self-determination theory (Nacke & Deterding, 2017). Meanwhile, goal-setting theory (e.g. Landers, Bauer, & Callan, 2017) and flow theory (e.g. Han, 2015) are also gaining more attention in recent years. In addition to the aforementioned theories, we included social comparison theory (Festinger, 1954) and behavior reinforcement theory (Skinner, 1953) for review. The intention was to gain an overall picture of how the individual motivation mechanism functions from both individual’s layer and social layer.

Goal setting theory (Locke & Latham, 2002), flow theory (Csikszentmihalyi, 1978), and behavior reinforcement theory (Skinner, 1953) interpreted the elements for constructing a motivating experience from the individual’s layer. According to Locke and Latham (2002), goal influences people’s motivation and task performance. Long-term and short-term goals, feedback to one’s performance, and assistance in evaluating one’s performance are measures for building up a motivating environment. It seems that there are some overlapping parts in flow theory and goal setting theory. Flow theory (Csikszentmihalyi, 1978) posits that clear goals, immediate feedback, suitable level of challenges, and perceived usefulness of challenges are important elements in building up full involvement and intrinsic enjoyment. Behavior reinforcement theory (Skinner, 1953) presented how incentives could be used to motivate individuals and reinforce positive behavior.
Self-determination theory (Deci & Ryan, 2010) and social comparison theory (Festinger, 1954) explains the establishment of a motivating experience from both the individuals’ perspective and social perspective. Self-determination theory (SDT) posits that autonomy, competence, and relatedness are three important psychological needs of people. Therefore, a sense of choice, and the psychological freedom in participating activities; feeling effective in building up competence when engaging with the context; and the perception of security, belongingness to a community helps in developing higher level motivation and engagement (Deci & Ryan, 2010). Social comparison theory elaborated individuals’ need for self-evaluation and individuals would compare their opinions with others. In a social context, an individual might even make efforts to achieve uniformity in actions or opinions within the group or community (Feinstger, 1954).

Based on the synthesis of the five psychological theories, we proposed a goal-access-feedback-challenge-collaboration (GAFCC) gamification design framework. It emphasizes that 1) clear and achievable goals, 2) access for building up competence, 3) immediate feedback, 4) suitable level of challenges, and 5) chances for collaboration and interaction are essential elements for designing a motivating experience. Game elements, such as badges, points, progress bar, quests could be the enabler of these five motivating elements. The relationship among game elements, motivating elements, and motivational needs is illustrated in Fig. 2. In the following part, we will introduce our research context, research methods and the gamified invention design based on the GAFCC design framework.

Fig. 2. Goal-access-feedback-challenge-collaboration gamification design framework
3 Methods

3.1 Research context

Information science course is a fundamental course that devoted to effective communication of knowledge and information management through scientific inquiry and professional practice. In this course, students need to achieve such targets as distinguishing information properties, applying information management models to create and transfer information. It is a course that addresses both theory and practice. In order to provide more active learning opportunities for students, the course instructor designed flipped learning materials (e.g. pre-class activity, pre-class reading materials, and post-class forum activity), and uploaded it onto Moodle system. Nevertheless, simply providing students with the materials online without any incentives did not attract many students to complete the post-class activities on time, and students did not seem to engage with the post-class discussions. To invite more participation to the flipped activities and bring fun to the class, we integrated gamification as a pedagogical tool into this course.

The gamified intervention design followed the GAFCC design framework. To indicate the short-term goals of each lesson, early bird badges were used to encourage learners to participate the pre-class individual activities, super-efficient badges were communicator badges were used to stimulate learners to participate the post-class forum discussion activities and interact with peers. To challenge learners, level up badges were used to encourage learners to persist in completing all the target activities. To address feedback, leaderboards were used to provide feedback to learner status and enable self-evaluation and competition. See Fig. 3. for motivating elements and selected game elements for this course. This study will mainly compare the effects of gamified intervention in promoting out-of-class forum discussion activities. The reason was that commenting and replying peers’ work is an important loop of this flipped course, which aimed to stimulate student reflection and promote higher-order thinking skills.

3.2 Data collection and instruments

A quasi-experiment was administered to test the effectiveness of this gamified intervention. This study involved two classes of first year undergraduates, one class as control group (flipped classroom, n=48), and one class as treatment group (flipped classroom with gamified intervention, n=48). In order to answer the research question “what is the effect of gamification on students’ behaviour engagement in out-of-class group discussion activities in flipped classrooms”, students’ participation data on discussion forum would be collected. Descriptive data analysis and Chi-square test were conducted to compare the number of postings, and the percentage of students that commented or replied to the postings on the discussion forums. To answer the research question “what are the students’ perceptions toward the use of gamification in a flipped classroom”, a learner perception on gamification strategies survey questionnaire was conducted in the treatment group (i.e. flipped learning plus gamification group). This survey questionnaire is a 5-point Likert-scale, and invites participants to chooses from...
“strongly agree” to “strongly disagree” to indicate their motivation in this learning setting. The sample questions include “I think gamification added fun to this course”, “I made more efforts on learning in a gamified setting than a non-gamified setting”.

<table>
<thead>
<tr>
<th>Motivating elements</th>
<th>Game elements</th>
</tr>
</thead>
</table>
| Goal                | • Early bird badge  
|                     | • Super efficient badge  
|                     | • Communicator badge  |
| Access              | • Access to optional level activities and learning resources  
|                     | • Autonomy in commenting others for more than one time or not  |
| Feedback            | • Leaderboard  
|                     | • All badges  |
| Challenge           | • Level up badge (i.e. complete target activities for certain times can be upgraded to next level)  |
| Collaboration       | • Communicator badge  |

Fig. 3. Motivating elements and selected game elements

4 Results

4.1 Participation in Out-of-class Group Activities

Student participation data on post-class group activities were collected and analyzed. In total, this course included 9 weekly post-class forum activities. In the gamified group, students were informed that commenting on each other’s postings for more than 3 times would win a weekly communicator badge. Students in the non-gamified group were encouraged to make comments to others’ postings, but participating or not participating the activities would not receive any badges. Descriptive data showed gamified group submitted more postings within an expected time (i.e. submit at the end of each week) than the non-gamified group in all the examined weeks. For example, at the end of the third week, gamified group submitted 61 comments to the tutorial 3, whereas non-gamified group submitted only 17 comments. See Fig. 4.
Fig. 4. Postings submitted by the end of each week (i.e. within an expected time)

Table 1. Chi-square test results for weekly forum activity participation

<table>
<thead>
<tr>
<th>Week</th>
<th>Treatment (N=48)</th>
<th>Control (N=48)</th>
<th>Chi-square</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>W1</td>
<td>65%</td>
<td>54%</td>
<td>$\chi^2(1) = 1.08$</td>
<td>$p=0.30$</td>
</tr>
<tr>
<td>W2</td>
<td>50%</td>
<td>48%</td>
<td>$\chi^2(1) = 0.04$</td>
<td>$p=0.84$</td>
</tr>
<tr>
<td>W3</td>
<td>58%</td>
<td>21%</td>
<td>$\chi^2(1) = 14.11$</td>
<td>$p=0.00$</td>
</tr>
<tr>
<td>W4</td>
<td>67%</td>
<td>5%</td>
<td>$\chi^2(1) = 37.82$</td>
<td>$p=0.00$</td>
</tr>
<tr>
<td>W5</td>
<td>10%</td>
<td>4%</td>
<td>$\chi^2(1) = 1.39$</td>
<td>$p=0.24$</td>
</tr>
<tr>
<td>W6</td>
<td>67%</td>
<td>25%</td>
<td>$\chi^2(1) = 16.78$</td>
<td>$p=0.00$</td>
</tr>
<tr>
<td>W7</td>
<td>31%</td>
<td>33%</td>
<td>$\chi^2(1) = 0.05$</td>
<td>$p=0.83$</td>
</tr>
<tr>
<td>W8</td>
<td>65%</td>
<td>54%</td>
<td>$\chi^2(1) = 1.08$</td>
<td>$p=0.30$</td>
</tr>
<tr>
<td>W9</td>
<td>90%</td>
<td>40%</td>
<td>$\chi^2(1) = 26.23$</td>
<td>$p=0.00$</td>
</tr>
</tbody>
</table>
Descriptive data showed that the gamified group had more number of students who participated in weekly forum discussion than the non-gamified group, except for week 7. See Table 1 for the proportion of students who participated in the forum discussions before due time each week. Chi-square tests were conducted to analyze the difference of forum discussion participation. The number of participants who participated the commenting or replying activities within each week were compared between two groups. Chi-square test results indicated that there were statistically significant differences in students’ participation in week 3, 4, 6, 9. For example, in tutorial 3, a significant interaction was found ($x^2(1) = 14.11, p = 0.00$) between the two groups. This indicated that more number of students in the gamified group participated the commenting activity than the non-gamified group in the third week. For another example, in tutorial 9, significant differences were found between the gamified group and the non-gamified group ($x^2(1) = 26.23, p = 0.00$). See Table 1 for details. Results showed that utilizing gamification strategies in flipped classroom was effective in promoting students’ participation in forum discussion activities before the deadline elapsed.

4.2 Student Perception toward Gamification

In this study, we used an 8-item learner perception on gamification survey to examine learners’ engagement with the flipped classroom. It examined students’ perception on gamification from such categories, perceived impact on interest, perceived impact on behavioral engagement, perceived impact on cognitive engagement. The reliability test indicated that the standard Cronbach’s Alpha was 0.94 ($n=39$, 8 items), and the internal consistency for the examined items was 0.94. This showed that the internal validity of this survey questionnaire was high. The survey questionnaire results showed that 61% ($n=24$) participants agree or strongly agree that they were stimulated to reflect on their learning strategies. It was reported that 59% ($n=23$) of the participants either agree or strongly agree that gamification added fun to this course. In this gamified setting, 51% ($n=20$) of the participants felt that they were clearer about their learning goals than in a non-gamified setting. In the surveyed participants, 54% ($n=21$) expressed that they were clearer about their learning progress, and 51% ($n=20$) stated that they made more efforts in the gamified setting than a non-gamified setting. See Fig. 5 for details. The survey questionnaire result indicated that more than a half of the participants perceived that gamification added fun to their learning, and indicated the learning goals and progress for them. In the cognitive aspect, more than a half of the participants reflected more on their learning strategies and made more efforts on learning. Although not all the participant were motivated by the game elements, integrating gamification with learning in this case did not generate much negative impact.

Students’ responses to the open-ended question “overall, do you think it is necessary to add in gamification strategies into courses? why” were collected and analyzed. There were 31 out of 39 survey participants who responded to this question. Result showed 26 out of 31 respondents (84%) expressed positive attitude in adding gamification strategies. Among them, 71% ($n=22$) participants gave an absolute “Yes”, and 13% ($n=4$) participants said “maybe”, “kind of”. The main reasons provided by the
participants were gamification was “fun” and “interesting”, and it provided “a good way to track progress”. The other reasons were gamification “can encourage active participation of students” and “provided a platform to discuss”. Students would be gain “tiny little achievements” along the learning process, and they “would be more willing to learn”. There were 16% (n=5) participants who against the idea of integrating gamification into class, one student stated that he or she could think of the benefits of adding gamification. In addition, one respondent recommended that an instructor add some “real awards”, and another participant suggested an instructor to introduce the game elements at the beginning of the course, and explicitly write the game rules into the course outline. This would enable students to remember the rules easily throughout the whole semester.

![Fig. 5. Motivation with gamification in the flipped classroom](image)

### 5 Discussion and conclusion

Students participation data showed that students in the gamified group completed more the post-class forum discussion activities than the non-gamified group. It is evident that, when evaluating students’ participation, gamified group submitted a great more postings than the non-gamified group. The data showed that gamification was effective in encouraging students early or on time participation in flipped classroom. This is good for enhancing students’ preparedness and timely participation for each lesson. Survey questionnaire data revealed that more than half of the students were motivated by the gamification design, and were encouraged to reflect on their learning strategies. However, a number of students hold a neutral view on the impact of gamification on their learning. Overall, our findings suggest that adding gamification to flipped
classroom did not generate much negative impact. It was mostly positive or neutral. As long as half of the participants were positively influenced by the game elements, we believe it is worthwhile for an instructor to keep exploring possible appropriate ways to optimize the use of gamification. The next question could be how to motivate an even larger number of students to participate in the flipped activities (e.g. post-class forum activities).

The students’ responses to open ended questions showed that a large number of the participants could see the benefits of adding gamification to flipped classroom. But a small number of students could not feel the significance of adding gamification to their course. In order to motivate more active participation in future courses, the instructor or research designer could consider introducing the purpose for integrating game elements at the beginning of courses, and see whether this effort would help more students see the value of having game elements in course.

The exploration on integrating gamification with flipped classroom is still at its infancy stage. The limitation of this study was that the experiment was carried out in only one course. To investigate and understand more about the effects of gamification in flipped courses, there is a need for more empirical studies guided by psychological theories and learning theories. We look forward to more studies that try different pedagogical strategies to enhance learning in flipped classroom settings.

References

A Virtual Clinical Learning Environment for Nurse Training

Sin-Chun NG 1, Lap-Kei LEE 1, Andrew K. LUI 1, Ka-Fai WONG 2, Wan-Yee CHAN 2, Hiu-Hin TAM 1

1 School of Science and Technology, The Open University of Hong Kong
Ho Man Tin, Kowloon, Hong Kong SAR, China
2 Division of Nursing and Health Studies, The Open University of Hong Kong
Ho Man Tin, Kowloon, Hong Kong SAR, China

{scng, lklee, alui, kafwong, awychan, thhtam}@ouhk.edu.hk

Abstract. Every nursing student is trained to possess certain skill set before they go for the clinical training in a hospital. This paper introduces the use of virtual reality to simulate a hospital ward for nurse training. The equipment in our virtual ward is carefully designed to simulate the equipment in Hong Kong hospital wards. Our virtual ward will provide several demonstrations on common ward operation tasks. Through the interactions provided in the virtual ward, nursing students can understand the ward operation routines in a better way. Our application is expected to reduce inexperienced nursing students’ anxiety and make them more familiar with the ward environment, which can then minimize medical error in their real practicum.

Keywords: virtual reality; nurse training; virtual ward environment

1 Introduction

Every nursing student is trained to possess the fundamental nursing skills, e.g., reporting vital signs of a patient, performing simple wound dressing, before they go for the clinical training in a hospital. Nursing students have also to be familiar with a general hospital ward environment. For junior nursing students who have no clear understanding on the ward environment, the most effective teaching way is to bring them to a real clinical ward. Ward orientation is the way to achieve this goal (Lee & French, 1997). Yet in Hong Kong, it is hard to arrange the ward orientation visits due to the high nurse-to-patient ratio of the hospitals; the ward space is always filled with patients, medical staff and equipment. Traditionally, the nursing students are trained by videos, live demonstration and hands-on practices in the nursing laboratories. The effectiveness of these methods is not questioned as they have been adopted for many years. Medley and Horne (2005) showed that using simulation technology to provide more interactions in nursing education can enhance nursing students’ learning experience and facilitate their understanding on the general ward environment. With
the advancement in virtual reality (VR), it is now possible to offer an immersive learner experience to supplement the traditional ways for nursing education.

In this paper, we propose the use of virtual reality as a contemporary teaching and learning strategy for nursing students. Virtual reality is a computer technology that uses software to generate a 3D virtual environment and simulates a physical presence of the user in an imagined world. Most of the existing virtual ward simulators are designed based on non-local wards with a spacious environment or wards with specific use (see Section 2 for more details). These virtual wards are too different than the wards in Hong Kong and cannot help the local nursing students to get familiar with the hospital wards in Hong Kong. We therefore implemented a virtual ward environment using VR to simulate a general ward environment in Hong Kong.

This paper focuses on the design of our virtual ward environment for nurse education in Hong Kong. The virtual ward is designed with high similarity to the real one in Hong Kong hospitals; we include characteristics of local ward, e.g., room design, floor plan, nurses station, treatment room, signage, posters and human characters. The equipment in our virtual ward is also carefully designed to simulate the equipment in Hong Kong hospital wards. This will help the nursing students to get familiar with the ward equipment and better understand how to select the correct equipment during ward operations.

Mastering common ward operations is an essential skill of nursing student for their future duties in hospital (McCaugherty, 1991). More interaction between the nursing students and the virtual ward environment can enhance nursing students’ understanding of the ward operation routines (Manias & Street, 2001). We incorporated several interactive elements and features into the virtual ward. The interactions are designed for understanding the ward operation routines and recognizing the ward facilities and equipment. The virtual ward also provides several demonstrations on common ward operation. Our application is expected to reduce inexperienced nursing students’ anxiety and make them more familiar with the ward environment, which can then minimize medical error in their real practicum.

2 Background in Nursing Education

2.1 Ward Orientation

In nursing education, the theories taught are much related in the real ward and clinical practices. Before the nursing students go for real training in a hospital as a practicum, they must be competent in the basic ward duty and operation, including patient cares and observation. It is essential for them to be familiar with a hospital ward environment to understand the setup of each room in ward (Papp et al., 2003). The acknowledgement of each equipment involved and its function are also important in their learning. A ward orientation is included in the syllabus of nursing education so as to prepare nursing students for their practicum in different Hong Kong hospitals.

It is becoming harder to arrange the ward orientation in Hong Kong hospitals. One reason is the high ward occupation rate, which was as high as 130% as of March 2016
Another reason is the shortage of nursing trainer among all the Hong Kong hospitals (Tsang, 2017). These two limitations are long-term and is expected to worsen. A plausible solution to these limitations is using computational simulation and virtual reality in the nurse training, which has been already adopted in other parts of the nursing education for several years.

2.2 Applications of Computational Simulation and Virtual Reality

Traditionally, the nursing students are trained by videos, live demonstration and hands-on practices in the nursing laboratories. Yet nursing students often find difficulties to visualize a dummy model as a real patient and to make the transition from the learning laboratories to the real patient setting. Medley & Horne (2005) used simulation technology to provide experiential learning to the nursing students, which improve the learning experience and effectiveness of the nursing students. Besides, computational simulation does not make threats to safety of real patients and can simulate specific and unique patient situations. Computational simulation has also been applied to develop serious games for nursing education (see Skiba (2008) for some examples).

With the advancement on computer graphics techniques and tools, virtual reality (VR) is growing in popularity on various applications (see the survey by Zhao (2009) and references therein). VR is a new technology that offers much beyond the previous simple 2D and 3D display of computational simulation. With the use of VR technology, the user can enter the virtual world with the related VR headset to experience something that the user seldom has the chance to come across. The VR platform also allows us to create, modify and manipulate the 3D objects in the same way as we do on physical object without the existence of real-world limitations (Bricken, 1991). In other words, VR is a platform of a high degree of realistic simulation for the freedom to create any scenario we would like to implement for.

Educational researchers are aware of the possibilities given by virtual reality (Christou, 2010). VR is particularly suitable for nursing education, as it provides a safe learning environment without the risk of harming real patients and it provides a controlled environment for the instructors to interact and keep track of the performance of the students. Second Life (Skiba, 2009) is a well-known web-based VR environment that provides clinical simulations of a number of scenarios where the students have to carry out some routine tasks (e.g. checking a patient’s vital signs) in the ward. It mainly focuses on providing a social interaction platform with people and it works like playing a clinical game. de Freitas et al. (2009) proposed an evaluation methodology for learning activities in Second Life. Jenson & Forsyth (2012) implemented a virtual ward for teaching ward duty including patient care and clinical judgment in an entertaining and interactive way. Besides of clinical simulation, a children hospital is also simulated for training nurses to get familiar with the real environment of Lurie Children’s Hospital (Vila et al., 2003) with a focus on wayfinding and navigation. Lau (2009) also implemented a virtual psychiatric ward for psychiatric education.
3 Virtual Ward Environment

This section gives the detailed design of the virtual ward environment, which aims to simulate a typical general ward in a Hong Kong hospital so that it can be used for ward orientation for junior nursing students. A nursing student can explore and “see” the virtual ward through the headset of the VR system, and interact with some items in the virtual ward by using wireless controller of the VR system.

The virtual ward environment is built with the VR development platform Unity3D and several software for building the 3D models of objects in the virtual ward including Autodesk Maya, Blender, MotionBuilder and Adobe Photoshop. The virtual ward can be run with a virtual reality system (e.g., HTC Vive) on a personal computer with at least 8GB of main memory and a graphics card (GPU) (e.g., NVidia GeForce GTX 1050).

3.1 Overview of Design

To achieve a high degree of realism, our design references the features of wards in Hong Kong public hospitals. Yet there is no unified design of wards for different hospitals and a difficulty is to integrate this divergence of designs into the limited space of our virtual ward environment. We study and figure out some important common features of these designs (to be discussed in the subsequent subsections) so that the virtual ward is able to offer a similar appearance of a real ward environment in Hong Kong. Our design of the virtual ward also takes reference to the standard requirements of the Hospital Authority (HA) in Hong Kong.

3.2 Ward Setup

Room design. A standard ward in Hong Kong includes plenty of beds for inpatient care services. These beds for patients are separately located in different rooms called cubicles. According to general ward design of Hong Kong public hospitals, a general ward has the capacity of at least 60 patients normally. These 60 patients are allocated to several cubicles. Each cubicle is normally designed to accommodate 8 patient beds, as shown in Fig. 1. There may also be a small cubicle with only 4 patient beds. Our virtual ward has 7 normal cubicles and one small cubicle for patient allocation.

Fig. 1. A cubicle in our virtual ward.
**Floor plan.** The floor plan of the virtual ward is shown in Fig. 2. A T-shape corridor is commonly found at the floor plan of the real ward among all hospitals and this is thus included in the design of our floor plan. We also allocated 8 temporary patient beds in the corridor to reflect the common phenomenon in public hospitals in Hong Kong due to the high ward occupation rate.

![Floor plan of our virtual ward.](image)

**Nurses station.** Nurses station is a ward facility where the on-duty nurses handle staff work behind the patients. It is a semi-open area with a service counter. As a precaution measurement, patients in more serious condition are allocated to the cubicle directly opposite to the nurses station so that these patients can be observed by nurses in the nurses station directly and immediate action can be taken for urgent cases (as shown in Fig. 3). To facilitate patient observation, we replace the wall of that cubicle (which faces the nurses station) with a glass.

![The cubicle observable from the nurses station is for patients under special care.](image)

**Treatment room.** Treatment room is a special room for on-duty nurses to give a basic medical treatment to patients in need. Our treatment room (Fig. 4) follows the common design of Hong Kong public hospitals with limited space.
Signage and posters. Signage and posters are included in the virtual ward, which are commonly found in the public hospitals in Hong Kong such that the nursing students can understand the location of each room and nurses station in an easy way.

3.3 Equipment and Interactive Labels

Ward equipment is a crucial element in our virtual ward. A nursing student has to be able to recognize the equipment, memorize its name and acknowledge its location. To this end, we include interactive name labels for the important equipment in our virtual ward to enhance students’ learning. These name labels are 3D text words hidden originally so that they do not obstruct the user’s view. The labels are popped up when the user is walking nearby the target area of the equipment.

Patient bed. Patient care is one of the normal ward duty which takes place at each cubicle. Patient bed is the basic unit of every cubicle, in which a bed table and a ring handrail are provided. There are also the patient cards on the wall above the patient bed to indicate the health condition of the patient and the special needs for the patient. Some patients have extra equipment such as oxygen tube, intravenous drip and heart rate monitor, which are set up to simulate the situation that a patient is under a relatively serious condition (Fig. 6).
Fig. 6. Patient bed for a patient with a relatively serious condition.

Equipment in treatment room. We label several important equipment in the treatment room which should be recognized by the nursing students (Fig. 7). This includes X-ray film illuminators, pulse machine, ultrasonic machine, surgical lighting, drug cabinets, and wash basin. We also include a clinical waste bin, which is yellow-colored with a clear caution label and contains a red-colored waste bag tied properly (Fig. 4). Such waste bin is essential in the treatment rooms of public hospitals. Our treatment room is designed to highlight the above equipment for students’ learning.

Fig. 7. Interactive labels for each critical item at the treatment room.

Equipment in e-trolley. The emergency-trolley (or e-trolley) is used for immediate treatment under urgent case and it is commonly found in the nurses station. The top of the e-trolley is for rescue equipment including a defibrillator and an oxygen bag inside a box. A sharps box is also presented here to collect used disposable materials like injection syringe and sterilized cotton. The sharps box in Hong Kong is yellow-colored with a caution label. The e-trolley has a number of trays for specialized equipment. Interactive labels are included to annotate equipment types in each tray and the labels are triggered by opening the tray. Fig. 8 shows that the interactive arrow and cross labels next to the tray for tray opening and closing.
3.4 Human Characters

Human characters, e.g., medical staff and patients, are crucial to make the ward look realistic. Our virtual ward has patients lying on their patient beds and nurses observing patients in some of the cubicles and nurses station. The cloth and uniform design of these human characters follows those commonly found in the Hong Kong public hospitals; the medical staff has their roles indicated by the uniform color, a clear label on the uniform and a staff card hanged in front (Fig. 9).

To demonstrate the ward duty, a simple scenario is set up at one of the cubicles where a nurse is examining a patient after his operation and a ward assistant is giving massage (a procedure of patient care) to him (Fig. 10).

4 Conclusion and Future Work

In this paper, an immersive reality of 3D scenarios and models has been implemented for nurse training. The virtual ward environment including cubicles, nurses station and
treatment room are built with high similarity to actual ward in Hong Kong hospitals. The equipment for ward duty and operation in the virtual ward is also specially designed for their basic understanding. With the use of interactive labels for the ward equipment, it is expected that the nursing students will become more familiar with the ward environment and have a better understanding of their future tasks of the real practicum.

In order to evaluate the effectiveness of this application, we planned to go for empirical research to test whether the application meets the pedagogical outcomes in March 2018. We will invite some of the nursing students to use our virtual ward application for a period of time. Questionnaires will be collected for OUHK nursing students for their feedbacks on our virtual ward. The results of the questionnaires are used to analyze whether the end users are satisfied with our application. We believe our virtual ward will reduce the anxiety of the inexperienced nursing students and will arouse the students’ interests in learning and visualizing the ward environment.

References


Research on Facilitate Teachers’ Professional Development through Experts into Classrooms Project

Li ZHAO *, Xiaodong XU

School of Information Technology in Education, South China Normal University,
No.55 West of Zhongshan Avenue, Tianhe District, Guangzhou, China

*1354063816@qq.com

Abstract. In recent years, the realistic teacher education paradigm emphasizes on learning through practice, and learning how to teach through experience and reflection. Practice based teachers’ professional development could be learned through three different kinds of experiences, i.e. learning through one’s own experience, learning through peers’ experience, and learning through experts’ experience. Learning through one’s own and experts’ experience is indispensable, scaffolding through theory and practice, experts would help teachers conduct effective reflection and insight. The project of Experts into Classrooms was based on teachers’ personal experience, and teachers would learn through practice guidance by both pedagogical professors and expert teachers of each subject, and learn through scientific analysis result provided by classroom observation analysis software.

Keywords: Experts into Classrooms; Teachers’ Professional Development; Teacher Training; Personal Practice

1 Introduction

In order to comprehensively enhance the overall quality of primary and secondary school teachers in our country, the Ministry of Education and the Ministry of Finance implemented the "National Training Program for Primary and Secondary School Teachers" for all primary and secondary school teachers in China in 2010, including "Model Training Project for Primary and Secondary School Teachers" and "Medium Western Rural Backbone Teacher Training Project" two elements. In recent years, with the promotion of innovative teacher education programs and initiatives such as the "Guopai Plan", various activities in teachers' teaching ability in various areas and in primary and secondary schools in our country have been extensively carried out. For example, school-based training, teaching competitions, watching open class, lectures and lectures, expert lectures, teacher workshops, academic conferences, heterogeneous lectures and various types of information technology support teaching and research activities.
In the meantime, some studies abroad show that paradigm shifts are taking place in the study of teacher education and teacher learning methods in recent years. For example, Fishman & Davis argues that in learning science, teacher learning should focus on how teachers learn to teach in new ways. In addition, Lampert, a famous teacher education researcher in the United States, emphasized that learning to teach can be very complicated. Lampard emphasized the situation of learning teaching, learning teaching must be from the teacher's teaching practice to learn. Some scholars, such as C. Day, a British scholar, believe that teacher professional development includes all teacher-faculty learning from experience and from the conscious and systematic direct and indirect effects on individuals, groups and schools. Quality improvement activities in the development.

According to the research and analysis of professional development of teachers both at home and abroad, the author believes that learning teaching must learn from three experiences, that is, learning from teachers’ own experience, learning from the teaching experience of peer teachers and learning from the teaching experience of experts. Therefore, the project adopted a new way of thinking that experts should cultivate the teaching practice of the target schools, classrooms and teachers themselves, and listen to the lessons to carry out individualized and targeted individual guidance. This is a A brand new model of professional development or learning. Experts can not only experience the concept and atmosphere of school education and teaching in a concrete situation, but also the relationship and influence of the school environment on the beliefs, values and attitudes formed by teachers. They can also understand the teacher’s current situation and professional development context so as to provide tailor-made Type of targeted guidance.

2 Methods

2.1 Basic Principle

a. Deepen the theoretical investigation based on the practical problems and needs encountered by teachers, and provide a systematic framework for teachers’ understanding and skills migration.

b. Focusing on training in the face of new situations and new problems, it is capable of coping with practical knowledge and adaptability of teaching of cognition and action in an almost instantaneous manner and solving difficult problems that cannot be solved in the long-term teaching.

c. Self-reflection of teachers and teacher inter-school collaboration to carry out research or collaboration within the group of teaching and research team, exchange ideas with each other to achieve mutual enlightenment together to improve the purpose.

d. Scientifically analyze teaching and provide scientific and consistent advice for class review. This project adopts the teaching video analysis software "Transana" developed by Wisconsin State University to make a scientific analysis of teacher's classroom teaching. Based on this, the project proposes suggestions for improvement of teachers' teaching and teaching experts re-design the teaching suitable for cultivating the personal style of the subject.
Based on this, this project has changed the past training emphasis theory, practice, training only outstanding teachers and other practices, the real improvement of teaching ability of teachers as the center of gravity to all teachers as the object of cultivation, to effectively improve the teaching ability of novice teachers, Young teachers and teachers with weak teaching ability are the key targets of training. Based on the objective and scientific data provided by the analysis results of teaching analysis software, teachers and students are used as the basis for teachers’ discussion, exchange, reflection and evaluation, deepening their participation in inter-school collaboration teaching and research Of teachers grasp the problem of teaching, awareness, provide a new perspective to see the problem and carry out objective scientific analysis, and then through the theory with the subject of experts, with rich experience in teaching disciplines of practical experts under the guidance of this "two to one "To adapt to personal style and personalized guidance, and effectively improve the training of teaching objects.

2.2 Implementation Plans

To university subject pedagogy experts and secondary school teachers as the main body set up tutor group.
The project hired several universities specializing in teaching and research university professor and has many years of teaching experience in primary and secondary teaching teacher as training mentor. According to their expertise, the professor of pedagogy from the university focuses on and analyzes the teaching events from the perspectives of teaching and learning theory and subject knowledge, and derives the scientific conclusion for teachers’ classroom decision-making. The author refers to this process as: reasoning on the matter and rationality by reason. As a practical instructor, famous teachers and teaching staff with many years of teaching experience come from the front line of teaching. According to their director, the emphasis and method of instruction is to carry out a phenomenological analysis of teaching events from the perspectives of educational methods, techniques and skills, and from their own past experience and training objects to establish solutions to solve the problem, the author said the process is: the matter, according to the decision-making. Provide effective resources for the effective implementation of the project.

Tailor-made incubation programs for novices and young teachers.
The main targets of this project are young teachers, breaking the traditional training convention centering on "key teacher training", earnestly promoting the balanced development of education and promoting the fairness of education. The project team, through in-depth questionnaires sent to schools by schools, interviews with principals and other surveys, selects the participants who are willing to participate on the basis of the recommendation of the president, and conducts baseline research on the target audiences and establishes personal growth record portfolio. After conducting discussions with academic experts After "consultation", tailor-made cultivation programs for them. At the beginning of the project, the experts will also issue questionnaires and pre-tests on the academic achievements, aptitudes and
comprehension levels of teachers and cultivators in the whole school. The questionnaire will be used for the basis and basis of comparison in the middle and end of the project.

**Experts into the school using scientific tools to analyze teaching.**
In the early months of the project, the experts will arrange for a certain period of time each month (totaling 10 days in teacher's class schedule) to enter schools. Through the on-site classroom teaching record, the first-hand information of the training target will be obtained and the assistant process the digital content of the curriculum And transcribing, using the professional software (Transana) for teaching analysis, the analysis results are uploaded to the “inter-school collaboration teaching and research platform”, and then through the “inter-school collaboration teaching and research platform” online seminars and evaluation results, experts and training objects to use the above analysis results, On-site one-on-one teaching analysis to inspire teachers to jointly modify, optimize the lesson plans, based on the analysis of teaching design; Next, the training of teachers in the new lesson in the application of lesson plans, lectures again, shooting video recording. Finally, issue a questionnaire or standardized test, the implementation of the teaching effect of post-test. Experts based on test results before and after the test results.

**Adopt the "two-to-one" guide mode to strengthen the interaction of cognitive apprenticeship.**
The training of the target will be guided by the "two on one" "cognitive apprenticeship" approach, that is, experts and training target "one to one" on the basis of guidance, innovative use of "2 +1" model cognitive apprentice System, that is, a training object equipped with two tutors, one of the two mentors with college disciplines professional background, the other is a rich teaching experience in the discipline of secondary school teachers; according to the individual teacher Objective data of video analysis, the two tutors will jointly make a scientific assessment and formulate a special pre-plan to enhance teachers 'teaching abilities. Based on the analysis of teachers' teaching plans and intentions and other cognitive information, the two supervisors will strengthen the effectiveness of the inter-mentors and apprenticeships; Make it break the original understanding from theory to practice, find out the lack of teaching knowledge and skills, analyze the weak links of teaching ability, correct the myths of teaching methods and teaching ideas, and comprehensively enhance teachers' teaching ability.

**To enhance the ability of the core "spiral" nurturing mode.**
Project team specialists stationed in schools on a regular basis every month to develop specific nurturing programs for specific target audiences and adopt new ways of designing research to establish the hypothesis of an effective training program that enhances teachers' teaching abilities → Collect and analyze data → Multiple iterations of training Experimental application of program application → recursive to the first step to implement a revised training program → iterative refinement of training objectives and training programs. In this iterative training implementation, each implementation is a "spiral rise" of teaching ability, rather than a simple repetition. In addition, combined with the evaluation and analysis of students' comprehension level,
the suggestions and guidelines of inter-school collaboration teaching and research staff, the software analysis results provided by experts and assistants constitute the "mirror" of teaching reflection of training students, Reconstruction of teaching behavior, and effectively improve the teaching ability of teachers.

**The training effect of scientific identification.**
After the completion of a training cycle, project experts use the relevant evaluation criteria of the International Association for Educational Achievement Assessment (IEA) in Europe and the United States, and then refer to China's "Standard of Teacher Education Curriculum (Trial)" and self-compiled teaching effect assessment scale, Teaching ability to conduct scientific assessment and identification; the same time, young teachers are encouraged to participate in various levels, all types of teaching competitions, with a true evaluation of the effectiveness of the project implementation.

### 2.3 Training Content

The training of teachers focuses on "learning to teach", the training guide includes: subject content knowledge, pedagogy knowledge, subject pedagogy knowledge, teachers’ practical knowledge, technology - content - teaching method knowledge (TPACK), teaching improvisation Skills and knowledge and more.

### 2.4 Training Object

This project is a professional development project of teachers in cooperation with a city of South China Normal University. With the support of the Municipal Education Bureau, 100 young teachers from 13 high schools (including junior middle schools and high schools) in the city were selected through consultation between the two parties. Subjects Is: mathematics, physics, chemistry, language, English five subjects; teachers from 23 years old to 46 years old, of which 46 were male teachers, 54 were female teachers.

### 3 Results

In the early stage of project implementation, the first questionnaire issued a total of 100 copies of the baseline survey, facing the training object of teaching ability of young teachers and attitude questionnaire, the recovery rate of 100%; in the implementation of the project after the release and recovery of second, since the implementation of the project after the survey, the number of copies issued 100 copies, 99 were recovered the recovery rate of 99%. The questionnaire focuses on 11 core knowledge and ability of the training content: subject knowledge and routine teaching ability, decision-making and prediction ability, the ability of teaching design, technical contents teaching ability of teachers, information culture and media culture and digital culture literacy, classroom management and teaching ability of teachers, learning control metacognitive ability and performance evaluation, and evaluation of teacher's ability, self-control
ability, teachers’ ability of teaching and scientific research. This questionnaire, as the basis for the objective evaluation of the effect of the project, was analyzed and analyzed, as shown below.

3.1 Comparison Before and After the Change

The comparison of teachers' scores before and after the survey is shown in Figure 1 on the next page. As can be seen from Figure 1, the training achieved important results. After training, the 11 competencies of the teachers increased to different extents compared with those before the training. In particular, the ability of the subject knowledge and teaching organization, teaching methods and information technology application ability, teachers' decision-making and forecasting ability, adaptability, teaching design ability, obvious changes in professional attitude of teachers.

Fig. 1. Comparison of teachers' 11 abilities before and after

3.2 Analysis of the Status Quo

Teachers' Professional Ability Post Test. After training, the comprehensive ability of teachers is enhanced. The proportion of 11 kinds of teachers' professional ability to the best teachers is the largest. Among the 11 abilities, there are 8 kinds of teachers, 90% of them achieve excellent and good level. The application ability of teaching methods and information technology teachers to reach the 100% level, excellent excellent and good rate of 76%, the ability of teaching design, teaching decision-making and prediction ability, subject knowledge and teaching organization ability of excellent rate of around 70%, the lowest one occupation attitude, excellent and good rate of the total has reached 77% (as shown in Figure 2).
Fig. 2. Post-test results of teachers' abilities

Conventional Expertise.
After training, most of the teachers had solid teaching skills. The sum of excellent and good rate of teaching routine knowledge and ability was 86.67%. All teachers' routine expertise reached above average level.

Adaptive Expertise.
After training, the total of adaptability and excellent and good rate is 93.06%. Most teachers have rich knowledge of solving changeable and complex teaching problems, all reaching above average level.

Pedagogical Method & TPACK.
After the training, most teachers can use all kinds of teaching methods to achieve the integration of information technology and discipline. The sum of excellence and good rate is more than 85%.

Decision-Making and Prediction.
After training, teachers can predict and decide on the teaching conditions according to the rules of teaching. The sum of excellent and good rates is more than 86%.

Instructional Design.
After the training, 100% of the teachers can carry out scientific teaching design, and more than 89% teachers reach excellent and good level.

Evaluation & Assessment.
After training, teachers can evaluate and evaluate the teaching scientifically according to the rules of teaching, and more than 88% of the teachers can achieve excellent and good level.

**Teacher Learning & Metacognition.**  
After training, teachers have a strong ability to learn and metacognitive, and the total number of excellent and good teachers is over 86%.

**Content Knowledge & Instructional Organization.**  
After training, the teachers' knowledge of discipline and teaching organization are strong, and more than 90% of the teachers have reached excellent and good level.

**Practical Knowledge.**  
After training, most of the teachers had strong practical knowledge, and the sum of excellence and good rate reached 78.24%, which is lower than other indicators. This indicates that the growth of practical knowledge is a relatively slow process.

**Profession Attitude.**  
After the training, the teachers' professional attitude and good rate of good rate reached 76.39%, and the average and above level reached 95.14%. The teacher's professional attitude determines the quality of education, which needs to be studied and improved in 4.86%.

**Teachers' Belief.**  
After training, the sum of good faith and good rate of teachers reached 93.75%, and the level of medium or above reached 100%. Teachers' beliefs affect the success or failure of educational reform and the physical and mental development of students. The findings show that the new concept of basic education curriculum reform has been deeply rooted in the minds of teachers.

**Teaching and Scientific Research.**  
After training, the sum of excellent and good rate of teaching and scientific research is 77%, the sum of middle and average rate is 23%, and there is much room for improvement of teachers' scientific research ability.

**Self-Regulation.**  
After training, the total self-regulation ability and excellent rate of teachers reached 82%, the average sum of middle and average was 23%, and teachers' self-regulation ability still needs to be strengthened. (above is shown in Figure 3).
3.3 Teachers Harvest and Recommendations

Training Harvest.
After the implementation of the project, teachers think that all aspects of their ability are improved to some extent. 58% of teachers think that their teaching methods and information technology application ability improved significantly, more than 30% of teachers think their teaching design ability, subject knowledge and Teaching organization ability, teacher learning, metacognitive ability gains a great deal, 27% of teachers think their assessment and evaluation ability has greatly improved.

Training Suggestions.
After the implementation of the project, 42% of teachers hope to observe the classroom of experts and excellent teachers, 15% of teachers hope to provide long-term instruction in teaching and research, 14% of teachers hope to provide more personalized guidance, which is the training target design and Improving training methods provides a valuable reference (As shown in Figure 4).
4 Discussion

4.1 Experts into the classroom, lectures and classes to promote growth.

After entering the school for the first time, the project team of experts combined with the pre-test questionnaire organized sub-disciplinary group (junior high school mathematics and high school mathematics teachers in each group 1, junior high school physics and high school physics 1, chemical teachers 1 group, language teachers 1 group, English teachers, a group of 100) training seminars, through self-introduction and interviews to fully understand the basic situation of training objects, and then use the first lecture to observe the situation of teachers, to develop the appropriate guidelines and strategies.

4.2 A pair of one guide to enhance the overall training of teaching ability.

In the next 8 lectures and online tutorials, experts conducted in-depth instruction in classroom lectures, taking lessons, using lesson recordings and playing video tutorials in a structured manner. For example, from the understanding of teaching objectives to the focus of knowledge, difficulties, practical knowledge of teachers, teaching design, characteristics of student learning, teaching arrangements and classroom management, teaching decision-making and predictive ability and metacognitive ability, information technology teaching application ability, Teaching and research ability (writing teaching research papers, reflective teaching ability), teacher attitude and other aspects
of a well-planned, systematic guidance. For example, the first instruction focuses on
teaching routine, the second instruction focuses on teaching goal analysis and
instructional design skills and methods, and the third focuses on instructional methods
and classroom organization management and prediction, decision-making ability and
metacognitive ability improvement guidance, the fourth focuses on changing the
teaching model, to create teaching guidance. Each guide incorporates the key
disciplines of knowledge, teacher attitudes and application of information technology
and other aspects of the guidance.

4.3 Data show that the project implementation has achieved remarkable
results in all aspects.

After a year's guidance, the statistics and analysis of interviews, experts and post-test
questionnaires with reference to experts showed that among 99 teachers (one of whom
did not submit the post-test questionnaire), there was no significant difference between
conventional expertise, adaptive expertise, teaching Method and information
technology application ability, teacher's decision-making and predictive ability,
teaching design ability, evaluation and evaluation ability, teacher's learning,
metacognitive ability, subject knowledge and teaching organization ability, practical
knowledge, teacher's beliefs, teacher's professional attitude All aspects of the program
have been significantly improved.

4.4 Nearly 400 video classroom record into the city's basic education, a
valuable resource.

Since the project was started, a total of nearly 400 classroom videos have been taken.
The recordings of these lectures are accompanied by the instruction of experts and
analysis results of teaching analysis software. At the same time, the contents of the
recording are carefully prepared by teachers in preparation for lectures and wonderful
lectures Under the record, which for the future development of the city's independent
professional education teachers and teachers learn from each other, inspire each other
to provide a precious educational resources, it is also the city's basic education
development of the times reality, it has become an era of educational change The
historical memory of the development of basic education; also a true record of the
growth of teachers for the teachers themselves to provide an opportunity for reflection
learning. There are not any other areas in China that have such systematic and 5 main
disciplinary classroom record teaching resources. They can serve as a teacher video
club similar to the United States to carry out teachers' mutual observational study and
learn from each other to provide learning resources and foundation.

4.5 Created a new model of teacher training

The project implementation experts into the classroom model, is a groundbreaking
meaningful attempt. The professional training model for teachers based on the
individual practice of teachers implemented by the project has unique characteristics.
It has changed the outdated ways of out-going centralized training and non-personal experience in the past, and has adopted the practical and scientific and effective experts into the classroom model and has been trained Object teachers are widely welcomed. Specific features are as follows:

1. Experts into classrooms, diagnose for development;
2. Comment via videos and analysis by software;
3. Teachers’ workshop with experts who points your direction;
4. Our members have privilege and contribute to subject teachers;
5. Eight times a year and renovate your teaching now.

To sum up, in recent years, some researchers and training institutions at home and abroad have put forward some new measures and methods in order to solve the shortcomings in the traditional technical rationality-based training mode. For example, from scattered and remedial training to system Learning; to solve practical problems in teaching as the theme of training; open cooperation with training and teaching cooperation to carry out training and so on. According to IEA’s “Trends in International Mathematics and Science Study” and PISA projects in other countries, countries like Europe and the United States have set the standard for studying Japanese teachers’ professional development models, and made the improvement measures of teachers’ teaching ability based on the scientific analysis of teaching videos. However, these measures can promote teachers in teaching and research to find the real problem? How to turn personal reflection into group thinking to increase objectivity? Can the teaching and research be personalized? That is, for a specific teacher's multi-perspective teaching and research; this teaching and research can be normalized and integrated into everyday? That is, every day after class, before going home for lesson preparation or teaching and research activities, practice yourself and improve the professional ability of teachers. In spite of these questions, these projects have provided the international advanced experience for teachers’ professional learning and development, and have played a helpful role in promoting the professional development of teachers of basic education in our country. As a new attempt to solve these problems, this project reflects the theoretical significance and practical value of this project.

References


Impacts of an Augmented Reality-based Guiding Strategy on Students’ Learning Achievement and Motivation in Conducting Scientific Tasks

Shao-Chen CHANG 1, Gwo-Jen HWANG 2

1 Graduate Institute of Technology Application and Human Resource Development, National Taiwan Normal University, 162, Section 1, Heping E. Rd., Taipei City 106, Taiwan, (R.O.C.)
2 Graduate Institute of Digital Learning and Education, National Taiwan University of Science and Technology, No.43, Keelung Rd., Sec.4, Da'an Dist., Taipei City 106, Taiwan (R.O.C.)

1 shao.chen76@gmail.com, 2 gjhwang.academic@gmail.com

Abstract. In this study, an augmented reality (AR)-based learning approach was proposed for guiding students to complete scientific tasks in the class. The participants were four classes of fifth graders who were divided into an experimental group and a control group. The students in the experimental group used the AR-based approach, while those in the control group learned with the conventional learning mode. From the experimental results, it was found that the AR-based learning mode significantly improved the students’ project outcomes and learning motivation in comparisons with the conventional approach in doing scientific tasks.

Keywords: augmented reality, scientific tasks, mobile learning, ubiquitous learning

1 Introduction

Engaging students in scientific tasks is an important teaching mode to enable students to apply what they have learned to solve scientific problems. The tasks are usually in the form of a scientific project. The aim of such learning tasks is to let students understand complex problems by investigation (Barron et al., 1998). Completing a scientific project requires the collaboration and interaction among group members.

The effects of engaging students in scientific projects have been reported by several researchers (Laffey, Tupper, Musser, & Wedman, 1998; Nagel, 1996). For example, Chang and Lee (2010) employed a project-based learning approach in a vocational high school to train students’ computer skills; they reported that the students were benefited in terms of communication, organization, and skills practice during the learning process. Meanwhile, Ardaiz-Villanueva, Nicuesa-Chacón, Brene-Artazcoz, de Acedo Lizarraga, and de Acedo Baquedano (2011) developed a project-based learning activity...
for third-grade students in a software engineering course for 15 weeks. From the experiment results, they found that the approach improved the students’ learning performance and attitudes.

On the other hand, is found that when dealing with scientific projects, students might encounter various difficulties, and hence personalized supports are needed. However, in a traditional class, a teacher usually need to take care of tens of students. Providing personalized guidance in the real-world learning scenarios using mobile technologies could be a potential solution to this problem. Therefore, in this study, an AR-based learning approach was proposed for guiding individual students to complete scientific tasks by adding digital guiding information to the real-world objects.

2 Relevant Studies

Azuma (1997) indicated three main elements of AR, including the virtual objects combined with real objects, simultaneous interactive information and 3D presentation. In other words, AR can provide users with interaction objects between the real and virtual environment and increase their engagement while using it (Chang, Chang, Hou, Sung, Chao, & Lee, 2014). With the advancements in the technology and recognition skills, AR have been adopted for years in education studies, such as mathematics (Sommerauer, & Müller, 2014), history (Chang, Hou, Pan, Sung, & Chang, 2015), science (Kamarainen et al., 2013; Chiang, Yang, & Hwang, 2014) and art (Wei, Weng, Liu, & Wang, 2015).

Sommerauer and Müller (2014) used AR in a tour of a mathematics exhibition; users could watch the animation of the exhibits and retain knowledge of mathematics and the concepts of the exhibits; the results showed that AR offered users a better way to understand the exhibits. Furthermore, Chang, Hou, Pan, Sung, and Chang (2015) used AR combined with interview strategies to conduct a touring activity for locating historic information. A total of 87 college students were divided into three groups to experience tour learning in order to increase their learning results and a sense of localization.

The above examples of the implementation of AR in education research indicate that AR can effectively increase students’ learning motivation and learning results; hence, students’ interaction and collaboration with peers can be improved. Accordingly, AR was selected as the guiding mechanism for experiment operation to guide students to conduct electromagnetic experiments.

3 An Augmented Reality-Based Learning Guiding Approach

In this study, an AR-based learning system were developed, the learning content is based on the concept of "electromagnetism," which is included in the elementary natural and living technology course. At beginning, students need to log into the learning system to study the pre-class learning content and complete the worksheet. The students could repeatedly watch the videos and make annotations to raise questions and discuss with peers and the teacher later in the class, as shown in Figure 1.
After the student completes the pre-class study, the teacher will explain the functions of AR, and the system will then guide the students to begin the electromagnetic experiment operation. At first, the system will guide the students to prepare experimental equipment and props, and the operation instruction animation will appear on the flat screen to guide them to know how to operate the experimental props, as shown in Figure 2.

If the students make errors in the steps of the operation process or if they place the props in the wrong position, the system will take the initiative to remind or inform them, so that students can quickly enter the learning situation. Moreover, The AR operating guidance system will not only join the animation guide, but will also provide the students with the magnetic field of magnetic force and magnetic flow direction. The students can therefore understand the operation of the magnetic interaction with the flow direction, and can truly understand the magnetic interaction principle as shown in Figure 3.
4 Experiment design

To evaluate the effectiveness of the AR-based learning system, an experiment was conducted on an elementary school science class to compare the students' learning achievements, critical thinking, group self-efficacy and learning motivation. The selected subject unit was the “magnetic force” unit of an elementary school natural science course. The aim of the subject unit was to foster students' ability of electromagnetic effect and electromagnet applications.

4.1 Participants

The participants of the experiment were 111 fifth graders from four classes. The experimental group, two classes of 56 students, was guided by the AR-based learning system, while the control group, two classes of 55 students, learned with the conventional learning approach. In order to avoid the influence of different instructors on the experimental results, all of the students were taught by the same instructor.

4.2 Experimental process

Figure 4 shows the procedure of the 6-week experiment. At the beginning of the learning activity, the students completed the pre-questionnaires of learning motivation. They also took a pre-test to evaluate their basic knowledge of the electromagnetic effect. During the experiment, the students in the experimental group learned with the AR-based learning system, while those students in the control group were guided by...
the teacher to finish the learning task. The time for the students to complete their learning tasks was 105 minutes. Both groups used the same learning content, including the pictures and videos. After the learning activity, the students took the post-test and completed the learning motivation questionnaire.

4.3 Measuring tools

The research tools of this study included the pre-test, the post-test of natural science and the questionnaire for surveying the learning motivation of the two groups who used the different approaches. Both the pre-test and the post-test were designed by two experienced natural science teachers. The pre-test aimed to evaluate the students’ prior knowledge of the natural science course content. It consisted of 20 multiple-choice items, such as “Which household goods are made using the electromagnetic principle?” The post-test included 10 multiple-choice items (50%), two matching items (20%), one fill-in-the-blank item (10%) and two short-answer questions (10%) for assessing the students’ knowledge of the electromagnetic effect and electromagnet applications. The perfect score of the post-test was 100. Its Cronbach’s alpha value was .72, showing acceptable reliability in internal consistency.

The students were asked to complete the first project as the pre-test result; moreover, they were asked to complete another project as the post-test result at the end of the experiment. Both projects were scored by two experienced teachers who had taught the natural science course for nearly 10 years. The scoring criteria consisted of four dimensions: accuracy (25%), completeness (25%), sophistication (25%), and durability (25%). The perfect score was 100.

Fig. 4. Experimental design of the learning activities.
The learning motivation questionnaire was modified from that developed by Keller (2010). The learning motivation questionnaire has six items in this study. A 5-point Likert rating scheme was employed in this questionnaire, where 1 represented highly agree and 5 represented highly disagree. The Cronbach’s alpha value of the questionnaire was .90.

5 Experimental Results

After the experiment, ANCOVA (Analysis of Covariance) was used to examine the students’ natural science learning achievements and their perceptions of the learning activity from different dimensions by excluding the impacts of the pre-test scores and pre-questionnaire ratings, respectively.

5.1 Analysis of learning achievements of knowledge test

Before conducting ANCOVA to analyze the students’ learning achievements, the homogeneity of the regression coefficient was tested on the two groups’ pre-test scores and was confirmed with $F = 1.26$ (p > .05). As shown in Table 1, there was an insignificant difference between the two groups, the adjusted mean value and standard error of the post-test scores were 84.53 and 1.10 for the control group and 86.98 and 1.10 for the experimental group ($F = 2.489$, p>0.05); that is, the students who learned with the AR-based learning approach did not significantly enhance their learning achievement.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Adjusted Mean</th>
<th>SE</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Group</td>
<td>56</td>
<td>86.89</td>
<td>8.84</td>
<td>86.98</td>
<td>1.095</td>
<td>2.489</td>
</tr>
<tr>
<td>Control group</td>
<td>55</td>
<td>84.62</td>
<td>10.1</td>
<td>84.53</td>
<td>1.101</td>
<td></td>
</tr>
</tbody>
</table>

5.2 Analysis of the project performance

Before conducting ANCOVA to analyze the students’ project performance, the homogeneity of the regression coefficient was tested on the two groups’ first-project scores and was confirmed with $F = 0.70$ (p > .05). As shown in Table 2, the adjusted mean value and standard error of the second-project scores were 85.08 and 1.10 for the control group and 93.97 and 1.09 for the experimental group. According to the results ($F = 33.21$, p<0.001), there was a significant difference between the two groups; that is, the students who learned with the AR-based learning approach showed significantly better project performance than those who learned with the conventional learning approach.
Table 2. The ANCOVA result of the students’ project performance.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Adjusted Mean</th>
<th>SE</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Group</td>
<td>56</td>
<td>93.95</td>
<td>5.616</td>
<td>93.97</td>
<td>1.085</td>
<td>33.21***</td>
</tr>
<tr>
<td>Control group</td>
<td>55</td>
<td>85.10</td>
<td>9.998</td>
<td>85.08</td>
<td>1.095</td>
<td></td>
</tr>
</tbody>
</table>

*** p<0.001

5.3 Learning motivation for science

In terms of learning motivation, before conducting ANCOVA to analyze the students’ learning motivation, the homogeneity of the regression coefficient was tested on the two groups’ learning motivation ratings and was confirmed with F = 0.01 (p > .05). Table 3 shows that the adjusted mean value and standard error of learning motivation ratings were 2.56 and 0.89 for the control group and 4.10 and 0.88 for the experimental group. According to the results (F = 139.00, p<0.001), there was a significant difference between the two groups. That is, the AR–based learning approach had significant impacts on improving the students’ learning motivation.

Table 3. The ANCOVA result of students’ learning motivation.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Adjusted Mean</th>
<th>SE</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Group</td>
<td>56</td>
<td>4.04</td>
<td>0.66</td>
<td>4.10</td>
<td>0.88</td>
<td>139.00***</td>
</tr>
<tr>
<td>Control group</td>
<td>55</td>
<td>2.63</td>
<td>0.61</td>
<td>2.56</td>
<td>0.89</td>
<td></td>
</tr>
</tbody>
</table>

*** p<.001

6 Discussion and Conclusions

In this study, an AR-based learning system approach was proposed. From the experimental results, it was found that, with the help of the AR guiding mechanism, the students’ learning achievements (i.e., the project performance) and learning motivation were significantly improved.

Regarding knowledge testing, it was indicated that the students using the AR-based learning system expressed that there was no content for practice in the system; the time for the experiment was too short so they could not remember the contents that had just been taught. From this, it can be known that the learning contents focused on the skills for operation procedures when students were using AR to learn; therefore, the experiment did not help students review the knowledge that had just been gained.

Moreover, from the project performance analysis, it was found that those learning with the AR-based learning approach showed significantly better project performance than those learning with conventional learning. It was found that, although the teacher had more time to explain the learning tasks in detail, the students still encountered difficulties in the electromagnetic motor production process. Because the problems
encountered by the students might not be the same, the provision of personalized assistance or guidance is needed. The experimental results showed that the use of AR technology is an effective approach to cope with this problem.

However, there are still some limitations to this study. First, the image-based AR can be affected by lights and angles, so recognition failure might occur during the process inside the classroom. Therefore, it is suggested that if researchers want to use image-based AR, the above problems should be conquered to lower any factor affecting the inference of the experimental results. Furthermore, the AR in this study mainly focused on the operation guidance. In the future, it is expected that more subject content and tests can be included in the AR-based learning activities.

Acknowledgements

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References


A Study on the Pattern and Trend of Students’ Typical Usage of Mobile Devices in Learning Activities

Simon K.S. CHEUNG
The Open University of Hong Kong
Good Shepherd Street, Homantin, Kowloon, Hong Kong
kscheung@ouhk.edu.hk

Abstract. This paper investigates the pattern and trend of university students’ typical usage of mobile devices for learning purposes. Based on the surveys conducted to the full-time students at the Open University of Hong Kong in the past 5 years, it is revealed that the majority of students usually use mobile phones for communication using social media whilst less than half usually use mobile phones in reading e-books and doing assignments. Tablet computers are usually used for connecting to learning portals and reading e-books. Notebook computers are still used for conventional usage, such as doing assignment. It is also revealed that the use of tablet computers for doing assignment becomes popular because of the availability of cloud-based storage. The use of mobile phones for connecting to learning portals becomes popular since many mobile apps for learning portals are available. As compared to mobile phones, tablet computers and notebook computers become less popular for communication using social media. The results affirm that the pattern and trend of typical usage depends on not only the nature of the learning activities but also the functional features, limitations and technological development of mobile devices.

Keywords: mobile learning, mobile devices, learning activities, mobile device usage.

1 Introduction

In the past decade, mobile devices have been widely used by university students for learning purposes. They generally include mobile phones, tablet computers and notebook computers, which are portable or handheld computers with an operating system, network and communication utilities for internet access, e-mail, social media, software applications, and data storage.

In Hong Kong, both the internet penetration and mobile device penetration used to stay at very high percentages. As reported in a recent census’s thematic household survey, in Hong Kong, the Internet penetration rate for the age group between 15 and 24 is 99.8%, and 99.3% of the same age group possess a mobile phone with internet access [1, 2]. Among many other regions and countries in Asia, Hong Kong has the
almost the highest internet penetration rate and mobile device penetration rate, as reported by the World Bank [3].

Given the over 99% internet penetration rate and mobile device penetration rate for the age group between 15 and 24 in Hong Kong, it can be inferred that almost every full-time university student possesses at least a mobile device with internet access. This enables mobile or ubiquitous learning, which emphasizes learning anywhere and anytime [4, 5, 6]. The successful adoption of mobile learning indeed depends on not only the technological feasibility of mobile learning but also the students’ needs of flexible learning [7, 8, 9, 10]. With the advent of the latest mobile technology and the growing needs of flexible and mobile learning, the popularity of using mobile devices for learning purposes has become obvious.

The Pearson Student Mobile Device Survey is a comprehensive survey conducted in 2011 to 2015 with an aim to better understand how students use mobile phones, tablet computers, notebook computers and other mobile devices for learning purposes [11]. The targets are college students in the United States. According to the survey, in 2015, 85% of students owned a mobile phone and 89% of students owned a notebook computer while 52% of students owned a tablet computer. The percentages had been steadily increased from 2011, especially on the ownership of tablet computers. It is also reported that, for learning purposes, notebook computers were still the most often used mobile devices, and that more students often use mobile phones than tablet computers. In figures, 87%, 64% and 40% of students often use notebook computers, mobile phones and tablet computers, respectively.

The author conducted similar surveys on the students’ usage of mobile devices at the Open University of Hong Kong for several years. Dated back to 2011/12, in terms of the ownership of mobile devices, 83% of distance-learning students and 92% of full-time students owned a mobile phone while 63% of distance-learning students and 59% of full-time students owned a notebook computer [12, 13]. Also, only 34% of distance-learning students and 16% of full-time students owned a tablet computer. Until 2014/15, the figures had not varied a lot, except that the percentage of full-time students owning a tablet computer had been increased by more than double [14]. It is reported that, over the academic years from 2012/3 to 2014/15, the typical usage of mobile phones, tablet computers and notebook computers had been stabilized. Mobile phones were often used for e-mail, social media and internet browsing, but not often used for reading e-books and doing assignments. Tablet computers were often used for connecting to learning portals and reading e-books but not for doing assignments. Notebook computers are often used in all learning activities [12, 13, 14].

This paper investigates the university students’ usage of mobile devices, based on the annual surveys conducted to the full-time undergraduate students at the Open University of Hong Kong. It aims to identify the student’s typical usage of mobile phone, tablet computers and notebook computers in different learning activities, such as connecting to learning portals, accessing e-books, communication using e-mail and social media, doing assignments, and browsing the internet for other online resources, as well as to observe the trends and changes in the usage over the past several years. The rest of this paper is structured as follows. Section 2 is an overview of mobile devices, which are generally characterized by their technical features and limitations.
Section 3 reports the results of the surveys in the past 5 academic years. Section 4 discusses the pattern and trend of the typical usage, based on the survey results. Section 5 briefly concludes this paper.

2 Overview of Mobile Devices

Mobile devices generally refer to hand-held or portable electronic computing devices with the processing capability comparable to a personal computer. These mobile devices are characterized by a number of features, including a flat screen display, a touch-pad or touch-screen interface, a virtual or physical keyboard, a weight of less than 2 kg, and the provision of network interfaces to access the internet through Wi-Fi network, and 3G or 4G cell network. Similar to other computing devices, mobile devices have an operating system and data storage, on which software applications can be installed and operated. Typical bundled software applications include e-mail, social media, online communication tools, calendar, internet browser, e-book reader, multimedia player, note taking utilities, etc.

Mobile devices are generally classified into 3 categories, namely, mobile phones, tablet computers and notebook computers. In this paper, the students’ usage of each of these 3 categories of mobile devices for learning are investigated. For the purpose of this study, the following definitions are used for mobile phones, tablet computers and notebook computers.

**Mobile phones.** Mobile phones broadly refer to smart phones which provide not only the telephony functions but also internet access and computing functionality. Mobile phones are characterized by a flat screen with a touch-screen interface and a virtual keyboard. Typical operating systems for mobile phones are Android and iOS. A typical mobile phone has a flat screen display of less than 6-inch width, supporting touch-screen navigation. Owing to the small screen size which is not conducive for reading e-books, many mobile phones do not provide e-book reader. The weight is less than 1 kg. Almost all mobile phones have the built-in camera and multimedia player. A mobile phone can be continuously used for several hours to half a day if its battery is fully charged. Network accesses are supported, including Wi-Fi network, 3G or 4G cell network. Representative examples are the Apple iPhone [15], Samsung Galaxy Note [16] and Sony Xperia [17].

**Tablet computers.** Tablet computers broadly refer to both tablet computers and slate computers, but not netbook computers which come with a fixed (and non-detachable) physical keyboard. Like mobile phones, tablet computers are characterized by a flat screen with a touch-screen interface and a virtual keyboard. Some tablet computers provide a detachable physical keyboard. However, tablet computers do not provide the conventional telephony functions. Typical operating systems for tablet computers are Android, iOS and Windows. A typical tablet computer has a flat screen display of 7 to 12-inch width, supporting touch-screen navigation. The weight is around 1 kg. A tablet computer can be continuously used for several hours to half a day if its battery is fully charged.
charged. For network interface, tablet computers are usually equipped with Wi-Fi network interface. It is not common for tablet computers to provide 3G or 4G cell network support. Representative examples are the Apple i-Pad [18], Samsung Galaxy Tab [19] and Microsoft Surface [20].

Notebook computers. Notebook computers broadly refer to notebook computers, netbook computers and laptop computers which are functionally identical to desktop personal computers. They have a fixed (and non-detachable) physical keyboard, with a touch-pad or track stick as the pointing device for navigation. A typical notebook computer has a screen display of 10 to 17-inch width. The weight ranges from 1 to 2 kg, depending on the screen size. Many conventional notebook computers resemble the desktop computers, operating on Windows or Mac OS and the traditional desktop software applications. Some notebook or netbook computers operate on Android or iOS. In recent years, notebook computers tend to use solid state memory which consume lesser power than the traditional hard disk drives. A typical notebook computer with solid state memory can be continuously used for 4 to 8 hours. Almost all notebook computers provide both wired and wireless network interface, but not supporting 3G or 4G cell network. Representative examples are the Lenovo ThinkPad [21], Apple MacBook [22] and Sony VAIO [23].

Table 1 summarizes the characteristics and technical features of mobile phones, tablet computers and notebook computers.

<table>
<thead>
<tr>
<th>Features</th>
<th>Mobile Phones</th>
<th>Tablet Computers</th>
<th>Notebook Computers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen size</td>
<td>Less than 6 inch</td>
<td>7 to 12 inch</td>
<td>10 to 17 inch</td>
</tr>
<tr>
<td>Disk storage</td>
<td>Solid state memory</td>
<td>Solid state memory</td>
<td>Solid state memory, or hard disk drives</td>
</tr>
<tr>
<td>Input device</td>
<td>Virtual keyboard</td>
<td>Virtual keyboard, or detachable keyboard</td>
<td>Physical and fixed (non-detachable) keyboard</td>
</tr>
<tr>
<td>Pointing device</td>
<td>Touch screen</td>
<td>Touch screen, or touch-pad of a detachable keyboard</td>
<td>Touch screen, touch-pad or track stick of a non-detachable keyboard</td>
</tr>
<tr>
<td>Weight</td>
<td>Less than 1 kg</td>
<td>Around 1 kg</td>
<td>1 to 2 kg</td>
</tr>
<tr>
<td>Battery life</td>
<td>8 to 12 hours</td>
<td>8 to 12 hours</td>
<td>4 to 8 hours</td>
</tr>
<tr>
<td>Network adaptor</td>
<td>Wi-Fi network, and 3G or 4G cell network</td>
<td>Wi-Fi network; seldom 3G or 4G cell network</td>
<td>Wi-Fi network, and wired network</td>
</tr>
<tr>
<td>Operating system</td>
<td>Mobile OS, such as Android and iOS</td>
<td>Mobile OS, such as Android and iOS</td>
<td>Conventional PC OS, or mobile OS</td>
</tr>
<tr>
<td>Application software</td>
<td>Mobile applications on Android and iOS</td>
<td>Mobile applications on Android and iOS</td>
<td>Typical PC applications, or mobile applications</td>
</tr>
</tbody>
</table>

In recent years, there are some new mobile phones with a larger screen size, say 6 or 7 inch, called phablets [24]. On the other hand, notebook computers become more
portable with longer battery life, after the adoption of solid-state memory instead of hard disk drives for reducing the weight and minimizing the consumption of power. Some notebook computers also support a detachable physical keyboard, and can be used perfectly as tablet computers without the physical keyboard as they support touch-screen with a virtual keyboard. Unquestionably, the boundary between mobile phones and tablet computers as well as the boundary between tablet computers and notebook computers become blurred.

For our study, phablets, which have telephony functions, are regarded as mobile phones. Notebook computers refer to those with a physical fixed (and non-detachable) keyboards that cannot be used as a tablet computer.

### 3 Survey on the Use of Mobile Devices for Learning Purposes

This section reports the survey on the students’ typical usage of mobile devices for learning purposes, conducted at the Open University of Hong Kong over the past 5 academic years.

The Open University of Hong Kong is a public university in Hong Kong offering both undergraduate and postgraduate programmes in full-time face-to-face mode or part-time distance-learning mode [25]. The university has been using a full-fledged online learning environment for 20 years, where students had used to retrieve course materials and learning resources, perform quizzes and tests, submit assignments and communicate with the instructors and peer classmates. For several years, an annual survey has been conducted to the undergraduate students at the Open University of Hong Kong on their typical usage of mobile devices in different learning activities, usually at the beginning of an academic year.

In this paper, the focus is placed on the full-time undergraduate students, using the surveys over the past 5 academic years, i.e. 2012/13, 2013/14, 2014/15, 2015/16 and 2016/17. For each year, a set of randomly selected students were invited to participate in an online survey in the form of multiple-choice questionnaires. The survey has two parts. In the first part, students were asked on their possession of mobile devices, and their daily usage in terms of hours per day. In the second part, there are three sets of identical questions, asking if mobile devices are usually used in the following learning activities. One set of questions is for mobile phones, and the other two are for tablet computers and notebook computers.

- accessing e-mails related to study;
- connecting to the learning portal for retrieving learning materials, enquiring learning-related information, submitting assignments, etc.;
- reading e-books or learning resources in e-format;
- communicating with other through social media or online chat;
- doing assignments or other learning tasks;
- browsing the internet for online learning materials.

The first part of the survey results are summarized in Tables 2 and 3, which report the possession of mobile devices and the daily usage, respectively.
Table 2. Possession of mobile devices for learning purposes.

<table>
<thead>
<tr>
<th>Mobile devices</th>
<th>2012/13 (n=385)</th>
<th>2013/14 (n=368)</th>
<th>2014/15 (n=359)</th>
<th>2015/16 (n=279)</th>
<th>2016/17 (n=370)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile phones</td>
<td>95% (367)</td>
<td>94% (337)</td>
<td>98% (274)</td>
<td>97% (360)</td>
<td></td>
</tr>
<tr>
<td>Tablet computers</td>
<td>29% (111)</td>
<td>43% (153)</td>
<td>43% (121)</td>
<td>42% (154)</td>
<td></td>
</tr>
<tr>
<td>Tablet computers</td>
<td>53% (204)</td>
<td>64% (228)</td>
<td>65% (181)</td>
<td>65% (239)</td>
<td></td>
</tr>
<tr>
<td>Notebooks</td>
<td>0% (0)</td>
<td>0% (0)</td>
<td>0% (0)</td>
<td>1% (3)</td>
<td></td>
</tr>
<tr>
<td>Nil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Daily usage of mobile devices for learning purposes.

<table>
<thead>
<tr>
<th>Daily usage in hours per day</th>
<th>2012/13 (n=385)</th>
<th>2013/14 (n=368)</th>
<th>2014/15 (n=359)</th>
<th>2015/16 (n=279)</th>
<th>2016/17 (n=370)</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 3 hours</td>
<td>69% (265)</td>
<td>72% (265)</td>
<td>69% (247)</td>
<td>73% (204)</td>
<td>78% (288)</td>
</tr>
<tr>
<td>2 to 3 hours</td>
<td>13% (51)</td>
<td>14% (50)</td>
<td>17% (62)</td>
<td>14% (38)</td>
<td>14% (51)</td>
</tr>
<tr>
<td>1 to 2 hours</td>
<td>12% (48)</td>
<td>10% (37)</td>
<td>11% (38)</td>
<td>11% (30)</td>
<td>6% (23)</td>
</tr>
<tr>
<td>Less than 1 hour</td>
<td>5% (21)</td>
<td>4% (16)</td>
<td>3% (12)</td>
<td>3% (7)</td>
<td>2% (8)</td>
</tr>
</tbody>
</table>

The second part of the survey results are summarized in Tables 4, 5 and 6. They show the percentages of students who usually use mobile phones, tablet computers and notebook computers in different learning activities.

Table 4. Usage of mobile phones in different learning activities.

<table>
<thead>
<tr>
<th>Learning activities</th>
<th>2012/13 (n=367)</th>
<th>2013/14 (n=342)</th>
<th>2014/15 (n=337)</th>
<th>2015/16 (n=274)</th>
<th>2016/17 (n=360)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessing e-mails</td>
<td>76% (279)</td>
<td>75% (257)</td>
<td>75% (252)</td>
<td>80% (218)</td>
<td>80% (288)</td>
</tr>
<tr>
<td>Learning portal</td>
<td>74% (271)</td>
<td>77% (265)</td>
<td>79% (267)</td>
<td>89% (238)</td>
<td>90% (324)</td>
</tr>
<tr>
<td>Reading e-books</td>
<td>44% (163)</td>
<td>44% (150)</td>
<td>47% (157)</td>
<td>50% (136)</td>
<td>51% (182)</td>
</tr>
<tr>
<td>Social network</td>
<td>93% (342)</td>
<td>94% (323)</td>
<td>94% (316)</td>
<td>94% (258)</td>
<td>98% (351)</td>
</tr>
<tr>
<td>Doing assignments</td>
<td>29% (106)</td>
<td>30% (101)</td>
<td>23% (78)</td>
<td>33% (91)</td>
<td>29% (106)</td>
</tr>
<tr>
<td>Browsing internet</td>
<td>73% (268)</td>
<td>76% (261)</td>
<td>74% (251)</td>
<td>75% (206)</td>
<td>79% (284)</td>
</tr>
</tbody>
</table>
Table 5. Usage of tablet computers in different learning activities.

<table>
<thead>
<tr>
<th>Learning activities</th>
<th>2012/13 (n=111)</th>
<th>2013/14 (n=137)</th>
<th>2014/15 (n=153)</th>
<th>2015/16 (n=121)</th>
<th>2016/17 (n=144)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessing e-mails</td>
<td>66% (73)</td>
<td>64% (88)</td>
<td>61% (94)</td>
<td>69% (83)</td>
<td>66% (95)</td>
</tr>
<tr>
<td>Learning portal</td>
<td>74% (82)</td>
<td>73% (100)</td>
<td>75% (115)</td>
<td>79% (95)</td>
<td>77% (111)</td>
</tr>
<tr>
<td>Reading e-books</td>
<td>64% (71)</td>
<td>68% (93)</td>
<td>67% (102)</td>
<td>70% (85)</td>
<td>63% (91)</td>
</tr>
<tr>
<td>Social network</td>
<td>71% (79)</td>
<td>63% (86)</td>
<td>65% (99)</td>
<td>60% (72)</td>
<td>60% (86)</td>
</tr>
<tr>
<td>Doing assignments</td>
<td>50% (56)</td>
<td>39% (53)</td>
<td>48% (73)</td>
<td>57% (69)</td>
<td>60% (87)</td>
</tr>
<tr>
<td>Browsing internet</td>
<td>73% (81)</td>
<td>69% (94)</td>
<td>71% (109)</td>
<td>71% (86)</td>
<td>72% (103)</td>
</tr>
</tbody>
</table>

Table 6. Usage of notebook computers in different learning activities.

<table>
<thead>
<tr>
<th>Learning activities</th>
<th>2012/13 (n=204)</th>
<th>2013/14 (n=194)</th>
<th>2014/15 (n=228)</th>
<th>2015/16 (n=181)</th>
<th>2016/17 (n=239)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessing e-mails</td>
<td>64% (130)</td>
<td>62% (120)</td>
<td>68% (155)</td>
<td>66% (119)</td>
<td>74% (177)</td>
</tr>
<tr>
<td>Learning portal</td>
<td>79% (161)</td>
<td>74% (143)</td>
<td>77% (176)</td>
<td>78% (142)</td>
<td>80% (193)</td>
</tr>
<tr>
<td>Reading e-books</td>
<td>70% (142)</td>
<td>67% (130)</td>
<td>70% (160)</td>
<td>69% (125)</td>
<td>71% (169)</td>
</tr>
<tr>
<td>Social network</td>
<td>67% (136)</td>
<td>54% (105)</td>
<td>59% (135)</td>
<td>59% (107)</td>
<td>59% (140)</td>
</tr>
<tr>
<td>Doing assignments</td>
<td>99% (201)</td>
<td>93% (181)</td>
<td>98% (224)</td>
<td>98% (177)</td>
<td>98% (235)</td>
</tr>
<tr>
<td>Browsing internet</td>
<td>70% (142)</td>
<td>65% (127)</td>
<td>72% (164)</td>
<td>67% (121)</td>
<td>67% (160)</td>
</tr>
</tbody>
</table>

4 Pattern and Trend of Typical Usage

This section discusses the pattern and trend of university students’ typical usage of mobile devices, based on the survey results.

It is shown in Table 2 that the percentage of students possessing mobile phones for learning purposes has been consistently high (over 90%), and even reached 97% or 98% recently. The percentage of students possessing tablet computers and notebook computers for learning purposes have become stabilized at around 40% and 65% respectively. For the daily usage of mobile devices for learning purposes, as shown in Table 3, there is an increasing trend over the past 5 academic years. The majority of students (near 80%) used to use mobile devices for more than 3 hours per day in different learning activities.

In Table 4, the students’ typical usage of mobile phones are communication using e-mail and social media, and connecting to learning portal and browsing the internet. The usage on online communication has been consistently high (over 75% and over 90% on
e-mail and social media, respectively) over the past 5 years. This is because the handheld mobile phones are portable and can access the network anytime and anywhere, through Wi-Fi network, 3G or 4G cell network interfaces. It is also shown that students do not usually use mobile phones for reading e-books and doing assignments. This aligns to the physical limitations of mobile phones, such as small screen size and no full-size physical keyboard. Besides, as many mobile apps for learning portals are available, more and more students usually use mobile phones for connecting to the learning portals.

It is shown in Table 5 that around 70% of students usually use tablet computers in all the learning activities, except doing assignments. There are however no particular learning activities that tablet computers were usually used by a large percentage (over 80%) of students. For reading e-books, it is clear that more students usually use tablet computers than mobile phones. Besides having a larger flat screen comparable to the size of printed books, tablet computers generally provide an e-book reader with some enhanced features, such as online dictionary and pronunciation, which are advantages over the traditional books. Among other learning activities, the least percentage of students usually use tablet computers for doing assignments. One reason is the lack of a physical keyboard. Another reason is the lack of memory storage. However, some new models of tablet computers offer detachable physical keyboards. Cloud-based storage is now provided for mobile users. Perhaps for these reasons, the percentage rose from around 50% to 60% last year.

Notebook computers are usually used by students as shown in Table 6. Over 70% of students usually use notebook computer in all learning activities, except for social networking (less than 60% of students usually use notebook computers for social networking). As most of the notebook computers do not connect to 3G or 4G cell networks, it is not convenient for social networking, where instant communication is preferred. This is also why only around 70% of students usually notebook computers for e-mail communication and internet browsing. Except on the portability and cell network connection, notebook computers offer many advantages over mobile phones and tablet computers, such as the provision of a physical keyboard, more memory storage, and more capacity of operating the conventional software applications. These advantages are especially useful for doing assignments, as reflected in Table 6 that a very large percentage (98% or 99%) of students usually use notebook computers for doing assignments.

Based on the above observations, the pattern of students’ typical usage of mobile devices can be derived. Table 7 summarizes the percentage of students usually using mobile phones, tablet computers and notebook computers in different learning activities. A higher percentage of students usually using a particular type of mobile devices for a particular learning activity implies that the type of mobile devices is frequently used for the learning activity. In contrast, a lower percentage implies that the type of mobile is not frequently used for the learning activity. In numerical terms, over 80% is generally regarded as very frequent, 60% to 80% as frequent, 40% to 60% as less frequent, and less than 40% as not frequent.
Table 7. Pattern of students’ usage of mobile devices in different learning activities.

<table>
<thead>
<tr>
<th>Learning activities</th>
<th>% of students usually using mobile devices in learning activities (in 5 years)</th>
<th>Mobile phones</th>
<th>Tablet computers</th>
<th>Notebook computers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessing e-mails</td>
<td>frequent</td>
<td>frequent</td>
<td>frequent</td>
<td>(75% to 80%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(61% to 66%)</td>
<td>(62% to 74%)</td>
<td></td>
</tr>
<tr>
<td>Learning portal</td>
<td>frequent</td>
<td>frequent</td>
<td>frequent</td>
<td>(74% to 90%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(73% to 79%)</td>
<td>(74% to 80%)</td>
<td></td>
</tr>
<tr>
<td>Reading e-books</td>
<td>less frequent</td>
<td>frequent</td>
<td>frequent</td>
<td>(44% to 51%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(63% to 70%)</td>
<td>(67% to 71%)</td>
<td></td>
</tr>
<tr>
<td>Social network</td>
<td>very frequent</td>
<td>frequent</td>
<td>less frequent</td>
<td>(93% to 98%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(63% to 71%)</td>
<td>(54% to 67%)</td>
<td></td>
</tr>
<tr>
<td>Doing assignments</td>
<td>not frequent</td>
<td>less frequent</td>
<td>very frequent</td>
<td>(23% to 33%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(39% to 60%)</td>
<td>(93% to 99%)</td>
<td></td>
</tr>
<tr>
<td>Browsing internet</td>
<td>frequent</td>
<td>frequent</td>
<td>frequent</td>
<td>(73% to 79%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(69% to 73%)</td>
<td>(65% to 72%)</td>
<td></td>
</tr>
</tbody>
</table>

Following the notion, as shown in Table 7, mobile phones are very frequently used for social networking, less frequently used for reading e-books, and not frequently used for doing assignments. Tablet computers are less frequently used for doing assignment. Notebook computers are very frequently used for doing assignment, and less frequently used for social networking. This pattern of usage is similar to the one derived by the author in 2015 [14].

Although the pattern of typical usage of mobile devices is quite stabilized, there are changes which mimic salient trend of typical usage of mobile devices over the past 5 years. Whilst these changes are mostly insignificant, some become more frequently used (upward trend), and some become less frequently used (downward trend) in particular learning activities, as shown in Table 8.

Table 8. Trend of students’ usage of mobile devices in different learning activities.

<table>
<thead>
<tr>
<th>Learning activities</th>
<th>Trend of usage of mobile devices in learning activities in terms of frequency</th>
<th>Mobile phones</th>
<th>Tablet computers</th>
<th>Notebook computers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessing e-mails</td>
<td>insignificant</td>
<td>insignificant</td>
<td>insignificant</td>
<td>insignificant</td>
</tr>
<tr>
<td>Learning portal</td>
<td>upward trend</td>
<td>insignificant</td>
<td>insignificant</td>
<td>insignificant</td>
</tr>
<tr>
<td>Reading e-books</td>
<td>insignificant</td>
<td>insignificant</td>
<td>insignificant</td>
<td>insignificant</td>
</tr>
<tr>
<td>Social network</td>
<td>insignificant</td>
<td>insignificant</td>
<td>insignificant</td>
<td>insignificant</td>
</tr>
<tr>
<td>Doing assignments</td>
<td>insignificant</td>
<td>upward trend</td>
<td>insignificant</td>
<td>insignificant</td>
</tr>
<tr>
<td>Browsing internet</td>
<td>insignificant</td>
<td>insignificant</td>
<td>insignificant</td>
<td>insignificant</td>
</tr>
</tbody>
</table>
Regarding the changes of students’ usage of mobile devices for learning purposes in the past 5 years, there are two significant trends or changes. One significant trend is that more and more students usually use mobile phones for connecting to the learning portals. An underlying reason is that, in recent years, many learning management systems have provided mobile apps for learning portals. These mobile apps provide some functional features, such as class calendar and examination calendar, timetables and announcements are more convenient for students to access through mobile phones anywhere and anytime.

Another significant trend is that more and more students usually use tablet computers for doing assignments. In recent years, cloud-based storage has become popular for users to store some working files on cloud when using mobile devices. Besides, detachable physical keyboards have become popular accessories for tablet computers. These keyboards are small, portable, and can be even foldable. With the provision of detachable keyboards and cloud-based storage, tablet computers can be used as good as notebook computers, and this explains the increasing trend of using tablet computers in doing assignments.

5 Conclusion

Todays, mobile devices have been widely used. Almost every student owns at least a mobile device for learning purposes. In this paper, we investigate the pattern and trend of students’ typical usage of mobile devices for learning purposes. Following a brief review of mobile devices which include mobile phones, tablet computers and notebook computers, this paper reports the surveys on the usage of mobile devices conducted to the full-time undergraduate students in the Open University of Hong Kong in the past 5 academic years. Based on the survey results, the pattern and trend of usage are derived and reported.

In summary, the majority of students usually use mobile phones for communication using e-mail and social media, whilst less than half usually use mobile phones in reading e-books and doing assignments. In contrast, mobile tablets are not as popular as mobile phones for communication using e-mail and social media. They are usually used for connecting to learning portals and reading e-books. Notebook computers are still used for conventional usage, such as doing assignments, reading e-books, and browsing the internet for learning resources. These observations on the pattern of students’ usage of mobile devices indeed align with the observations obtained in an earlier study by the author [14].

Over the past 5 academic years, it is observed that more and more students usually use mobile phones for connecting to learning portals, and use tablet computers for doing assignments. This is because the availability of many mobile apps of learning portals or learning management systems, and the availability of some cloud-based storage and the provision of detachable keyboards for some tablet computers. On the other hand, there are no significant changes on the pattern of usages of notebook computers in different learning activities.
The findings reflect that the patterns of how mobile phones, tablet computers and notebook computers are used for learning purposes have become stabilized, and the usages depend on the nature of the learning activities and the technical features as well as limitations of the mobile devices. The findings also reflect that the trend of usages depend on the latest technological development of the mobile devices. It is hoped that the findings can provide some insights on the students' typical usage of mobile devices for learning purposes in Hong Kong.

References

The Acceptance of “Flash Class” – Mobile Mini-lessons through WeChat

Ting YANG 1, Hao ZHONG 1, Qingmin MOK 1, Ivan Ka-Wai LAI 2, Kwan-Keung NG 3

1 School of Business, Macau University of Science and Technology, Taipa, Macau
2 Faculty of International Tourism and Management, City University of Macau, Taipa, Macau
3 University of Sunderland in Hong Kong, Hong Kong

ytt163@126.com, benchunggz@foxmail.com, kirodemon@163.com
ivanlai@cityu.mo
Steven.Ng@sunderland.edu.hk

Abstract. The aim of this study is to identify the factors that influence the acceptance of “Flash Class” - mobile mini-lessons through WeChat. The empirical results were obtained in a sample of 187 university students in China. The results of PLS analysis indicate that performance expectancy, effort expectancy, social influence, hedonic motivation, and habit directly affect the acceptance of using "Flash Class" through WeChat for students learning English. The results of multi-group analysis also indicate that gender moderates the effect of effort expectancy on user behavioural intention. This study makes several suggestions to the “Flash Class” developers for improving their designs according to the listed factors in order to satisfy the learners’ needs.

Keywords: mobile mini-lesson; mobile instant message; mobile learning platform; UTAUT2

1 Introduction

In China, a mobile instant messaging and social network app such as WeChat is not only used as an instant communication application, but also extended to a mobile learning platform for students. Nowadays, ‘Flash Class’ is a new innovative service in WeChat, which allows teachers to quickly make mobile mini-lessons and share them with students. There is an increasing number of students who are using it to learn and share English knowledge directly through WeChat because this way of mobile learning is more convenient, faster, and relatively stress-free for students to learn English. In order to recruit more students to participate this app, the purpose of this study is to examine the factors that can significantly explain the acceptance of “Flash Class” based on the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) model. This

study will examine the impacts of the factors of UTAUT2 including Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), Hedonic Motivation (HM), Price Value (PV), and Habit (HB) on the behavioural intention (BI) toward using “Flash Class” through WeChat for students learning English. Furthermore, it also examines the differences in students’ gender as a moderator factor that influences the effects of PE, EE, SI, FC, HM, PV, and HB on BI.

2 Literature Review

2.1 The Unified Theory of Acceptance and Use of Technology 2 (UTAUT2)

An essential factor which determines the success or failure of a new technology is the acceptance of users. Hence, it is crucial for the “Flash Class” developers to know users’ needs and the acceptance level of users. There are various researches aimed at the factors which predicted user acceptance of a technology such as Technology Acceptance Model (TAM) (Davis, 1989), Diffusion of Innovation (Rogers, 1995), The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). The UTAUT was developed by unifying eight different theories including the Theory of Reasoned Action (TRA) (Ajzen and Fishbein, 1980), TAM, the Motivational Model (MM) (Davis et al., 2006), the Theory of Planned Behaviour (TPB) (Ajzen, 1985), a combined theory of Planned Behaviour/Technology Acceptance Model (C-TPB-TAM), the Model of PC Utilization (MPCU) (Thompson et al., 1991), Innovation Diffusion Theory (IDT) (Moore and Benbasat, 1996), and Social Cognitive Theory (SCT) (Compeau et al., 1999). The UTAUT model has four core determinants of usage and intentions, including PE, EE, SI, and FC. It also includes four moderators of key relationships: gender, age, experience, and voluntariness of use. The UTAUT has been used to describe technology acceptance in the organizational context. Recently, Venkatesh et al. (2012) extended UTAUT to UTAUT2 which was focused on individual perspectives in technology adoptions. Hence, the UTAUT2 has been adopted for exploring self-technology service, smart mobile device adoption, and learning management software acceptance (Raman and Don, 2013). Since the purpose of this research is to explore the possible factors influencing individual users’ adoptions, so the UTAUT2 model will be adopted to explore the factors that can significantly explain the acceptance of “Flash Class” through WeChat for students.

3 Research Hypothesis

As discussed above, PE, EE, SI, FC, HM, PV, and HB may have positive effects on BI toward using “Flash Class” through WeChat for students learning English; and students’ gender may as a moderator that influences the effects of PE, EE, SI, FC, HM, PV, and HB on BI. The following hypotheses were developed. Fig. 1 shows the research model.
H1: Performance expectancy (PE) has a direct effect on user behavioural intention toward using “Flash Class” through WeChat for students learning English.

H2: Effort Expectancy (EE) has a direct effect on user behavioural intention toward using “Flash Class” through WeChat for students learning English.

H3: Social Influence (SI) has a direct effect on user behavioural intention toward using “Flash Class” through WeChat for students learning English.

H4: Facilitating Conditions (FC) have a direct effect on user behavioural intention toward using “Flash Class” through WeChat for students learning English.

H5: Hedonic Motivation (HM) has a direct effect on user behavioural intention toward using “Flash Class” through WeChat for students learning English.

H6: Price Value (PV) has a direct effect on user behavioural intention toward using “Flash Class” through WeChat for students learning English.

H7: Habit (HB) has a direct effect on user behavioural intention toward using “Flash Class” through WeChat for students learning English.

H8: Students’ gender moderates the effects of PE, EE, SI, FC, HM, PV, and HB on user behavioural intention toward using “Flash Class” through WeChat for students learning English.
4 Findings

Through the online surveys in September 2017, totally 187 valid data were collected from university students. The measurable items for PE, EE, SI, FC, HM, PV, HB and BI were adopted from Venkatesh et al. (2012). Table 1 shows the sample characteristics. 54 respondents (28.9%) were males, 133 respondents (71.1%) were females. Most of the respondents were aged between 19 (28.3%) and 20 (23.0%).

<table>
<thead>
<tr>
<th>Table 1. Demographic information (n=187)</th>
<th>Frequency</th>
<th>%</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>54</td>
<td>28.9</td>
<td>18</td>
<td>9.1</td>
</tr>
<tr>
<td>Female</td>
<td>133</td>
<td>71.1</td>
<td>19</td>
<td>53</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>year-1</td>
<td>5</td>
<td>2.7</td>
<td>20</td>
<td>43</td>
</tr>
<tr>
<td>year-2</td>
<td>88</td>
<td>47.1</td>
<td>21</td>
<td>29</td>
</tr>
<tr>
<td>year-3</td>
<td>40</td>
<td>21.4</td>
<td>22</td>
<td>27</td>
</tr>
<tr>
<td>year-4</td>
<td>37</td>
<td>19.8</td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td>Edu</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PG year-1</td>
<td>5</td>
<td>2.7</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>PG year-2</td>
<td>12</td>
<td>6.4</td>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>Over</td>
<td>7</td>
<td>3.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>13.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 presents the means, standard deviations, and Partial Least Square (PLS) loadings of each measurement item. All factor loadings of each construct exceed 0.7, which reached the recommended level. Table 3 shows the values of Cronbach’s alpha, average variance extracted (AVE), construct reliability (CR), and correlation analysis of eight constructs. The AVE and CR values of all constructs exceed 0.6 and 0.8, respectively. And all values of correlation are less than 0.85, so eight constructs are relatively independent of one another. These results confirm the data reliability and validity of the discriminants.
Table 2. Mean, Standard deviation, and PLS Loading (5-point Likert Scale)

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Factor Loading</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI1</td>
<td>3.18</td>
<td>0.883</td>
<td>0.869</td>
<td>HT1</td>
<td>2.85</td>
<td>0.994</td>
</tr>
<tr>
<td>BI2</td>
<td>3.14</td>
<td>0.929</td>
<td>0.889</td>
<td>HT2</td>
<td>2.81</td>
<td>1.008</td>
</tr>
<tr>
<td>BI3</td>
<td>3.24</td>
<td>0.886</td>
<td>0.914</td>
<td>HT3</td>
<td>2.78</td>
<td>0.939</td>
</tr>
<tr>
<td>BI4</td>
<td>3.26</td>
<td>0.893</td>
<td>0.845</td>
<td>HT4</td>
<td>2.96</td>
<td>0.952</td>
</tr>
<tr>
<td>EE1</td>
<td>3.45</td>
<td>0.856</td>
<td>0.877</td>
<td>PE1</td>
<td>3.29</td>
<td>0.813</td>
</tr>
<tr>
<td>EE2</td>
<td>3.4</td>
<td>0.813</td>
<td>0.843</td>
<td>PE2</td>
<td>3.41</td>
<td>0.859</td>
</tr>
<tr>
<td>EE3</td>
<td>3.42</td>
<td>0.841</td>
<td>0.835</td>
<td>PE3</td>
<td>3.21</td>
<td>0.878</td>
</tr>
<tr>
<td>EE4</td>
<td>3.59</td>
<td>0.878</td>
<td>0.744</td>
<td>PV1</td>
<td>3.04</td>
<td>0.812</td>
</tr>
<tr>
<td>FC1</td>
<td>3.79</td>
<td>0.993</td>
<td>0.801</td>
<td>PV2</td>
<td>3.09</td>
<td>0.853</td>
</tr>
<tr>
<td>FC2</td>
<td>3.78</td>
<td>0.844</td>
<td>0.829</td>
<td>PV3</td>
<td>3.08</td>
<td>0.854</td>
</tr>
<tr>
<td>FC3</td>
<td>3.71</td>
<td>0.923</td>
<td>0.790</td>
<td>SI1</td>
<td>2.9</td>
<td>0.959</td>
</tr>
<tr>
<td>FC4</td>
<td>3.27</td>
<td>0.865</td>
<td>0.750</td>
<td>SI2</td>
<td>2.98</td>
<td>0.989</td>
</tr>
<tr>
<td>HM1</td>
<td>3.24</td>
<td>0.815</td>
<td>0.891</td>
<td>SI3</td>
<td>3.15</td>
<td>0.933</td>
</tr>
<tr>
<td>HM2</td>
<td>3.15</td>
<td>0.809</td>
<td>0.912</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HM3</td>
<td>3.21</td>
<td>0.799</td>
<td>0.905</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fig. 2 shows the results of PLS analysis. The value of $R^2$ of the research model is 0.749 that can be described as ‘substantial’ (Hair & Sarstedt, 2011). In summary, PE, EE, SI, HM, and HT are all significantly related to BI, indicating that H1, H2, H3, H5, and H7 are supported, but H4 and H6 are unsupported, H8 is partially accepted where gender moderates the effect of EE on BI toward using “Flash Class” through WeChat for students learning English.

Table 3. Reliability, Validity, Correlations and Square Roots of AVEs

<table>
<thead>
<tr>
<th>Cronbach's Alpha</th>
<th>AVE</th>
<th>CR</th>
<th>BI</th>
<th>EE</th>
<th>FC</th>
<th>HM</th>
<th>HT</th>
<th>PE</th>
<th>PV</th>
<th>SI</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI</td>
<td>0.902</td>
<td>0.774</td>
<td>0.932</td>
<td>0.880</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE</td>
<td>0.844</td>
<td>0.683</td>
<td>0.896</td>
<td>0.610</td>
<td>0.826</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC</td>
<td>0.817</td>
<td>0.629</td>
<td>0.871</td>
<td>0.399</td>
<td>0.592</td>
<td>0.793</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HM</td>
<td>0.887</td>
<td>0.815</td>
<td>0.930</td>
<td>0.738</td>
<td>0.664</td>
<td>0.542</td>
<td>0.903</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HT</td>
<td>0.919</td>
<td>0.805</td>
<td>0.943</td>
<td>0.768</td>
<td>0.444</td>
<td>0.296</td>
<td>0.693</td>
<td>0.897</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE</td>
<td>0.868</td>
<td>0.791</td>
<td>0.919</td>
<td>0.692</td>
<td>0.636</td>
<td>0.404</td>
<td>0.662</td>
<td>0.615</td>
<td>0.889</td>
<td></td>
</tr>
<tr>
<td>PV</td>
<td>0.865</td>
<td>0.787</td>
<td>0.917</td>
<td>0.614</td>
<td>0.503</td>
<td>0.443</td>
<td>0.680</td>
<td>0.673</td>
<td>0.476</td>
<td>0.887</td>
</tr>
<tr>
<td>SI</td>
<td>0.847</td>
<td>0.767</td>
<td>0.908</td>
<td>0.668</td>
<td>0.481</td>
<td>0.357</td>
<td>0.622</td>
<td>0.631</td>
<td>0.553</td>
<td>0.540</td>
</tr>
</tbody>
</table>
5 Discussion and Conclusion

Habit is the strongest predictor of user behavioural intention toward using “Flash Class” through WeChat for students learning English (β =0.364, t-statistics=5.219). Performance expectancy, effort expectancy, social influence, and hedonic motivation are also the determinants of user behavioural intention toward using “Flash Class” through WeChat for students learning English (β=0.167, t-statistics=2.654; β=0.166, t-statistics=2.553; β=0.186, t-statistics=2.679; β=0.151, t-statistics=2.052 respectively). The results also indicate that gender is a moderator which influences the effect of effort expectancy on user behavioural intention toward using “Flash Class” through WeChat for students learning English (β=0.180, t-statistics=2.473).

Performance expectancy shows a significant effect on user behavioural intention toward using “Flash Class” through WeChat for students learning English. This indicates that students as the potential users have realized the benefits they can get from using “Flash Class” through WeChat for learning English. The mobile mini-lessons can be used to supplement the textbooks for students to learn English.
The influence of effort expectancy on user behavioural intention toward using “Flash Class” through WeChat for students learning English is significant. It shows that students would like to use “Flash Class” because they believe that it is easy and convenient for them to use “Flash Class” through WeChat for learning English.

Social influence has a significant effect on user behavioural intention for students using “Flash Class” through WeChat to learn English. Students will be influenced by their friends, classmates, and teachers who used the “Flash Class” for learning English and were satisfied with its learning effect. Students would accept their acquaintances’ suggestions to use “Flash Class” to learn English.

The influence of hedonic motivation on user behavioural intention toward using “Flash Class” through WeChat for students learning English is significant. Accordingly, students believe that they can better learn English in more interesting forms such as audio, picture, text, and multiple-choice exercises, thus, they would like to use “Flash Class”.

The effect of habit on user behavioural intention toward using “Flash Class” through WeChat for students to learn English is significant. This explains that students would like to learn English anytime, anywhere through WeChat, which helps them to develop a good learning habit of English.

The results of this research explore that gender moderates the effect of effort expectancy on user behavioural intention toward using “Flash Class” through WeChat for students learning English. In order to further explain the differences between males and females, the multi-group analysis (MGA) was used to analyse the samples. Table 4 shows the results of MGA of gender groups. There is a significant difference in effort expectancy (coef. Diff= -0.373, p-value=0.982) between males and females. For the female group, they will incline to use “Flash Class” through WeChat for learning English because it is easy for them to use.

<table>
<thead>
<tr>
<th>Table 4. Males vs Females</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males (n=54)</strong></td>
</tr>
<tr>
<td>EE -&gt; BI</td>
</tr>
<tr>
<td>FC -&gt; BI</td>
</tr>
<tr>
<td>HM -&gt; BI</td>
</tr>
<tr>
<td>HT -&gt; BI</td>
</tr>
<tr>
<td>PE -&gt; BI</td>
</tr>
<tr>
<td>PV -&gt; BI</td>
</tr>
<tr>
<td>SI -&gt; BI</td>
</tr>
</tbody>
</table>

The results show that facilitating conditions and price value insignificantly influence on user behavioural intention. At the present stage, students have a good experience in using WeChat, so they don’t think they will have any problem in using “Flash Class” through WeChat platform to learn English. Moreover, since most of the “Flash Class” English courses through WeChat are free of charge, therefore, there is no significant impact on price value factor.
In conclusion, the results of PLS analysis indicate that PE, EE, SI, HM, and HT have direct effects on user behavioural intention toward using “Flash Class” through WeChat for students learning English and gender moderates the effect of effort expectancy on user behavioural intention. This study also gives several suggestions to the “Flash Class” developers for improving their designs according to the above factors in order to satisfy the learners’ needs.

References
Wine Appreciation Apps: Tools for Mobile Learning and Ubiquitous Learning

Kenneth Shiu-Pong NG 1,*, Ivan Ka-Wai LAI 2, Kwan-Keung NG 3

1,2 Faculty of International Tourism and Management, City University of Macau, Taipa, Macau
3 University of Sunderland in Hong Kong, Hong Kong
1,* kennethng@cityu.edu.mo, 2 ivanlai@cityu.mo, 3 Steven.Ng@sunderland.edu.hk

Abstract. Although Wine Appreciation Apps (WAA) are aimed for wine enthusiasts to understand how to appreciate and enjoy wines, these apps are very useful for university students, who are studying wine courses, to obtain wine knowledge. However, these apps are not popular as supplementary tools for students to study wines. Therefore, this research aims to identify the factors that influence students’ behavioural intention toward using WAA for supplementing their learning in wine courses. The research is based on UTAUT model. According to the conditions of WAA, a new variable ‘flexibility’ is added. In the previous research, system flexibility has been used for web-based training research on the intention of users, defined as to use the web-based systems anytime and anywhere. 200 valid data were collected by questionnaire survey. Data analysis was performed by using PLS. The results of the study indicate that Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, and Flexibility are the factors that influence learners’ behavioural intention toward using WAA. This research has verified the applicability of UTAUT on studying the mobile learning and ubiquitous learning. This study also provides some recommendations for WAA developers to enhance the design of WAA. It provides a new model for studying the mobile learning and ubiquitous learning.

Keywords: UTAUT, flexibility; mobile learning; wine appreciation

1 Introduction

Food and beverage management is one of the popular divisions in the hospitality and tourism education. Many famous institutions are providing short-term training courses and long-term degree programs. For instance, Le Cordon Bleu provides a wide range of Culinary Arts courses from fine-dining to pastry in many locations (Le Cordon Bleu Programs, 2017). And The Hong Kong Polytechnic University designs a 1.5-year Master of Science program in International Wine Management (HKPolyU, 2017). Many of these traditional courses and programs, no matter short-term or long-term, are
face-to-face courses. However, owing to the development of mobile technology, people learn from mobile apps become more and more prevalent. Mobile apps can be used for education in various aspects; one successful area is language learning, according to George Chinnery’s (2006) survey, the language learning mobile apps can be used for vocabulary practice, quiz delivery, online tutoring, video playback, file sharing and so on. And also, when people are using mobile apps to learn, the course contents can be personalized, as the apps can automatically sync the user’s learning status, and allow the lessons to be adjusted based on user’s performance. Furthermore, when the mobile apps provide options for multi-languages, students can choose their native language to study and it is not easy to be achieved in the face-to-face classrooms (Godwin-Jones, 2011).

As of March 2017, there are over 2.8 million apps in Google Play and 2.2 million apps in Apple App Store (Statista, 2017), and some of the categories are popular such as games, business, education, book and so on. Given that the gaining attention and popularity in mobile technologies increases in the education sectors, many studies are suggested and educators are encouraged to involve in designing the educational mobile apps (Hsu et al., 2012). In the hospitality industry, although there are some apps being designed to learn restaurant management or hotel management, they are not popular enough as supplementary tools for students to study; especially apps are limited in the study of wine. Therefore, based on the Unified Theory of Acceptance and Use of Technology (UTAUT) model, this study attempts to examine the factors influencing students’ behavioural intention (BI) toward using wine appreciation apps (WAA) as supplementary tools for studying via Partial Least Squares (PLS) software.

2 Literature Review

2.1 The Unified Theory of Acceptance and Use of Technology

Venkatesh et al. (2003) proposed the UTAUT model that aims to explain user behavioural intentions to use new technology and subsequent usage behaviour. According to this theory, four critical constructs are direct determinants of user behavioural intention. These four constructs are: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC). PE is defined as the degree to which a person believes that using a particular system would enhance his or her job performance; EE is defined as the degree to which a person believes that using a particular system would be free of effort; SI is defined as the degree to which an individual perceives that important others believe he or she should use the new system; and FC are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system (Venkatesh et al., 2003). In the previous research, system flexibility has been used for web-based training research on the intention of users (Alrawashdeh and Al-Mahadeen, 2014). Flexibility of e-learning system was defined as the degree to which an individual believes that he/she can access the system from anywhere at any time (Hsia and Tseng, 2008). Thus, this research includes Flexibility (FL) into the UTAUT to survey if it also has a significant impact on the BI.
2.2 Apps Using in Learning in Hospitality Industry

Given the rapid development of smartphone technology, smartphones and apps are widely used in many areas of learning. For instance, Dickinson et al. (2014) suggested that the app primary functions in tourism industry can be information, two-way sharing, context awareness, internet of things, and tagging. And it enhances the temporal alignment among people, and provides tourists more information, knowledge and awareness before travel, during travel and post travel. One of the reasons why App using becomes more and more prevalent in recent years as it is regarded as a seamless learning, a learning style that the learners can learn in various kinds of environment, and they can switch the way of learning from on to another easily, without limitation of time and space (Wong, 2012). With the technology of mobility, learning apps allow learners to facilitate learning activities out of the classroom and connect and communicate with other peers through the apps. Furthermore, the added equipment on mobiles such as internet connection, embedded camera, GPS receiver and RFID, can also assist on student’s learning (Jeng et al., 2010). However, mobile apps are limited by the small screen size, WIFI environment, battery capacity, computational power and so on (Chen et al., 2008). Therefore, it is crucial to examine how to adapt the knowledge in one area for delivering students in order to achieve the learning outcomes.

In the hospitality industry, mobile learning shows many advantages. Firstly, when scheduling training is a big challenge in hospitality industry due to the job nature, the mobile training can be arranged 24 hours, 7 days and it reduces face-to-face scheduling and coordination. Secondly, employees from different departments with different learning styles can learn from the same mobile app. Third, the update policies or standards can be spread to all of the students quickly after something important changed. Even though there are apparent advantages in mobile learning in hospitality industry, it is still in the process of developing, especially there is no specific research studying the mobile learning in the hospitality industry.

Thus, this research was conducted on one specific mobile application, the Wine appreciation app for mobile learning, where students can use this app to search for information, communicate with peers, and learn some courses. Based on the UTAUT model, this study examines the student’s behavioural intention to use this new technology in learning wine knowledge, in order to testify the factors that influence student’s acceptance and use of the mobile learning technology in the hospitality industry.
3 Research Hypothesis

As aforementioned, UTAUT model that aims to explain user behavioural intentions to use new technology and subsequent usage behaviour; FL is proposed to be the fifth key construct that would contribute any significant impact as similar as the other four constructs (PE, EE, SI, and FC) on university students’ BI (BI) for using WAA for mobile learning. Flexibility refers to the ability to react to a wide range of possible environments with few penalties in terms of time, effort, cost or performance (Sethi and
Sethi, 1990; Upton, 1995). In this study, FL is defined as the degree to which a university student believes that he/she can access the WAA from anywhere at any time for mobile learning. Figure 3 shows the research model. There are FIVE research hypotheses which are listed as follows:

H1: PE has a significant influence on university students’ BI for using WAA as supplementary tools for studying a Wine course.

H2: EE has a significant influence on university students’ BI for using WAA as supplementary tools for studying a Wine course.

H3: SI has a significant influence on university students’ BI for using WAA as supplementary tools for studying a Wine course.

H4: FC has a significant influence on university students’ BI for using WAA as supplementary tools for studying a Wine course.

H5: FL has a significant influence on university students’ BI for using WAA as supplementary tools for studying a Wine course.

Fig. 3. Research Model

Twenty questionnaires have been sent out to qualified respondents for a pilot test; after collecting the respondents’ comments, the questionnaire has been further revised for official research. Total 200 sets of questionnaires have been collected from university students in Macau in September 2017. Total 183 valid data were analysed via PLS software because 17 questionnaires were removed due to invalid responses and/or uncompleted responses.

4 Findings

Referring to the analysis of descriptive information of these 183 responses, 66% of respondents are female students and 72% respondents are Year 4 students; 36% of
respondents are at the age of 21, 21% of respondents are at the age of 18. Questionnaires used a 7-point Likert-type scale. The mean scores of PE, EE, FC, and FL are ranged from 5.40 to 5.70; however, SI has received the lowest scores among these six constructs; specially on SI-2 “Classmates think that I should use WAA to supplementing classroom learning in a Wine course” and SI-3 “People around me think that I should use WAA to supplementing classroom learning in a Wine course”, the mean scores of these questions are 4.99 and 5.03 respectively. The mean and standard deviation scores of these six constructs are shown in Table 1.

The reliability and validity test results are reported in Table 2, the values of Average Variance Extracted (AVE) and Cronbach’s Alpha are more than 0.5 and 0.7 respectively in both BI, EE, FC, FL, PE, and SI; therefore, the results demonstrate that construction of the questionnaires and responses are reliable and acceptable.

### Table 1. Mean and Standard Deviation of measurable items

<table>
<thead>
<tr>
<th></th>
<th>PE 1</th>
<th>PE 2</th>
<th>PE 3</th>
<th>FC 1</th>
<th>FC 2</th>
<th>FC 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEAN</td>
<td>5.396</td>
<td>5.456</td>
<td>5.374</td>
<td>5.231</td>
<td>5.297</td>
<td>5.582</td>
</tr>
<tr>
<td>S.D.</td>
<td>1.057</td>
<td>1.019</td>
<td>1.096</td>
<td>1.201</td>
<td>1.124</td>
<td>1.210</td>
</tr>
<tr>
<td></td>
<td>EE 1</td>
<td>EE 2</td>
<td>EE 3</td>
<td>FL 1</td>
<td>FL 2</td>
<td>FL 3</td>
</tr>
<tr>
<td>MEAN</td>
<td>5.445</td>
<td>5.495</td>
<td>5.577</td>
<td>5.538</td>
<td>5.555</td>
<td>5.764</td>
</tr>
<tr>
<td>S.D.</td>
<td>1.092</td>
<td>1.138</td>
<td>1.096</td>
<td>1.030</td>
<td>1.107</td>
<td>1.002</td>
</tr>
<tr>
<td></td>
<td>SI 1</td>
<td>SI 2</td>
<td>SI 3</td>
<td>BI 1</td>
<td>BI 2</td>
<td>BI 3</td>
</tr>
<tr>
<td>MEAN</td>
<td>5.396</td>
<td>5.033</td>
<td>4.995</td>
<td>5.577</td>
<td>5.621</td>
<td>5.604</td>
</tr>
<tr>
<td>S.D.</td>
<td>1.133</td>
<td>1.181</td>
<td>1.193</td>
<td>1.070</td>
<td>1.061</td>
<td>1.133</td>
</tr>
</tbody>
</table>

### Table 2. Average Variance Extracted (AVE), Composite Reliability, and Cronbach’s Alpha

<table>
<thead>
<tr>
<th></th>
<th>AVE</th>
<th>Composite Reliability</th>
<th>Cronbach’s Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI</td>
<td>0.853</td>
<td>0.945</td>
<td>0.914</td>
</tr>
<tr>
<td>EE</td>
<td>0.769</td>
<td>0.909</td>
<td>0.85</td>
</tr>
<tr>
<td>FC</td>
<td>0.814</td>
<td>0.929</td>
<td>0.886</td>
</tr>
<tr>
<td>FL</td>
<td>0.791</td>
<td>0.919</td>
<td>0.868</td>
</tr>
<tr>
<td>PE</td>
<td>0.786</td>
<td>0.917</td>
<td>0.864</td>
</tr>
<tr>
<td>SI</td>
<td>0.75</td>
<td>0.9</td>
<td>0.833</td>
</tr>
</tbody>
</table>

In addition, regarding the correlation analysis, please refer to the latent variable correlations table in Table 3; the correlation values among these six constructs are all lower than 0.85 which reflect the correlations among these six constructs are reasonable and acceptable.
Table 3. Latent Variable Correlations Analysis

<table>
<thead>
<tr>
<th></th>
<th>BI</th>
<th>EE</th>
<th>FC</th>
<th>FL</th>
<th>PE</th>
<th>SI</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI</td>
<td>0.923</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE</td>
<td>0.517</td>
<td>0.877</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC</td>
<td>0.607</td>
<td>0.491</td>
<td>0.902</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FL</td>
<td>0.688</td>
<td>0.747</td>
<td>0.553</td>
<td>0.889</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE</td>
<td>0.703</td>
<td>0.589</td>
<td>0.62</td>
<td>0.682</td>
<td>0.887</td>
<td></td>
</tr>
<tr>
<td>SI</td>
<td>0.638</td>
<td>0.696</td>
<td>0.616</td>
<td>0.569</td>
<td>0.704</td>
<td>0.866</td>
</tr>
</tbody>
</table>

The bootstrapping analysis in SmartPLS programme with 183 responses to 5000 samples was performed to assess the significance of the path coefficients among these five constructs. According to the PLS-SEM results, the p-values of PE, SI, FC, and FL are less than 0.05. Therefore, H1, H3, H4, and H5 are supported. However, H2 has been neglected as its p-value is over 0.05. Table 4 and Figure 4 show the results of the Partial Least Squares Structural Equation Modelling (PLS-SEM).

Fig. 4. Results of PLS-SEM analysis
Table 4. Results of PLS-SEM analysis

<table>
<thead>
<tr>
<th>FACTOR → BI (Behavioural Intention)</th>
<th>Beta Value</th>
<th>p-Value</th>
<th>Accept/Reject</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: Performance Expectancy → BI</td>
<td>0.266</td>
<td>0.000</td>
<td>Accept</td>
</tr>
<tr>
<td>H2: Effort Expectancy → BI</td>
<td>-0.023</td>
<td>0.739</td>
<td>Reject</td>
</tr>
<tr>
<td>H3: Facilitating Conditions → BI</td>
<td>0.161</td>
<td>0.012</td>
<td>Accept</td>
</tr>
<tr>
<td>H4: Social Influence → BI</td>
<td>0.176</td>
<td>0.004</td>
<td>Accept</td>
</tr>
<tr>
<td>H5: Flexibility → BI</td>
<td>0.333</td>
<td>0.000</td>
<td>Accept</td>
</tr>
</tbody>
</table>

Overall speaking, according to the above reports, Flexibility (FL) has demonstrated as one of the significant influences on university students’ BI toward using WAA in addition to PE, FC, and SI in UTAUT.

5 Discussion and Conclusion

Technology is coming to become a major tool in education nowadays especially in higher education and vocational training that needs not only basic theories in the textbook. Practical knowledge like demonstration of serving food and wine and for many areas, for example, hospitality service training, property management and also kinds of industry related to service can be a more efficient way for people to learn in all ages and nationality as visual reflection is always a common language in the world; thus, by adopting mobile apps which becoming most popular way in daily life usage of communication will also become a major trend for people more willing and easy to learn knowledge and skills.

This research aims to use the UTAUT model via PLS software to analyse university students’ BI for using WAA. The research results generate a body of knowledge on identifying those salient factors which influence the BI of university students toward using WAA; especially in the research it reflects that as mobile phone apps have been introduced for more many years and results shows that EE is not a very important issue when people decided to use apps like WAA. The research results may also facilitate the service industry to identify important factors for attracting more organization to use the mobile apps for improving the flexibility, efficiency and also service quality of staffs in their work.

This research aims to analyse the BI for using the WAA among university students by adopting the UTAUT model. Even though the five research hypotheses are all supported by the research results above, researchers would recommend conducting a broader research to other customer segments, such as hotel restaurant staff, wine lovers, white-collar workers, professions, and elderly groups as these groups are increasing their interest on wines for different reasons. In addition to the university students’ group. Researchers recommend conducting further research to identify factors for motivating the BI of all these customer groups toward using WAA so as to assist the wine industry to promote their wine products by increasing the wine knowledge of potential customers and also the flexibility of purchase. Last but not least researchers would recommend a boarder research on other Apps except in Wine learning and it will contribute in the areas of Apps design for Apps developers.
References


An Android App for Preparation of Hong Kong Driving Test

Wai-Shing HO¹, Jacky C. K. CHAN², Yin Chun PUN², Hiu Fung SO², Jeff K. T. TANG³, Wai-Man PANG³

¹³ School of Computing and Information Sciences, Caritas Institute of Hong Kong, 2 Chui Ling Lane, Tiu Keng Leng, Tseung Kwan O, N. T., Hong Kong SAR, China
² School of Science and Technology, The Open University of Hong Kong, 30 Good Shepherd Street, Ho Man Tin, Kowloon, Hong Kong SAR, China

¹ wsho@cihe.edu.hk, ² {s1130727, s1130729, s1130707}@ouhk.edu.hk, ³ {jtang, wmpang}@cihe.edu.hk

Abstract. Nowadays, nearly everyone has a smart phone, especially our youngsters. How educators use smart phones to help students learn would be an ongoing and important topic. In this paper we would like to share our experience in the development of an Android app for the preparation of driving test in Hong Kong. Many existing apps do help potential drivers to acquire knowledge for the written test. However, none of them exploit the power of smart phones, e.g., using of videos and interactivity, to help users on the road test. Thus, we developed this app so that users can have a one-stop portal for them to prepare Hong Kong driving test. Users can revise and test their knowledge for the written test using a question-and-answer based interface. Moreover, users can our annotated videos or the interactive scenarios to revise how they should handle various situations for the road test. Our app tried to exploit various functionalities of smart phones to help users be better prepared for Hong Kong driving test. Evaluation showed that users were more than satisfied with our interface and recommended our app to their peers.

Keywords: mobile app; driving test; technology in education; interface design
Computer Game-Based Foreign Language Learning: Its Benefits and Limitations

Blanka KLIMOVA \(^1\), Jaroslav KACETL \(^2\)

\(^1\) University of Hradec Kralove, Rokitanskeho 62, Hradec Kralove, Czech Republic
\(^2\) blanka.klimova@uhk.cz, \(^2\) jaroslav.kacetl@uhk.cz

Abstract. At present, young people cannot imagine their life without the use of information and communication technologies (ICT). Therefore it is no wonder that the use of ICT in school education is as normal as the use of textbooks. The purpose of this article is to explore the efficacy of computer games in foreign language learning and highlights its benefits and limitations. The authors conducted a literature review of available studies focused on the research studies in the world’s acknowledged databases Web of Science, Scopus, and Science Direct in the period of 2010-2016. The findings indicate that computer game-based foreign language learning seems to be especially effective in the vocabulary acquisition. They obviously generate many benefits such as exposure to the target language, increased engagement, or enhancement of learners’ involvement in communication. On the contrary, there are certain limitations such as the fact that high interactivity may hinder the vocabulary acquisition and learning, not all games are useful for language learning, or a lack of knowledge about computer games among language teachers and institutions hinders their proper use. Thus, in order to prove the effectiveness of the use of computer game-based foreign language learning, more longitudinal randomized control studies with larger subject samples are needed in this field.

Keywords: games; computers; foreign language learning; review; effectiveness

1 Introduction

Currently, young people cannot imagine their life without the use of information and communication technologies (ICT). For children the use of ICT is as natural as breathing. As Prensky [1] claims, children spend most of their free time interacting with computers and playing computer games. In fact, the average teenager in America spend 1.5 hour on the Internet and 1.5 hour on playing video games. Therefore it is no wonder that the use of ICT in school education is as normal as the use of textbooks. However, it is the pedagogy of the implementation of ICT in the classroom which is important: the how rather than what. [2] And one of the motivational strategies seems to be computer games. As Uzun [3] argues, games can create an environment where education is mostly learner-centred and with a good opportunity for socialization. Klimova [4] extends that game is a natural means for children to understand the world.
around them. Therefore, it should be part and parcel of their learning, including the learning of foreign languages.

Findley [5] explains that game-based learning is used to teach a specific skill or attain a specific learning result. However, it is not clear whether computer games have more positive effects than negative effects on foreign language learning. In fact, research into the use of computer games in education is relatively new, but growing rapidly and a lot of foreign language teachers attempt to introduce these games in their teaching since it may be effective on every age group, particularly on children [6].

The purpose of this article is to explore the efficacy of computer games in foreign language learning and highlights its benefits and limitations.

2 Methods

The authors conducted a literature review of available studies focused on the research studies in the world’s acknowledged databases Web of Science, Scopus, and Science Direct in the period of 2010-2016. In addition, they analyzed and evaluated the findings in order to perform comparison of the finding the research studies detected on the basis of the following keywords: foreign language learning AND computer games, foreign language learning AND videogames.

The study was included if it matched the corresponding period, i.e., from 2010 up to October 2016; if it included young healthy children adults; if the intervention involved the use of a computer game or a videogame; if it focused on the learning of foreign language; and if the study was written in English. The selection period starts with the year of 2010 since several reviews and studies (e.g., [7-8]) were published on this topic before this period.

3 Findings and Discussion

Based on the relevant reviewed studies, the findings [6, 9-12] indicate that computer game-based foreign language learning seems to be especially effective in the vocabulary acquisition. Aghlara and Tamjed [6] in their study with 40 subjects aged 6-7 years reveal that digital games have a positive effect on learning process since the mean score of English vocabulary test in the experimental group was significantly higher. In this study 20 pupils were taught English vocabulary with the help of digital computer game SHAIEX and the other half of pupils in a traditional, face-to-face method. During one week pupils had three 90-minute sessions and this lasted for 45 days.

Furthermore, Smith et al. [12] argues that inference-based computer games result in better learning of new vocabulary than with traditional hardcopy lists of new words. Inferencing, i.e., determining the meaning of a new word from its context, is a key strategy for second- and foreign-language vocabulary learning. Bado and Franklin [13] in their study report that besides the improvement of the EFL vocabulary and knowledge, educational videogames also enhance the development of cooperation, scaffolding, and motivation.
Only one study [14] reported a negative effect of the videogame on the vocabulary acquisition. In this study, 80 randomly-selected Japanese university undergraduates were paired based on similar English language and game proficiencies. One subject played an English-language music video game for 20 minutes while the paired subject watched the game simultaneously on another monitor. The follow-up tests revealed that both the players and the watchers of the video game recalled vocabulary from the game, but the players recalled significantly less vocabulary than the watchers. The authors argue that these results might be caused by the extraneous cognitive load induced by the interactivity of the game. In addition, the players perceived the game and its language to be significantly more difficult than the watchers did. The players also reported difficulty simultaneously attending to gameplay and vocabulary. The fact that high interactivity of games may provide less support for vocabulary learning has been recently confirmed by Yudintseva. [15]

Nevertheless, there are certain problems with using computer games in language classrooms. As it has already been mentioned, there is not much on-going research on game-based foreign language learning and the same applies to evaluations of using these activities in language classrooms. [16]. Moreover, as Ashraf et al. [9] maintain, teachers cannot bring games into the class without having thoroughly planned how to use them. Aghlara and Tamjid [6] warn teachers not to apply digital games for their own sake as they teach students from different backgrounds with various needs and expectations. de Haan et al. [14] add that not all video games are useful for language learning, and they also strongly recommend traditional techniques like pre-teaching vocabulary using drills and dictionary work. Even though playing video games may be a pleasant way to learn vocabulary, it is not the best one to retain vocabulary. [14, 16] Moreover, de Haan [16] emphasizes that effective game-based foreign language teaching and learning is more likely to occur if practical conclusions can be drawn from empirical evidence and adds that language teachers and institutions must know more about computer games to use them effectively.

In fact, teachers face four pedagogical challenges when using computer educational games in their classrooms, which are as follows [17]:

- they have to direct pupils’ attention to the potential of the games and to what has to be learnt in them;
- they have to make learners aware of the relevant contents and their learning accomplishments;
- they have to establish the missing connection between the real world and the simulated game;
- they have to encourage learners to be critical of what has to be learnt while playing the computer game.

There were limitations of the reviewed studies in the sense that these studies involved a small scale samples of subjects and they did not last long. Thus, their effectiveness is slightly questionable. Furthermore, the tests conducted shortly after the interventions generate short-term effects in terms of students’ short-term knowledge retention. [18]

Table 1 below summarizes the main benefits and limitations of the computer games for foreign language learning.
Table 1. Main benefits and limitations of the computer games for foreign language learning

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Limitations</th>
</tr>
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<tbody>
<tr>
<td>exposure to the target language; increased engagement; improvement of language skills, structures and vocabulary in particular;</td>
<td>high interactivity may hinder the vocabulary acquisition and learning;</td>
</tr>
<tr>
<td></td>
<td>low efficacy of studies;</td>
</tr>
<tr>
<td>computer-aided language learning technologies will continue to be developed and may enhance learners' involvement in communication.</td>
<td>a lack of knowledge about computer games among language teachers and institutions hinders their proper use.</td>
</tr>
</tbody>
</table>

Source: Authors’ own processing

Further research in the area of the use of computer game-based foreign language learning should focus on the other aspects (e.g., the development of productive language skills such as speaking and writing, as well as pedagogical methods and techniques) than just the vocabulary acquisition in foreign language learning. In addition, this research should include longitudinal randomized controlled studies.

The limitations of this review study consist in the lack of available research studies on the research issue and different methodologies of the included publications. This might result in the overestimated effects of the findings, which may cause an adverse impact on the validity of these reviewed studies. [19]

4 Conclusion

The use of computer games seems to be an inherent attribute of present foreign language learning. It obviously generates many benefits such as exposure to the target language, increased engagement, or enhancement of learners’ involvement in communication. On the contrary, there are certain limitations such as the fact that high interactivity may hinder the vocabulary acquisition and learning, not all games are useful for language learning, or a lack of knowledge about computer games among language teachers and institutions hinders their proper use. Thus, in order to confirm the efficacy of the use of computer games for foreign language learning, more longitudinal randomized control studies with larger subject samples are needed in this field.
Acknowledgments

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References

Preparing for Examination: an Extended Implementation of a Generator that Uses the Same Questions to Form Tests

Doru Anastasiu POPESCU, Daniel NIJLOVEANU, Nicolae BOLD

1,3 Department of Mathematics and Computer Science, University of Pitești, Pitești, Romania
2 Faculty of Management, Economic Engineering in Agriculture and Rural Development, University of Agronomic Sciences and Veterinary Medicine Bucharest, Slatina Branch, Romania

1 dopopan@yahoo.com, 2 nijloveanu_daniel@yahoo.com
3 bold_nicolae@yahoo.com

Abstract. The preparation for an exam has a multitude of perspectives. Assessment in learning can be made using various methods and techniques. One of the most widespread methods of assessing the progress of learners is the multiple-choice test. In this paper, we present a web implementation of a generator of tests which uses same questions that are stored in a certain form (generally referred as the database of questions), an extension of a previously-presented implementation of the same system. The main difference and the novelty brought to the system is that the questions have a larger number of choices than a standard number chosen by a user, from which will be randomly chosen a fixed number of choices, the correct one(s) being amongst the chosen ones. Also, in order to avoid situations of learning based on the choice letter (a, b, c etc.), the variants will be shuffled every time, their position being changed whether the question is generated once more. One of the characteristics that differentiates it from other test generators is the distinctive environment that was created for, the generator being built for the particular context of the learning used within the studied academic environment.

Keywords: test, random, learning

1 Introduction

Assessment by multiple-choice tests has its advantages and disadvantages. Despite its seeming superficiality, the multiple-choice test is widely-used but not limited to the educational and academic learning environments for its quickness in implementation and easiness in checking correct answers. Multiple-choice tests are also easily implementable electronically, included in web applications or any type of software, being one of the most widespread types of electronic assessment. Nonetheless, the usage of these tests has several drawbacks, the main being the fact that a test of this kind does not show the whole knowledge and the skills that the learner possess. Based

on these facts, multiple-choice tests are a good alternative to other types of assessment when a short and quick examination is made.

This paper extends a theoretical proposition of a system [2] which generates tests with a fixed number of questions that have a chosen number of variants by randomly selecting questions from a database of questions (which may be a proper database, a text file etc., depending on the implementation language). These questions are accompanied in the database by a various number of choices which are chosen in the desired number and generated in a shuffled arrangement, in order for the correct choice(s) to be positioned distinctively at a different runtime.

The main distinctive features of the system are the particular learning style that was the source idea of the generator and the introduction of the multiple choices over the fixed number of showed choices within the assessment process.

2 Literature work

Assessment in learning is a strongly-studied subject in the literature. Assessment is a particular subject in a variated domain of electronic-based learning [9], due to the sensitivity of the subject and the implications in various fields [1]. On-line assessment raises a series of issues related to learning efficiency [6] or defining learning strategies [3].

Multiple-choice tests are widely-used within on-line assessment because their easy transpose to an informatics implementation. Due to this main advantage, various models of multiple-choice e-learning tests were created [2], [5].

The usage of on-line assessment and educational systems has as one of the effects the formation of a learning style based on different principles than the traditional paper-based learning systems [7], [8]. The assessment can be made regardless the spatial or temporal context, with the condition of the existence of a device, usually connected to Internet, and the answer check can be made instantaneously. The massive gather of more actors of learning within such a platform leads to the creation of open learning environments [4], which can have benefices on the educational evolution of the involved parts.

3 Short description and implementation

A short statement of the issue presented in this paper is: given a set of nrq questions qi, i = 1, nrq each question with its nrc number of choices set xj, j = 1, nrc, it is required a multiple-choice test formed of k questions, each question having c choices.

The issue can be easily modeled using number representation and arrangements. Starting from the idea that each question is labeled with a number from 1 to total number of questions from the database and each choice labeled with a number from 1 to total number of choices for a question, the problem is reduced to:

- generating k distinct questions;
for each generated question, the generation of $c$ distinct choices with the requirement of the presence of the correct choice(s) amongst the generated ones;

— the shuffle of the chosen choices at the previous step.

For each question, the form of the generated sequence is $q \ x_1 \ x_2 \ ... \ x_c$, where $q$ is the selected question and $x_i$ is the selected choice. Actually, the subsequence $x_1 \ x_2 \ ... \ x_c$ is an arrangement of the choices set of the question $q$. The obtained sequence is then decodified by outputting the question statement and the textual choices.

In order to show the usefulness of the described system, we have implemented it in a form of a web application, for $c = 3$. This application was used for the training of the senior students for their final degree examination and is built using PHP for programming and MySQL for the database. Figure 1 presents the graphical user interface for a user, while Figure 4 shows the structure of the tables within the database.

![Main panel of the GUI of the web implementation: (1) login-free trial test area; (2) members area](image)

Within the application, the data structures that are used are the next:

— $nrq$ is the number of question in the pool or database of questions;

— $q[nrq]$ is the array of questions that stores all the questions within the database with their characteristics: index, statement, number of choices ($nrc$), correct answer;

— $k$ is the size of the test, that is, the number of questions that must be chosen from all the $nrq$ questions;

— $c$ is the question size, that is, the number of choices that each question must have within the test; $c$ must be larger than the minimum number of choices of all questions ($c \geq \min \{nrc\}$);

— $qs[k]$ is the array that stores the questions that are selected for the current test;

— $vars[c]$ is the array where the chosen choices for a certain question are stored;

— $viz[c]$ is the array that stores whether the selected choice was chosen for output for a certain question; it can be 1 (if the choice was chosen at a given step) or 0 (otherwise).
In the pseudocode, the function \text{rand}(a,b) has the next meaning: it generates a random integer number in the interval comprised between a and b.

The user has basic functionalities, such as generating a trial test and creating an account. The extra functionalities given by the account creation are given by the statistical area and the generation of all questions within the database during a whole session of tests, which assures passing through all the questions.

A part of the function that generates the choices, namely that generates questions with a single correct choice is presented next.

\begin{verbatim}
T ← \text{rand}(1,nrc)
ind_cor ← \text{rand}(1,c) //we choose next a position for the correct choice `index` and we mark it as visited
vars[ind_cor] ← index
viz[index] ← true
for i = 1,c do
  if i = ind_cor then
    viz[ind_cor] ← true
  else
    while viz[T] = true do
      T ← \text{rand}(1,nrc)
      vars[i] ← T
      viz[T] ← true
  endif
endfor
\end{verbatim}

![Fig.2. Trial test window: (a) before solving; (b) after solving](image_url)
The database stores the list of all questions and data related to the user. A structure of the database with its three tables is presented in Figure 4.

The relation between scripts is shown in Figure 5.
The idea itself is quite simple, but the keys of the whole system are the introduction of false-leading choices and the permanent movement of the choices in order to avoid static learning of variants and to encourage logic thinking.

### 4 Results

The overall idea of introducing electronic-based assessment brings an extra motivation for the student, for some basic psychological reasons. The e-based version is usable in any context for learning, being ready at any moment. This is why learning for an examination is enhanced by the easiness in usage and the development of wearables and portable devices (laptops, smartphones etc.).

The system was successfully introduced in the learning process for the final examination for the students in 4th year at the Faculty of Management, Economic Engineering in Agriculture and Rural Development at Slatina Branch. Unfortunately, a study could not be run in order to show the effects of the implementation over student learning enhancement, but students that ran tests on a daily basis had better results at the final exam than the average of all four years results. Some of the feedback of the students that used the system showed some of its advantages:
- quick learning of the theoretical aspects involved in learning
- avoids mechanical learning
- easiness and fastness in usage due to its electronic form
- adaptability to other contexts

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**Fig. 5. Client-server-relation and scripts involved**
5 Conclusions

A system of this type can have beneficial effects on the learning of the students involved. We recommend the usage of multiple-choice tests as a part of the preparation for an examination, due to its particular features in respect to learning. The system is fully updatable, many features can be added in order for the user to interact with other learners and to create a better understanding and integration within the assessment environment and, thus, to create a better experience for the user, because e-based learning is and will remain a debatable topic.

References

The Evolution of Continuing Professional Development in the Accountancy Profession in Hong Kong: Towards an E-learning Mode

Billy Tak-Ming WONG 1, Kam Cheong LI 2, Beryl Yuen-Yee WONG 3, Joseph Shiu-Wing YAU 4

1,2,3 The Open University of Hong Kong, Hong Kong, China
4 Centennial College, Hong Kong, China
1,2,3 {tamiwong, kcli, byywong}@ouhk.edu.hk
4 joseph.yau@centennialcollege.hku.hk

Abstract. Continuing professional development (CPD) is ongoing learning and development in order to keep abreast of the advances and changes in a profession and perform competently. For accountancy professionals, CPD is needed throughout their careers. To cater for their needs in Hong Kong in terms of flexibility in time and place, the e-learning mode has become popular and is the future trend in CPD. This paper reviews the modes of delivery of CPD programmes for the accountancy profession in Hong Kong. It examines the programmes which have adopted diverse ways to support accountants to maintain and enhance their technical knowledge and professional skills. This article analyses the features of e-learning for the CPD programmes. They offer benefits for the participants such as self-controlled learning, self-assessment of understanding, and social learning with the online community of peers and colleagues. However, the e-learning channels may have limitations in supporting high-level training. Based on the results of this study, the future trends in CPD for the accountancy profession are discussed in relation to the potential of the latest advances in technology-enhanced learning.

Keywords: Continuing Professional Development (CPD); Accountancy profession; E-learning

1 Continuing Professional Development for the Accountancy Profession in Hong Kong

Continuing professional development (CPD) is the learning and development that professional accountants need to carry out throughout their careers to keep abreast of advancements and changes in the profession, and to perform their role competently (Association of International Accountants, n.d.). It is a compulsory requirement for the accountancy profession in Hong Kong. As required by the Hong Kong Institute of Certified Public Accountants (HKICPA), every professional accountant has to
complete at least 40 CPD hours per year, within which 20 hours should be verifiable training, such as attending the professional seminars offered by recognised professional accountancy bodies. In developing and offering CPD activities, the professional accountancy bodies are required to comply with the International Accounting Education Standards Board (IAESB) governed by the International Federation of Accountants (IFA), which develops the International Education Standards as the authoritative framework providing guidance for the CPD (Lange, Jackling & Suwardy, 2015). It has been widely contended that the CPD for accountants promotes the formation of high-quality corporate reporting (Kaspina, 2015; Mendoza, 2013; Wahab & Yusof, 2013).

Since it is common that the professional accountants have to work overtime and overseas inside and outside their workplace, many of them in Hong Kong have difficulty in attending the CPD activities in a classroom setting. To help members to fulfil the CPD requirement, the HKICPA and other local professional accountancy bodies in Hong Kong have recognised e-learning as an acceptable mode of CPD training. Furthermore, they have been offering their self-produced programmes or collaborating with the local academic institutions to providing formal CPD education and training opportunities in the e-learning mode.

This paper aims to offer an overview of the developments of CPD for the accountancy profession in Hong Kong. It presents the findings of a survey showing the features of CPD programmes, based on which their future trends towards the e-learning mode are discussed.

2 E-learning in Accounting CPD

Supported by the technological advances, e-learning has been gradually adopted as a popular delivery mode of accountancy CPD. As identified by Ross and Anderson (2013), popular delivery modes of CPD in accounting range from face-to-face seminars and webinars to face-to-face courses, online courses and computerised education. Visual media, interactive software, quizzes, simulation games and collaborative learning have also been promoted in the accounting field (Dimitrios, Labros, Nikolaos, Maria, & Athanasios, 2013; de Lange, Jackling, & Suwardy, 2011). Distance-learning programmes with multimedia materials and bulletin boards have also been used (Basioudis & de Lange, 2009).

The benefits of e-learning for accountancy professionals have been studied and reported. For example, Dimitrios et al. (2013) found that online collaborative learning got students involved in study and helped them to gain an in-depth understanding. Sandras and Walsh (2004) also reported that a web-based delivery system, together with an online discussion group, effectively improved students’ knowledge and skills. Basioudis and de Lange (2009) stated that the interactive feature of e-learning, such as online chat, can stimulate active participation, mental effort and mutual learning, and that students are motivated to learn independently in the online environment.

While technology has been shown to benefit accounting education, there are also challenges and limitations which may hamper its effectiveness. Online professional
learning may be underutilised because of insufficient technology infrastructure and ineffective application (Basioudis & de Lange, 2009; Hare, 2009; Kashora, van der Poll, & van der Poll, 2016). The online interactive elements that have been applied in CPD — such as online discussion groups and interactive videoconferencing — may be less effective than expected because of badly designed online modules, where interaction with peers or instructors can be totally lost (Glogowska, Young, Lockyer, & Moule, 2011; Hare, 2009). Also, Dimitrios et al. (2013) expressed concern about the excessive use of computer programs for teaching as they possibly imply a “coded” way of acquisition rather than a deep understanding of the accounting subject, resulting in “mechanistic” or superficial knowledge. Thus, careful planning is required for electronic and blended learning modes to ensure that online and/or face-to-face components reflect the learning outcomes and are able to meet the learning needs of the professionals (Glogowska et al., 2011).

To cope with the needs of accounting professionals, Hare (2009) and Ross and Anderson (2013) proposed the factors which influence accounting professionals in choosing CPD events, among which accessibility was a major one. Glogowska et al. (2011) showed that an advantage of online delivery is that temporal and spatial obstacles are minimised so that practitioners are more encouraged to take part in CPD activities. Also, de Lange et al. (2011) presented their findings on the effectiveness of CPD resources among accountants in the Asia-Pacific region, covering the accountants’ attitudes and the types, modes and selection of CPD activities. These findings show that both professional accounting bodies and practitioners have become more inclined to adopt e-learning due to its flexibility.

Despite e-learning having been emphasised as a promising means for accounting CPD and its benefits being recognised, the overall adoption of e-learning in accounting CPD in Hong Kong has not been comprehensively studied. This paper addresses this issue through a survey of local accounting CPD programmes.

3 Survey of Accounting CPD Programmes in Hong Kong

3.1 Method

A survey was conducted to examine the accounting CPD programmes offered by local professional bodies, as well as higher education institutions. The CPD programmes were surveyed from the official websites of these professional bodies and institutions, and relevant information was collected. The survey was conducted in September 2017, with a total of 71 programmes. Eight categories of information were collected, including: (1) medium of delivery; (2) delivery mode; (3) type of learning resource; (4) institutions; (5) CPD hours; (6) ways of keeping CPD evidence; (7) mode of payment; and (8) enrolment. The webpages of some programmes did not provide certain categories of information, such as the way to keep CPD evidence. In addition, a programme may provide more than one type of learning resources, such as online courses and reading materials.
3.2 Results

Medium of delivery.
Fig. 1 reports the medium of delivery for the CPD programmes. The internet is the major medium of delivery, with 62% of the programmes delivered online, whereas only 38% were face-to-face.

![Fig. 1. Medium of delivery](image)

Delivery mode.
Fig. 2 presents the mode of delivery, with some of the CPD programmes involving more than one means of learning. For example, online courses may also cover online quizzes, interactive group sessions and online reading. Seminars were a major mode of delivery, among which 29 were live webinars and seven were recorded webinars. Some seminars were held face-to-face, alongside other kinds of events.

![Fig. 2. Mode of delivery](image)

Type of learning resources.
Fig. 3 shows the different types of learning resources. Apart from attending seminars, taking courses was a common form of accounting CPD. Technology is playing an essential role in offering e-resources, electronic books and articles. On the other hand, workshops, forums and conferences, usually conducted face-to-face, were still in use.
Institutions.
Fig. 4 presents the institutions which offered the CPD programmes. Most of the programmes were offered by professional bodies such as the Association of Chartered Certified Accountants (ACCA) Hong Kong and Hong Kong Institute of Certified Public Accountants (HKICPA). Local higher education institutions mainly (co-)organise single events, except the Open University of Hong Kong and City University of Hong Kong which also provided specialised courses.

<table>
<thead>
<tr>
<th>Name of institution</th>
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<tbody>
<tr>
<td>HKU Space</td>
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<td>THEi</td>
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<tr>
<td>MBA &amp; CIMA</td>
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<td>IVE</td>
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<tr>
<td>Hong Kong School of Commerce</td>
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<tr>
<td>Hong Kong Polytechnic University</td>
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<tr>
<td>Open University of Hong Kong</td>
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<tr>
<td>City University of Hong Kong</td>
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<tr>
<td>HKICPA</td>
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<td>ACCA HK</td>
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</table>

1 CIMA: Chartered Institute of Management Accountant;
IVY: Institute of Vocational Education;
MBA: Manchester Business School;
THEi: Technological and Higher Education Institute of Hong Kong
**CPD hours.**

Fig. 5 shows the ways that CPD hours are recognised. A majority of programmes, such as online courses or activities, preassigned a specific number of CPD hours for participants, who are expected to spend the hours on the e-learning platform to complete the programmes. On the other hand, face-to-face activities, such as seminars or workshops, counted the actual attendance time of participants.

![Fig. 5. CPD hours](image)

**Ways of keeping CPD evidence.**

Fig. 6 presents the ways of keeping CPD evidence that is required for participants for audit purposes. Online events naturally keep electronic evidence on the e-learning platform. For face-to-face events, hardcopy certificates were usually distributed to participants after the events.

![Fig. 6. Ways of keeping CPD evidence](image)

**Mode of payment.**

Fig. 7 outlines the mode of payment. Over half of the CPD activities are paid for (e.g. a fee for each CPD hour offered by HKICPA), whereas the others are free of charge for members of professional bodies.

![Fig. 7. Mode of payment](image)
Enrolment.

Fig. 8 presents the application procedure. Most of the events, regardless of whether they were delivered in the face-to-face or online mode, offered online enrolment. However, some face-to-face activities required enrolment by mail or in person; and a few of them had a specific deadline for applications.

4 The Future of CPD of the Accountancy Profession

Technology is recognised as an enabler in accounting CPD. In the ACCA survey conducted in 2016 which covered a broad range of stakeholders in accountancy, 57% of the respondents agreed that many entry level roles in the accountancy profession will be replaced by technology; and 84% believed that accounting and finance professionals can focus on higher value-added activity with the aid of technology (ACCA Survey, 2016; Li, 2017). In addition, reflecting the growing expectations of employers, clients, regulators and other stakeholders for professional accountants, the results also suggested that CPD through various technological means, or e-learning, has become essential in order to equip accountants to face the opportunities and challenges brought by technological advances.

E-learning has become a powerful and influential trend for CPD in the accounting profession. It is recognised that technology will continue to play a determining role in CPD for accountants, though it may not entirely replace conventional teaching methods. Dimitrios et al. (2013) suggested that information and communication technologies should be integrated only when they can adapt to students’ abilities and ambitions, while making the learning process more effective and interesting. Likewise, Rothwell and Herbert (2007) commented that the accountancy profession must realise the importance of CPD for maintaining its credibility. Future CPD has to be less supply-led and more demand-driven, and should take account of individual needs, development goals and priorities.

In addition, Ross and Anderson (2013) mentioned that accessibility is a recurring indicator for choosing CPD activities as accounting practitioners rank the factors of cost and location high in their decisions on participation. Therefore, mobile technology is a viable way to support accessible CPD for learners from different regions. The provision of distance, online and on-demand learning activities can assist accountants in attaining their work/life scheduling needs. As the next generation is likely to possess an increasing comfort level with technology and mobile applications, Ross and Anderson (2013) forecast that newly qualified accountants may prefer online and
distance modalities, and thus more and more CPD providers will offer a wide range of programmes in all modalities. They elaborate that there is potential for the application of mobile technology in live webinars, recorded seminars, and recorded conferences, as well as self-paced computer-aided education. Despite the fact that there are still few courses and programmes fully compatible with mobile devices, the number is going to rise as relevant technologies and users develop.

5 Conclusions

The findings of this study supplement the literature on CPD modalities for accounting professionals. The medium for delivering CPD resources is inclining towards online rather than conventional face-to-face approaches. Nonetheless, though the number of accounting CPD events conducted in the virtual world exceeds that of activities with physical attendance, face-to-face events still comprise a large proportion and are yet to be replaced (Dimitrios et al., 2013).

Regarding the mode of delivery, the results of this study have similarities to, but also differences from, the previous literature. As indicated by Dimitrios et al. (2013), there is a great variety of delivery modes and materials ranging from face-to-face meetings and live webinars to online quizzes and interactive groups. However, the observations from studies such as Głogowska et al. (2011) that suggest blended learning modes were not supported by the results of this study. All of the face-to-face occasions in this survey did not involve any supplementary resources or activities online.

The diverse types of learning resources show a trend towards e-learning — not only did the number of webinars outnumbers that of seminars, but e-resources have also emerged as one of the main types of learning (de Lange et al., 2011). Furthermore, it is worth noting that over half of the accounting CPD programmes facilitate online records and enrolment, which is another sign that CPD in the accountancy profession is heading towards e-learning.

Overall, this paper has presented the major patterns of local CPD practices in the accounting profession. It provides insights into recent delivery modes and teaching materials, and reveals potential areas for further development and exploration. While online tools and practices can hardly replace traditional methods, e-learning can enhance the effectiveness of teaching. In spite of some drawbacks, e-learning is also a prevailing trend as it is convenient and encourages active participation.

Looking ahead, this study suggests further work in investigating this dynamic profession and its new patterns of CPD practices. In light of relevant literature and data, we should keep an eye on the potential future developments in Hong Kong accounting CPD. Further research on the evaluation of human and infrastructure support should be conducted.
Acknowledgement

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References

Learning Analytics in Higher Education Institutions in Asia

Kam Cheong LI 1, Carmen Jiawen YE 2, Billy Tak-Ming WONG 3

1,3 The Open University of Hong Kong, Hong Kong
2 Caritas Institute of Higher Education, Hong Kong

1 kcli@ouhk.edu.hk, 2 cye@cihe.edu.hk, 3 tamiwong@ouhk.edu.hk

Abstract. This paper reports a study on the development of learning analytics in higher education in Asia. Semi-structured interviews were conducted with eight senior managers or senior academics from various tertiary institutions in Asia. The participants were asked about their institutions’ position on learning analytics, the progress in its implementation, factors leading to effective implementation, and challenges encountered, if any. The results showed that in those institutions where learning analytics has been implemented, it aimed mainly at enhancing student retention, pedagogy and student learning experience. Its effective implementation relies on support from senior management, and taking students’ views into account in decision-making. The participants’ institutions encountered difficulties due to teachers’ and students’ concerns, such as the increased workload and data privacy, as well as technical issues in data collection, processing and analysis. In short, though starting late in Asia, learning analytics has been gradually gaining attention and is being implemented. The future directions of research and practices in learning analytics are also discussed.

Keywords: learning analytics; higher education; tertiary institutions; Asia

1 Introduction

Learning analytics (LA) refers to “the measurement, collection, analysis, and reporting of data about learners and their contexts, for the purposes of understanding and optimizing learning and the environments in which it occurs” (Siemens, 2013, p. 1382). Its implementation covers various levels — from the micro- and meso-levels, which target respectively individual learners and the institution as a whole, to the macro-level which focuses on a cross-institutional perspective (Shum, 2012). By bringing together the advances in technological, pedagogical and social development, LA has been regarded as having high potential for enhancing learning and addressing the diverse needs of the stakeholders in higher education institutions (Siemens, 2012).

LA has had an impact on changing educational practices and improving learning experiences. For example, in reviewing the case studies on the implementation of LA between 2008 and 2013, Avella, Kebritchi, Nunn, and Kanai (2016) found that LA was
beneficial to students’ learning behaviours and outcomes, instructors’ performance, curriculum development, personalised learning, and research in the field. Also, Sclater, Peasgood and Mullan (2016) revealed that LA enables higher education institutions to enhance teaching quality and improve student retention, and helps students to take control of their own learning.

Despite the growing popularity of LA in higher education, its development in Asia is relatively slow. The existing work has been mostly done in the USA, Australia, and the UK (Sclater et al., 2016). From a survey of academics’ views on the adoption of LA, Drachsler and Greller (2012) found that the responses from Romance and Latin American countries were rather limited when compared with those from Anglo-Saxon countries. There was even a lack of response from Russia, China and India. One possibility is a general lack of awareness of LA in these countries. According to a survey targeting instructors in higher education institutions in China, Xiong and Chang (2015) found that more than half of the respondents regarded LA as their most unfamiliar teaching technology. In analysing the authorship of the Third Conference on Learning Analytics and Knowledge, Ochoa, Suthers, Verbert and Duval (2014) revealed that, while Europe and North America contributed a total of 134 authors, there was only one from Asia. The notably lower proportion of Asian researchers in this field may have also constrained the development of LA in the region.

This paper seeks to unveil the development of LA in higher education institutions in Asia and explore the future directions in the field. It presents findings from interviewing academics and senior managers from various higher education institutions in China, Japan, India, the Philippines and Malaysia. They shared their views on and experience of LA, covering their institutions’ position, the progress in implementation, factors contributing to the effective implementation, and challenges encountered.

2 Literature Review

Despite a few papers illustrating LA’s overall development across the globe, the existing literature has yet to provide a thorough coverage of the situation in Asia. For example, Sclater et al. (2016) examined the case studies from the USA, the UK and Australia. From the LACE Evidence Hub (LACE, n.d.), which collects and summarises the features of LA cases, these three counties together contributed more than half of the cases in its latest collection.1 Other literature reviews of LA also have not put regional speciality as a focus. For instance, Arroway, Morgan, O’Keefé and Yanosky (2016) covered in general the driving factors, uses, institutional readiness, and strategies to guide LA implementation. Also, Leitner, Khalil and Ebner (2017) analysed more than a hundred papers on LA and identified the research strands, LA techniques, limitations of research studies, and stakeholders.

In contrast, the related literature mainly presents the situation or reports particular projects in some Asian countries. The following summarised examples of the literature for several of these countries.

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1 As of 24 November 2017.
2.1 China

In China, the literature focuses more on the conceptual aspect. Gao and Fu (2016) reported a systematic review of the LA literature in China between 2012 and 2014, and showed that they were mostly concerned with the value of analytical data, the importance of LA in constructing a smart learning environment, and the research and application of LA in the West. Jiang, Zhao, Li and Li (2017) conducted a detailed analysis of LA dashboard applications to examine their potential benefits and limitations. Meng, Gu and Li (2014) categorised different LA tools and compared their functionalities, providing a guideline on the selection of learning tools in learning and teaching. Also, Xiong and Chang (2015) collected instructors’ views on LA and identified the major obstacles that restrained its implementation in Chinese higher education, viz. limited sources of data due to the insufficient popularity of e-learning, the difficulty of developing an analytical model, and the limited level of instructors’ digital literacy.

There is a limited number of case studies presenting the practices of LA in China. For example, Zhang, Wang, Han and Lv (2015) collected and analysed students’ data in a college, such as library records, Internet access, and course performance, in order to improve the effectiveness of a programme. Ma, Han, Yang and Cheng (2014) assessed the role of instructors for students’ engagement in an online learning environment by tracking the weblog data related to the activities of instructors and students in a university.

2.2 South Korea

In South Korea, Jo (2012) developed a dashboard, called the “Learning Analytics for Prediction and Action” (LAPA), which was implemented in a private university with the aims of visualising students’ online learning behaviours, and promoting their development of a smart and personalised learning style. Jo also identified the difficulties of interpreting the visualised LA data, and recognised the importance of LA in providing personalised and timely educational opportunities and feedback to learners on their needs and ability. In addition, Jo, Yu, Lee and Kim (2015) suggested more LA components for tracking the weblog data, and discovered factors which were significant in predicting students’ performance, such as the login frequency and regularity of the learning interval in a learning management system (LMS).

2.3 Japan

In Japan, new LA tools and approaches have been proposed for enhancing learning experience. Ogata, Houb, Li, Uosakic, Mouri and Liu (2014) proposed a system called “System for Capturing and Reusing of Learning Log” (SCROLL), which aimed to help learners to record, recall, and organise their learning logs. Ogata et al. stressed that the system can be further extended to analyse learning content by accumulating data in learning logs, so as to find learning patterns and supply appropriate learning materials in accordance with learners’ habits. Sorour, Goda and Mine (2015) collected comment
data from a course in the Kyushu Institute of Information Science and applied text mining techniques in order to predict the grades of students. By applying latent semantic analysis, they found that students’ comment data was influential in predicting their grade. Ogata et al. (2015) implemented LA based on e-book data in Kyushu University. They tracked and analysed educational big data from the LMS, the e-portfolio system and the e-book system, and found that the time students spent on reading or viewing e-books had a positive effect on their study results.

2.4 India

In the literature focusing on India, Pratheesh and Devi (2015) analysed a collection of students’ opinions and argued for the importance of adopting LA in software engineering education. They discovered that most students preferred a technology-based collaborative learning environment, in which LA would be helpful in detecting learners’ learning styles and preparing learning materials that suited them. Also, Boulanger et al. (2015) carried out an experimental study in the Anna University in India, implementing an LA system called “Smart Causal Analytics on Learning”, which aimed at “collecting learning traces from any learning domain and analysing those learning traces to extract the underlying competency levels in the same learning domain” (p. 291). They found that the classes which adopted this system generally outperformed the others.

2.5 Summary

Overall, the literature regarding LA in Asia has been limited. Case studies reporting practices of LA cover only certain countries, such as South Korea and Japan, and most of them were only at an initial stage. Although this literature review only provides a glimpse of the adoption of LA in individual countries, there is a scarcity of studies showing the situation of LA in Asia, such as the progress, the goals, the success factors and challenges. This study aims to address this limitation by collecting the views and experience of academics and managers in higher education institutions in Asia on the implementation of LA in their respective institutions.

3 Methodology

3.1 Participants

A total of eight senior academics and managers were invited to participate in semi-structured interviews. They came from higher education institutions in a total of five Asian countries — China, India, Japan, Malaysia and the Philippines. They were all Professors or unit heads in their institutions.
3.2 Semi-structured Interviews

The semi-structured interviews were conducted in July 2017, which took about 5 to 20 minutes. Below are the key interview questions. The researcher also asked other follow-up questions according to the interviewees’ responses.

Interview questions

1. Have you heard of learning analytics?
2. Is your institution developing learning analytics?
3. How long has your institution been developing learning analytics?
4. What are the goals of your institution for developing learning analytics? What is expected to be gained from the learning analytics?
5. What is the progress in the development of learning analytics in your institution?
6. What obstacles, if any, have your institution encountered during the development?
7. What are the future plans on the development of learning analytics in your institution?
8. What do you think of learning analytics?

4 Results and Discussion

The results showed that all the participants had heard of LA. Six of them reported that their institutions were developing LA. Most of the other institutions were at the early stage of the development, e.g. less than five years; and some of them are still in the process of planning. In this section, the findings were categorised into the following themes and discussed along with the results of the past research.

1. The development of learning analytics in higher education institutions mainly aims to enhance student retention, better pedagogy, and improve student learning experiences.

The institutions aimed to develop LA to achieve various goals. During the interviews, goals at different levels were mentioned by the participants. At the institutional level, most of the institutions aimed to maximise the student attendance, improve student-teacher interaction, and enhance retention with the use of LA. This finding is consistent with the research done in the UK and US, which shows that one of the drivers for universities implementing LA is to use it as a predictive tool to identify students at risk of attrition so as to increase their continuation on the programme (Arroway et al., 2016). One participant mentioned that his university applied LA in order to discover trends and problems in education that could not be identified by using conventional means. This reflected a positive attitude from the university’s senior management towards investment in LA.

At the teacher level, the participants replied that the application of LA in higher education would offer insights for teachers to improve their teaching. Specifically, it
was expected that LA would help to achieve the goal of facilitating policy-making to improve pedagogy, meet the teachers’ needs, monitor students’ learning progress, and gather student feedback.

At the student level, most participants expected that the use of LA would improve students’ learning experiences, making learning and teaching more meaningful. To sum up, the development of LA was considered to fulfil goals in the areas of university administration, pedagogy, and students’ learning experiences and performance. The most important driver for the senior management for implementing LA was to enhance student retention; and to improve the pedagogy and students’ learning experiences and performance were the main goals of academics.

2. The implementation of learning analytics in higher education institutions needs to listen to students’ voices.

Three participants mentioned that a small working group had been formed for the implementation of, or a pilot study on, LA in their institutions. One of the institutions even provided funds for the preliminary research on this topic. As for the progress, five institutions were planning to collect or had been collecting student data for the LA projects. The main sources of data included student demographic information, the LMS login data, information on enrolment and retention, course performance (e.g. attendance rates, assignments, and exam pass rates), and course evaluation.

3. The difficulties of implementing learning analytics in higher education institutions consist of concerns from teachers and students and technical issues of learning analytics.

The participants identified several difficulties in implementing LA in their institutions. In some institutions, the academics hate changes and so it was difficult to get them on board. In addition, they were not happy that some information is shared with students through student dashboard, which may increase their workload. Similar concerns have been found in other studies. For example, Howell, Roberts, Seaman and Gibson (2017) found that academics were uncertain about the responsibility they should bear after releasing the findings of LA to students. The follow-up efforts to help the students deal with the negative reports based on LA analyses may have had a significant impact on their workload. To solve this problem, clear responsibility, instructions, and procedures should be provided to the teachers to facilitate their follow-up with the students. It is preferable that an intervention unit to offer necessary and timely assistance and consultancy to students be set up to reduce the workload of the teaching staff. One of the participants mentioned this mechanism in her university which has been functioning effectively and has provided considerable help to students in need.

The participants mentioned that some of the students do not like the idea that the university can track their digital footprints and they are concerned about the issue of data protection and privacy. However, most of the participants indicated that their students were informed that their personal data and data generated from their study in the university would be collected and used for analysis and report purposes once they
were admitted to a programme. The practices of the interviewees’ institutions showed that there may not be an option for students to opt out of data collection for LA. The need for informed consent and the option of opting out should be provided in the universities in the planning of LA (Slade & Prinsloo, 2015).

In some of the institutions, LA is a new field to be explored. Some participants found it difficult and time-consuming to consolidate data from different sources and make an integral use of them. In particular, one mentioned that sometimes there is no clue to identify the useful and important data in the huge dataset. These comments revealed that the data collection for LA needs cooperation from different departments and units within the university, where support and coordination from senior management is considered of great importance. Hiring data analytics specialists to form a specific working group for learning analytics would be a solution to managing the collected data in an efficient way.

4. The senior managers interviewed from most of the institutions provided sufficient support for the development of learning analytics.

Most of the participants expressed that the senior management at their universities have a positive view of LA. Some of them provided administrative support to coordinate the data collection for the LA projects, while others offered research funds for a pilot study on LA. However, in one university in Japan, the participant said that the senior management was sceptical about the effectiveness of LA and did not provide any support for it.

5. Most of the participants possessed a positive attitude towards learning analytics and consider it as an effective tool for higher education.

The participants expressed that research and the application of LA should become one of the foci in tertiary education. More useful predictive models should be discovered and the findings should be used not only for monitoring students, but more importantly for intervention when students at risk are identified. It is hoped that it can help to personalise the students’ learning process and improve their learning experiences and performance.

5 Conclusions

The present study reveals the trends of LA in Asia, which are not adequately addressed in the previous research. It contributes to showing that tertiary institutions in Asia, though starting late, have gradually become aware of the usefulness and importance of LA. In the interviews, two of the eight participants reported that their universities have been using LA for policy-making and student retention. Four of the participants’ institutions have been conducting preliminary research on LA and plan to make use of it in the near future. The other two participants reported that their universities were not in favour of LA or even doubted its effectiveness, and therefore, no support was received from the senior management for its implementation.
In the interviews, no participant mentioned the views of students. It has been pointed out that students’ views have been missing for a long time in the decision-making on LA and attention should be paid to engaging them in such a process (Roberts, Howell, Seaman, & Gibson, 2016). The students should be empowered and enabled to become one of the designers of their own learning experiences so that they can gain control over their own learning. For developing LA in Asian universities, it is therefore recommended that students’ perspectives should be taken into account in decision-making.

The follow-up intervention based on the results of LA may not be welcomed by students. The students at risk may not want to be identified, as the negative feedback from LA may damage their psychological well-being by labelling them and lowering their self-esteem (Howell et al., 2017). Therefore, how to deal properly with the students’ data and provide feedback to them needs a more considerate and informed approach.

Despite the relatively small sample size, the findings of the present study suggest that the development of LA has been slow but is gradually progressing in Asia, and the tertiary institutions in Asia are generally positive towards it. The challenges for the institutions, as raised by the participants in this study, have also been reported and addressed in the relevant literature. It can be expected that LA will gain a more important position on the agenda of higher education development in the continent.

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References


Implementation of a Web-based Course Evaluation in Clinical School – A Pilot Study

Xuan HE

Department of Education, Peking University Third Hospital.
No. 49 North Road, Haidian District, Beijing, China

hexuan_yu@126.com

Abstract. This paper describes the web-based evaluation for obtaining course, instructor assessment data. Previously, the Peking University Third School used overall scores assessment forms that students completed during class at the end of each semester. Low response rates and clinician-educators cannot receive specific feedback from students led to the development of an online platform with new assessment forms. Then our clinical school conducted a pilot study of this process, presents the quantitative and qualitative results of the pilot study, and summarizes the survey that asked students their perceptions regarding paper course evaluation and online course evaluation.

Keywords: assessment, web-based, course evaluation

1 Introduction

Student assessment of courses and instructors is a standard process used in higher education institutions, including clinical schools. In a survey of 79 pharmacy schools, 72 schools indicated they used data from students in their assessment of faculty members’ teaching skills. These data are also used to provide feedback for improvement of instruction as well as help determine merit-based raises and promotion and tenure decisions.

Despite the widespread use of student perception data, a number of potential problems exist with the traditional data collection process. In a survey of deans and faculty at 126 medical schools in the United States, low response rates and inadequate sample sizes were frequently listed as a source of concern, primarily the result of voluntary participation policies. Barnett and Matthews reported concerns on the part of pharmacy faculty about the administration of student assessments occurring at the end of a class period, leaving students little time to give much thought to the assessment instrument. Grussing also reported problems with inadequate time for instrument completion and the lack of representativeness when student participation is low. For team-taught courses, further problems are introduced when too much time passes between the time an individual instructor teaches their portion of the course and when that instructor is assessed by students at the end of the semester.
Similar problems were encountered with the student assessment of courses and instruction at the Peking University Third Hospital of Clinical. The original version of the course assessments was web-based form. Students were asked to give a total score of instructors and courses and their participation was not mandatory. Scores were electronically scanned and returned to faculty instructors and administrators, but with no any formal feedback loop for continuous improvement of the curriculum. This traditional course assessment process proved to be problematic for a number of reasons. A major problem was the low response rates, which generated concern about the quality of the data obtained from the system. In addition, clinician-educators cannot receive specific feedback from students and opportunities for improvement on the part of faculty members were minimized.

In the fall semester of 2016, our clinical school began the design and development of a comprehensive and formal assessment process that is implemented regularly and uniformly across the school, with results documented, analyzed, and disseminated to students and faculty, and ultimately resulting in a continuous quality improvement process.

Reasons for the establishment of the new course evaluation process were as follows:

- faculty members could receive feedback, including comments, that is be practical and convenient to use and useful for clinician-educators in motivating self-improvement;
- students could complete the evaluations as early as possible, especially for those classes in which they only see the instructor(s) for a few weeks;
- students would have time to give more thoughtful comments;
- and the data could be available electronically (for later evaluation as needed).

2 Methods

2.1 Design of the Assessment Forms

The questionnaire items were designed based on the clinical education literature (so that it would be valid), that it should have broad-based support within the institution (so that it would be accepted), and that it should be useful. Therefore, we designed evaluation forms in conjunction with current literature and through collecting qualitative data from a series of interviews with all relevant stake-holders in Peking University Third Hospital.

The first draft of the questionnaire was based on an inventory of effective clinical teaching behaviors, which was based on a model of tailored clinical teaching. This first draft was reviewed and modified by a committee in the department of medicine (the education administrator, the chief resident, and a medical educator). This draft was then modified with feedback with representatives from each of the stakeholder groups (educational administrators, clinician-educators, residents, and medical students) and from the major clinical teaching divisions (medicine, pediatrics, surgery, and gynecology). This iterative process involved asking for opinions about the important
qualities of teaching to identify key items needed for the questionnaire. We invited feedback about the specific questionnaire items on each draft.

When the process of continual modification and refinement reached the “point of redundancy” (i.e., the meetings no longer resulted in new ideas or disagreements), we concluded that consensus had been attained, and we finalized the questionnaire. This iterative process allowed us to gain support from all areas within the institution and helped us inform people of the impending changes in the clinical evaluation process.

Each assessment form was tailored to the course type, but all forms included items about the perceived quality of course objectives, format, materials, instructional methods, examinations or other assessment measures, and course directors (see Appendices 1-2). Each statement on the assessment form was rated using a 5-point Likert scale where 1 = strongly agree, 2 = agree, 3 = neutral, 4 = disagree, and 5 = strongly disagree.

2.2 Online Platform Implementation

In the fall semester of 2016, we conducted a trial of the online assessment in two required courses, one is a didactic course and the other is skills course. The pilot program yielded positive feedback concerning ease of use from students and faculty members in these courses as well as from the administrators responsible for implementing the assessment forms, leading to the decision to implement the online assessment platform in the 2016-2017 academic year for all courses except experiential courses.

Students logged into the system via a pass-word-protected web site and had access only to those courses for which they were registered. “Open” and “close” dates were indicated for each assessment based on course end dates. Open dates allowing access to a course assessment began on the date a course finished. Access to each course assessment was closed 7 days later. During the one-week window when a course assessment was accessible, students logged on to the web site, responded to each item by clicking on their selected responses (1 through 5), and had the opportunity to enter free-text comments. Forms could not be submitted until all items were answered; comments were not required. While a course assessment window was open, students could determine the completion status for that course. Once the assessment window for a course closed, students not completing the course assessment were notified by e-mail that they needed to complete the written assessment form.

The quality of the platform was measured in terms of response rates, subjective perceptions of quality, and analysis of potential biases through mandatory participation. Online response rates were determined for each course and aggregate response rates for didactic courses were determined for the fall semesters.

2.3 Mandatory Participation Policy

To avoid the potential for response bias resulting from student self-selection, we instituted a mandatory participation policy. Although the system kept individual responses anonymous, student input could be tracked to allow identification of students
not submitting completed online assessment forms. This feature allowed us to enforce the mandatory participation policy. Students not completing online assessments were required to complete a written version identical to the online forms. The penalty for not completing the online or written assessments was prohibition from registering for classes the subsequent semester. This policy was reviewed and approved by university legal counsel.

The option of using a reward rather than punishment system to obtain a 100% response rate was discussed by our educational administrators, clinician-educators, residents, and medical students. While a reward system seemed more palatable to them, identifying a reward system that would appeal to all students and faculty members proved difficult. Additionally, a reward system does not provide a mechanism for enforcement of the mandatory participation policy should a student not respond to a particular reward.

3 Results

3.1 Assessment Forms Development

Anecdotal reports from students obtained throughout the semester and during focus group meetings indicated that the online assessment platform was accessible and easy to use. The platform allowed students to complete assessments in a private and unhurried environment. Students and faculty members appreciated the convenience of the online platform especially because it did not interrupt classes and course assessment results were sent to instructors and course directors in a timely manner.

Administratively, the platform proved extremely time consuming. Because all instructors and courses in the first 2 professional years (except experiential courses) were included in the assessment process, more than 800 assessments had to be tracked through the platform reports. Every student who did not complete one or more of the assessments had to be identified, contacted, and provided with printed assessment forms to complete, a process that required additional tracking. A number of issues with the web-based platform that needed to be resolved to improve the process also were identified.

3.2 Response Rates

Online response rates for the individual fall and spring courses ranged from 74% to 100% for all 2 classes (Table 1). Overall responses for courses taught in the spring 2017 semester were higher than for those courses taught in the fall 2016 semester, a trend observed across all 2 years (P1 through P2) of the curriculum.

Online response rates were higher for courses ending at the end of the semester compared with courses ending mid-semester (data not shown). Eight of 9 courses that ended mid-semester had response rates less than 90% (range 73% - 86%). In contrast, of the 31 courses that were completed at the end of semesters, only 4 had response rates below 90% (range: 85% to 89% percent). The mid-versus end-of-semester response rate pattern was observed for both fall 2016 and spring 2017 courses.
Table 1. Fall 2016 and spring 2017 online response rates by course type and class year.

<table>
<thead>
<tr>
<th>Course Type</th>
<th>Class Year</th>
<th>Fall 2016(%)</th>
<th>Spring 2017(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Didactic courses</td>
<td>P1</td>
<td>84</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>P2</td>
<td>92</td>
<td>90</td>
</tr>
<tr>
<td>Professional skills development courses</td>
<td>P1</td>
<td>92</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>P2</td>
<td>94</td>
<td>73</td>
</tr>
</tbody>
</table>

3.3 Response Means

Responses to individual items ranged from 1.4 to 2.6 across all fall 2016 courses, and from 1.4 to 3.4 across all spring 2017 courses (Table 2). For spring 2016 responses in the P1 didactic group, only 1 of 96 items scored a 2.3; the range for the remaining 95 items was 1.5 - 2.0. For spring 2017 responses in the P2 didactic group, 1 course had a range of 2.1 - 3.4; responses for the other 4 courses had a range of 1.6 - 2.5.

Table 2. Range of Student Responses for Course Assessments by Course Type and Class Year*

<table>
<thead>
<tr>
<th>Course Type</th>
<th>Class Year</th>
<th>Fall 2016</th>
<th>Spring 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Didactic courses**</td>
<td>P1</td>
<td>1.5-2.2</td>
<td>1.5-2.3</td>
</tr>
<tr>
<td></td>
<td>P2</td>
<td>1.4-2.0</td>
<td>1.6-3.4</td>
</tr>
<tr>
<td>Professional skills development courses**</td>
<td>P1</td>
<td>1.7-2.2</td>
<td>2.0-2.8</td>
</tr>
<tr>
<td></td>
<td>P2</td>
<td>1.9-2.4</td>
<td>1.6-1.9</td>
</tr>
</tbody>
</table>

* Scale: 1 = strongly agree; 2 = agree; 3 = neutral; 4 = disagree; 5 = strongly disagree.

**Course assessment items presented in Appendices 1 through 4.

4 Discussion

Data are being generated that can be used to improve the delivery of our courses and to better meet the school’s educational objectives. In the process of developing the new evaluation form, faculty throughout the school have been involved in formalizing their educational objectives and making them more apparent to the students. Consistent with the reported ease of use and accessibility of the system, overall online response rates were high, ranging from 74% to 100% for individual courses.

The mandatory participation policy was instituted to eliminate potentially biased results from low response rates. The concern was also raised that the policy might encourage artificially low responses from disgruntled students being forced to complete written assessment forms when they missed deadlines for online participation.

In the few instances where student assessments were not as positive, steps are being taken to determine the cause for the lower ratings. While student perception data alone may not be appropriate to initiate course changes.
5 Conclusions

The online student course and instructor assessment program provides an opportunity to collect data that is more representative of student perceptions, does not interfere with classroom activities, allows students sufficient time to respond appropriately, and provides a mechanism for delivering results to faculty and administrators in a timely manner.

Our clinical school will examine several issues including the following: number of students who opt not to take the evaluations; whether student comments begin to decline in number or decrease in richness of constructive thought; and whether a change in the rate of student complaints occurs in direct response to the number of evaluations they are required to complete on their own time.

Overall, focus groups with students and faculty members involved in goal-oriented conversations can help to promote a process of meaningful, constructive evaluation. Developing a culture of assessment among faculty members and students is crucial for encouraging an atmosphere of openness and willingness to strive together toward improving teaching and learning.

References

Appendix 1. Didactic Course Assessment Instrument

Scale: Strongly Agree, Agree, Neither Agree/Disagree, Disagree, Strongly Disagree

Course objectives . . . .
1. . . . were presented clearly in the course syllabus
2. . . . were explained clearly at the beginning of the course
3. . . . were directly related to lectures or other instructional activities
4. . . . were directly related to graded exercises (exams, assignments, etc.)
5. . . . helped me identify important concepts and principles in the course

Course structure and format . . . .
6. . . . were well organized
7. . . . were described adequately in the course syllabus
8. . . . facilitated my learning in the course

Course texts, handouts, syllabi, etc. . . . .
9. . . . were well organized for use in the course
10. . . . helped me learn the course material

Course content . . . .
11. . . . was organized in a manner that helped me learn
12. . . . was provided in a logical sequence
13. . . . built upon material in previous courses
14. . . . was relevant to the practice of pharmacy or delivery of health care
15. . . . stimulated my interest in the subject
16. . . . helped me learn the course material
17. . . . helped me prepare for graded exercises (exams, quizzes, etc.)

Graded exercises (e.g., assignments, exams, performance assessments, etc.) . . . .
18. . . . helped me learn the course material
19. . . . were consistent with the content or skills taught in the course
20. . . . reflected the time spent on the subject matter presented in the course

Course director(s) . . .
21. . . . clearly informed the students about the manner in which (s)he can be contacted
22. . . . were accessible to students throughout the course as stated in the syllabus
23. . . . addressed student concerns during the course
24. . . . interacted with students in a professional manner

Pace of instruction . . .
25. The pace of instruction in this course was . . . too fast, about right, too slow
Appendix 2. Skills Course Assessment Instrument

Scale: Strongly Agree, Agree, Neither Agree/Disagree

Clarity of purpose:
1. The purpose of this course was clearly explained.
2. The outcomes of this course were clearly explained.

Instructional activities:
3. The instructional activities used in this course (group discussions, hands-on activities, SOAP noting, physical assessment, standardized patients) contributed to my learning about the practice of pharmacy.
4. The activities in this course helped me better comprehend the connection between health sciences and pharmacy practice.
5. Activities in the course were helpful in raising my awareness of professional behavior, attitudes and ethical expectations relevant to pharmacy practice.

Course content:
6. The course content was organized in a manner that helped me learn the course material.
7. The materials necessary for me to complete assigned tasks were made available.
8. This course complemented what I learned in other courses.
9. Work inside and outside of class time was reasonably well balanced.

Student performance:
10. As a result of this course, I am developing the ability to communicate more clearly.
11. As a result of this course, I am developing the ability to solve pharmacy-related problems.
13. Feedback regarding my performance was helpful towards improving future performance.

Course directors:
14. The course directors were accessible as stated in the syllabus.
15. Course directors addressed student concerns during the course.
16. Course directors interacted with students in a professional manner.
17. Comment on whether the course was appropriately challenging.
18. Comment on what topics or skills you consider to be absent from the course and would like to see included.
19. Comment on aspects of the course that the directors should consider revising or eliminating.
20. Comment on the sequence of activities in the course.
Using Tablet Computers in Robot Class Promotes Formative Assessment: An Experience from A Primary School in Beijing

Sijie MA¹, Hui REN²

¹Graduate School of Education, Peking University
No. 5 Yiheyuan Road, Haidian District, Beijing, China
²Elementary School of Peking University
YanDongYuan, Peking University, Haidian District, Beijing, China

¹masijie@pku.edu.cn, ²renhui77@163.com

Abstract. With the development of education informatization, tablet computers are popularized in primary and secondary schools. Since there are many ways to use tablet computers for teaching and learning, researchers have studied the application of tablet computers in all disciplines and the effectiveness. This study was based on classroom observations and an interview with an information and technology teacher in order to see how tablet computers were actually used in class. The teacher shared her teaching experience from a primary school in Beijing. The school has introduced iPad and LEGO® Education WeDo 2.0 Core Set with its software into fourth-grade robot classes for more than one year. A group of three or four students share an iPad and the LEGO set during the class. With the software on iPad, they can record their learning process by multimedia, including texts, pictures, photos and videos. The inquiry activities of problem discovering and solving are recorded. Besides, experiences of trying or failing are required to be mentioned for reflection. Students also use tablet computers to share and present their learning outcomes to the class. As for teachers, they help students to record their learning better by questioning techniques. With students’ records, teachers would have a more comprehensive understanding of their learning progress. In this way, the interviewed teacher thinks that using tablet computers in robot class not only supports collaborative learning, but also promotes students’ formative assessment.

Keywords: tablet computers; robot class; formative assessment; primary school
Personalizing the Blended Learning Experience in Vocational Education

Bo Luen LEE

Hong Kong Institute of Vocational Education

Abstract. Today, most in the education community would agree that information technology is being applied in online learning environment to improve student performance for more effective learning. This study first investigates the impacts of academic self-concept, blended learning approaches and their effect on academic achievement among Hong Kong Chinese tertiary students. The participants were 100 first year full-time Hong Kong Chinese students studying in a postsecondary vocational institution. The results of a post-course survey of these students are used to describe their learning experiences and attitude towards blended learning. It is predicted that some determinants liked academic self-concept and blended learning approaches may have direct effects on students’ academic achievement over the first semester in their first year’s study.

In addition, how personalized blended learning occurred in vocational education would be discussed in the present study. When personalized learning is considered in local vocational educational context, it indicates student-centered learning approach designed to help all students including good or poor performers in HKDSE that will prepare them for a career after their graduation in vocational education programs.

Finally, it helped to understand whether personalized blended learning could contribute to student performance in vocational education. By observing the same group of 100 fresh first year full-time students’ study behavior on business courses, it may help to explore the key issues that impact students, teachers and schools on personalized blended learning. In short, what is the most effective personalized blended learning design in vocational education? This study would suggest some critical components for personalized blended learning and ways for both face-to-face and modern instructional design to back it up.

Keywords: Academic self-concept; Blended learning approaches; Personalized learning; Students’ learning experiences; Vocational education
A Study in Introducing Adolescent Students to Simple Programming Skills using an Online Games Editor

Theodor WYELD 1,*, Minoru NAKAYAM 2

1 Flinders University, Australia
2 Tokyo Institute of Technology, Japan

* theodor.wyeld@flinders.edu.au

Abstract. There is a movement in early childhood education towards teaching children how to code. Learning to code in early education is not a new idea. It has been promoted in the curriculum at various times since the 1980s. It is only very recently, however, that the need to know how to code has become critical. In particular, university-age students feel the need to know how to code to achieve their goals of employment after graduation. Many have not had the benefit of learning to code from an early age. But, post-graduation jobs increasingly require some understanding of how programs work and developed. This has accelerated since the rise of technology hubs around the world, such as Silicon Valley in the USA. Since the early 2000s there has been an increasing demand for graduation students with coding skills. Graduating students have attempted to meet this demand by teaching themselves some rudimentary coding skills, such as what is needed for web apps. But, many report that they struggle to get past the basics. While they may understand some of the core concepts, they find it difficult to put them into practice and are unable to write their own programs from scratch. On the other hand, employers need programmers or project managers that understand problem solving and how to translate solutions into code. Hence, graduating students need to focus also on this aspect rather than just which language to learn. Indeed, languages fall into and out of favour depending on shifts in technology over time. Therefore, understanding code structure may be more important than a deep knowledge of code syntax. HTML and JavaScript are often promoted as a good place for the late learner to start. They are logical, easy to learn, dynamic languages that sit on top of a main language. They are also often cited in ads for jobs in the technology industry. As such, this project used HTML and JavaScript to introduce students to the core structure of coding. It used the approach that learning to code should be both fun and leverage existing interests. An online 2D mobile games editor was developed for groups of students to learn how to build a small app for their mobile device. In so doing, they were interacting directly with the code base and creating solutions to problems. Groups evaluated each other’s games for playability and functionality. This shifted the focus from code learning to outcomes. In the process, their anxieties about learning to code were somewhat relieved. This is evidenced by their responses to a before and after survey. The surveys show a shift in sentiment from a fear of coding to a better understanding of the potential of coding to produce creative outcomes. However, despite the shift in sentiment
across the project, there was still too much reliance on external help – students were not able to initiate programming without some assistance. This suggests, along with the method described in this paper, other methods should also be explored.

Keywords: learning to code, learning to program, code anxiety, online editor

1 Introduction

Coding is already being promoted as a way to encourage children to think about computing as another creative outlet. Their socialising on digital networks demands some fundamental understanding of the technology, how it works, and even how to produce for it. Their enthusiasm for creating digital media to share is only matched by the communities that support the activity. They modify, create, design, illustrate, animate and tell stories using digital media. This is extended into programmable toys, robots and other devices (Kafai & Burke, 2016). But, this explosion in programming activity at an early age has found their older siblings – between 18 and 25 – playing catch-up. It is this later group that are now at university age and know that the sort of jobs available after graduation increasingly require some understanding of programming; either coding or project managing. Their anxiety about gaining the requisite skills is real, yet largely ignored in curricular outside the traditional computer science courses. This paper discusses a project which attempts to address this deficit by introducing students to coding in a non-threatening albeit realistic development environment. It exposes students to some simple coding logic which is focused on creative outcomes rather than learning a coding language. It found that, by providing students with some pre-formed code which works and can be easily edited to personalise the results, students took ownership of the process and largely overcame their prior fear of coding. While this is only one method of introducing students to coding, the need to provide for an authentic environment whereby students could hold an expectation of succeeding was paramount to its success.

1.1 The need to learn to code

The idea that children should be learning how to code from an early age is not new. Since the time of accessible computing in the late 1970s and early 80s Papert (1980) was advocating its role in the curriculum. Papert (1980) saw computer systems as a new medium for learning. He saw it as a shift away from passive knowledge acquisition to actively promoting individual creativity. The computer provided a logical environment for exploring creativity at a new level. His work with Piaget (see Ackermann, 2001) exposed him to different ways of approaching how children learn. Papert (1980) felt a need to shift education from instruction to natural-inquiry; children should be free to construct their own knowledge. His Logo programming language was designed to compliment a child’s egocentric position and movement by developing their nascent theories about geometry. He was not simply suggesting that children should learn coding as another language. Rather, he saw computer programming as a way to
restructure maths and grammar such that it accommodates the child’s natural tendencies to learn as a creative pursuit. Learning to code is in this sense not an end in itself but a means to explore the role of computing in modern society. He subscribed to the constructionist philosophy that computers are merely an epistemological tool to inspire and express creative ideas. He claims, like Minsky (1988) proposes, the computer’s ability to simulate reality, and processes outside of reality, mirrors human thought processes – it provides insights into our own ways of thinking and changes them in the process. Although many schools attempted to incorporate at least some of Papert’s ideas, few persisted. It is only recently that there has been renewed push for coding to be added to the curriculum in early education. However, there is a growing cohort of university-aged students who need to know how to code as a pre-condition of employment post-graduation.

1.2 The rise of the need to code

The rise of high-tech innovation hubs in places like Silicon Valley, Bangalore, Shenzen (Startup Warehouse), Dublin (Silicon Docks), Tokyo, Taipei, Seoul, has led to a shortage of coders after the early 2000s. The growth in demand for coders was more than 30% between 2007 and 2012, and is predicted to grow at 22% between 2012-2022. Most recently a group has formed called the ‘learn to code’ movement (see code.org). They are pushing for coding to be taught in schools. They have support from a wide variety of high-profile advocates such as the mayor of NY, Michael Bloomberg, Microsoft founder Bill Gates, Facebook founder Mark Zuckerberg, and President Obama pushing for legislation to include computer science in every public-school curriculum.

The rise in the perceived need to learn how to code is based on the success of entrepreneurs such as Elon Musk and Mark Zuckerberg. They are often cited as extraordinary success stories that others should try to emulate. But, some argue coding is not the new literacy – coding is simply the extension of existing skills in a new framework (Farag, 2016). The framework is one usually reserved for those who work in it directly. But, increasingly, everything we interact with has some code base. And, knowing how to code helps us understand how it works. But, just like you don’t need to know how a car works to drive it, it does help if you know something about how cars work if you have any chance of understanding how to fix it if it breaks down. In this sense, knowing how code works also helps you know what questions to ask when directing others to do the coding for you.

1.3 How graduating students are teaching themselves code

Many graduates are coming to the realisation that in order to secure employment they need to know how to code. Some learn bootstrap (a front end responsive framework for building websites – WordPress was built on it). CSS is another place they start learning how front-end code affects websites. Websites in general are a good place to start to learn coding as it is more about layout and structure than functionality per se. Other packages include: SQL, JavaScript, Ruby on Rails, HTML, Sass, Stylus, Meteor (a full
stack JavaScript framework). For example, many of the blogs, news sites and eCommerce sites that the current crop access are web apps. Content Management Systems (CMS) like Wordpress and Magento (which does eCommerce) make it easy to edit and build these sorts of web apps. However, the limits of a CMS are quickly reached. More advanced design or technical features require a more advanced understanding of the underlying code. JavaScript is a common method for adding the functionality.

### 1.4 Getting past the basics

The most common difficulty for beginners is getting past the basics. They may have learned some code but don’t really know how to go about building their own programs from scratch. They might understand the theory but can’t put it into code. They understand some core concepts but are not sure about where and when to use them. They don’t know how to combine the various core concepts such as loops, arrays and variables. They feel lost after completing the basics. This can be caused by a number of factors. Often the learning environment is not the same as the actual developing environment. Hence, getting started in a real environment helps facilitate some self-guidance. The learning environment is often supported with lots of hints and technical advice. But, when it comes time to develop the code from scratch, none of that is there. Knowing the correct syntax does not guarantee they understand the underlying concepts. Too much help makes the programming look artificially easy. When students are left to do their own coding they may find they don’t have a deep understanding of how to construct it.

Whether working from an IDE (Integrated Development Environment - compiler) or the command line, a real coding environment is more conducive to deep learning than simply writing pseudo code. It is actually from the debugging and error fixing that learning begins. Copying and pasting other peoples’ code is useful, but only if the student understands what it does and how to fix it when it doesn’t work.

### 1.5 What to focus on

It is not enough to simply know how to code. Many students that have completed a course in coding do not feel they can actually write a program from scratch. They may understand these concepts and syntax but not how to put them together to solve a problem by building an actual program. The learning environment had too much support. When this support is taken away, they feel lost. What matters is knowing what the problem is and how to implement a solution for it using code. The focus here is on solving the problem rather than learning to code per se (Shermer, 2005).

### 1.6 Coding changes a student’s way of thinking.

Coding should be fun. It should let students make things and build things. But it requires a lot of patience and hours of practice. Coding trains students to think in a certain way – but it is very narrow. Coding should not be seen as a goal in itself. It should instead
be seen as a tool for solving problems. Students are more likely to commit to learning to code if they have a problem they want to solve than learning to code for its own sake. But, while students can learn to code quickly, this doesn’t make them a coder or engineer – it generally takes about 10 years to ever become expert in anything. However, even knowing the rudimentary basics of coding gives students a headstart in a world that relies on coding. It also means students can engage with fully-qualified programmers, and they will believe you know what you are talking about. In some ways, it’s more important to know how coders think than actually being a coder.

1.7 Which languages in greatest demand?

The highest salaries paid (usually linked to demand for knowledge of a particular language or shortage of those with that language) to coders by language can be ranked as: ‘Ruby on Rails’, Python, C++, iOS, JavaScript, Java, C, PHP and SQL. But, one needs to be able to switch languages as the demand changes. And, one needs to know several languages. For example, even though Ruby and Python might appear to be the highest paying positions, most job ads list C, SQL and Java as also necessary. In fact, Ruby is not listed as often, meaning that, while Ruby may be highly paid, there are not many positions when compared to raw C. JavaScript and Python are often also listed (see figure 1). This is the case for established firms. For start-ups, the story is different.

![Fig. 1. Distribution of code languages as advertised between 2014 and 2017 (codementor, ??).](image)

While ‘Ruby on Rails’ was the favoured language in 2015, in 2017 it tends to be JavaScript, Python and Java. These are easy to learn languages that can be used to produce prototypes quickly (see figure 2).
Fig. 2. Distribution of coder language preferences in startups for 2017 (codementor, ??).

In order to get ready for post-graduation industry, beginner learners need to know how to use repository/version control resources like GitHub. There they can post their projects and see what others are doing and share code. Employers often look at a potential employees history of programming activity. GitHub is one of the places they expect to find this history. Between StackOverflow and GitHub there are many resources for beginning learners.

1.8 The future of languages

The question of what language to learn now presents a dilemma. Languages fall into and out of favour depending on support and the sorts of apps needing to be developed. The shift from workstations in the 80s, to internet in the 90s, and mobile devices since the 2000s, has seen a lot of change in which languages are used. For example, now that JavaScript can be used for back-end development, and because it is relatively easy to learn, it is becoming increasingly popular. And, because some of the biggest sites were built in ‘Ruby on Rails’ (which is also easy to learn), they continue to need developers to maintain them (such as Airbnb, Twitch, Hulu and so on). However, Node.js is starting to take over from Rails, just as Rails took over from Python’s Django, and so more growth in JavaScript is expected. By contrast, Python is the preferred language for educators and scientists. Hence, there will be continued growth in this language. It is an easy to learn and flexible language so it has wide appeal. As Android has captured such a large proportion of the market, the demand for Java programmers has increased. Java is scalable, stable and has such an enormous collection of feature libraries that almost anything can be developed in it. It is also relatively easy to learn compared to C++. Therefore, Java will continue to grow over the years. On the other hand, where
Objective-C was once the preferred developer environment for iOS, Swift has now largely taken over. Nonetheless, Objective-C and Swift are very similar, therefore, knowing how to code in both is an advantage. C is a low-level (machine code) language. As such it is vital for programming at the operating system level. This is quite difficult to understand programming conceptually and practically. Hence, there are few developers in this domain. It also means there are high-paid jobs to be had. But, demand can vary across the years, so it is important to be proficient in more than one language. An example of a language which fell out of favour only to come back is SQL. Other RDMS languages took over from SQL for a while on large database platforms, such as Hadoop, Spark and Cassandra. But, as the database grew even larger, the non-SQL query languages used started to underperform. As such, SQL has made a come-back. Google’s BigQuery now uses SQL. Spark also uses an SQL module for some of its products (ClustrixDB, DeepSQL, MemSQL, and VoltDB). SQL is important for managing and analysing big data. It is also an easy scripting language to learn. It is important to know how to leverage the access to big databases that SQL affords for front-end apps such as data-driven websites. Although C++ is much harder to learn than some of the high-level languages, its power and functionality make it a very important language in high demand. Along with C++, C# is another popular language. In particular, it is used in the gaming industry (Unity 3D). Once learned, it seems to generate its own following; that is, developers are loyal to developing everything they can in it. This means it is well supported by developer communities, but one has to be careful that they do not lose sight of the need to know other languages also.

2 The project

From the literature on how best to facilitate learning to program, it is important to set up an authentic developer environment with a ‘real’ project which both challenges students but also sets achievable goals. As such, this project uses a 2D online games environment. Teams of students begin by accessing some preformed, working, code. They can then customize the game to suit their creative imaginations. The games are evaluated by other teams to satisfy broad appeal rather than hedonistic pursuits alone.

From the literature it seems text-based programs are a good place to start. But they are often not very interesting. By introducing students to something familiar and fun – 2D games – they can push themselves and it holds their interest. Working with a GUI (Graphical User Interface – buttons, panels, sliders and so on) leverages the fact that many common programs implement GUIs. However, GUIs are not always implemented in the same ways. Some use object-oriented programming, others call to the native graphics of the operating system. With the games editor used in this project, some standard buttons and graphic elements as buttons demonstrates at least 2 different approaches to the same problem. By integrating HTML into the JavaScript this also showed how they can be integrated. JavaScript is used to generate HTML code. But, because JavaScript and HTML syntax is often similar it is easy to get confused – especially for where to put quotes as text wrappers etc. Hence, this project included both challenging elements and common solutions. Students started with some
fully developed and functional code. Simply changing the variables and seeing what effect they had helped them understand how they function in the overall code.

2.1 Justification for using a 2D online games editor

From the literature we can identify some core competencies that the current cohort of students need and how to achieve them. The learning activity needs to be:

1. a fun activity;
2. an authentic experience – in a realistic developer environment;
3. able to help them overcome their anxiety about coding;
4. about working with pre-formed working code;
5. integrated with their existing everyday activities, such as game play;
6. about focusing on problem solving, not coding per se; and,
7. in a language that is in high demand yet easy to learn.

Structuring learning activities as enjoyable exercises leads to deeper learning outcomes (???). By making the learning task enjoyable, students are more likely to engage and complete all the requirements (???). Building a small 2D game on a mobile device is the sort of activity most students enjoy doing.

Working in teams (4-5 students per team, 4-5 teams per class), students can leverage each other’s strengths whilst making up for deficits in knowledge. The diverse range of skills and backgrounds in a normally distributed student population fosters collaboration and sharing of skills and knowledge. This also parallels the sort of developer environments they are likely to encounter in the industry post-graduation.

Students express their anxiety about code by avoiding it. Presenting them with the raw code up front forces them to confront their fears. Often they simply haven’t had the opportunity to engage in a coding exercise that isn’t intimidating because they find the code largely incomprehensible and it is not clear how it works or what each part does. Starting with some pre-formed code that works straight up means they can experiment with some simple, clearly labeled, variables and see the effect immediately. This is intended to break down their barriers to learning to code.

The pre-formed code is in a rudimentary form that encourages exploration and experimentation. It is graphically primitive. The first task is to substitute the graphics elements with their own images. This allows them to personalise the game and they can take ownership of it.

Most students spend at least some of their day playing games on their mobile devices. It makes sense then that they should want to know how to build their own games. The simple editor used in this project lets them choose from a number of pre-formed games which they can customise and combine to create a version, or entirely different game, from.

Because the code is already pre-formed and the various variables and functions are clearly labelled, they can start to be creative immediately. In the creative pursuit of a personalised game, they need to think through what problems they need to overcome to achieve their goals. In this sense, they don’t need to learn the code in detail – just enough to solve the problems they encounter.
The interface is fully functional and largely self-explanatory. They do not have to learn a new piece of software just to learn how to code. JavaScript and HTML were used. These are in high demand, encountered on a daily basis and easy to learn. The students do no need to complete the project knowing how to code, rather, they simply need to understand the role coding plays in problem solving.

The apps they develop are runnable on multiple platforms: PC, mobile device, tablet and so on. The development environment uses a PC with a mouse and keyboard, but the apps they develop can be run on touch control devices. The code is written in such a way as to accommodate the way different browsers treat code differently. As the variables are clearly labelled they can adjust them to see the effect immediately. The immediacy of the feedback promotes confidence in what they are doing. The editor includes error messaging. It shows the user what the problem is and where in the code it has arisen. This facilities easier problem solving at the code level. The interface is a simple, browser-based, text editor. As such, it avoids the added abstraction of the hidden functions in an IDE. It also means the environment variables, links, dependencies and so on do not need to be set up in advance. This removes much of the potential confusion around programming. The apps they develop include the core features of most graphics type applications – a GUI with buttons, graphics, changes and animation, substitution and methods or functions to activate elements such as moving enemies or scrolling player handlers. For a more detailed overview of the online editor see: Wyeld & Barbuto (2014).

This project was first formed in 2009 using Flash. In 2014 it was recast as HTML4. Although HTML5 was available, at that time not all mobile devices implemented HTML5 fully. In 2018 it will shift to HTML5 and leverage the power of the ‘canvas’ function to open up other possibilities. This shift in code base mirrors the developer world where languages are constantly evolving.

3 The editor

Students logon to the online games editor and choose a game from the four basic games provided (see figure 3). There are also examples of previous group’s projects to inspire them. They can also hack the code of the previous games to implement features in their own.
Once students have chosen a base game to work with they can click through to the underlying code. The code editor is laid out with the few controls needed for version control, saving and adding assets on the left panel, with the raw code on the right panel. All variables and functions include full descriptions in the comment text (see figure 4).

As the game is being edited it can be played on the PC or via the browser on their mobile device. The first task is to find the native screen resolution for their mobile device.
device. It is necessary to edit the canvas width and height variables to match their device. This promotes investigation into the functionality of their own devices as well as a fundamental understanding that customisation also means often it only serves a single device. From here they simply scan the code for interesting terms such as ‘number of enemies’, ‘start speed’, ‘lives’ and so on. With these few variables they can make instant changes to the game which are updated each time they save and play. Within minutes they are modifying a game. These simple acts gets them thinking about what other possibilities there are for the overall game design. They only need to find that part of the code that achieves their goals. But, along the way, they start to pick up the structure – where parts of the code are repeated or referenced, and so on. In this non-threatening, authentic, developer environment, they are taking control of the game and coding without actually realising it. Each significant change to the game is saved as a new version. They are required to have their games evaluated by other groups at each significant change phase using some standard evaluation proformers (see Gamasutra, 2013). This ensures they get feedback from their peers and so meet the greater need of satisfying a common goal – popular adjustments which lead to a game that others are also interested in playing. This further promotes the notion of an authentic developer environment.

4 Tracking the change in sentiment.

A questionnaires was provided for the students before and after the project. This was done in order to track any change in sentiment across the project. It was hoped students would shift from being intimidated and anxious about coding to wanting to know more about how to code. There were 66 respondents in the first questionnaire (18 female, 48 male) and 69 in the second questionnaire (19 female, 50 male) They included second and third year university students at Flinders University, Australia. The degrees they were enrolled in included: IT, Media, Digital Media, and Arts. The questionnaire was conducted in class. The students were enrolled in the topic ‘Interaction Design’. The questionnaires related to their final project in this topic.

4.1 First questionnaire

There were 18 questions in the first questionnaire which included the simple yes/no question: ‘have you ever used any computer game making tools before today?’ and ‘which ones?’ (list them). This was followed by 11 Likert-scale questions (strongly disagree, disagree, neutral, agree, strongly agree) referring to: being intimidated by code; the logic of computer programs; finding the controls of a program; facility with computer programs; ease with most computer programs; a desire to learn to program; programming confidence; level of prior-understanding of programming; confidence with coding; confidence with using a code editor; and, prior experience with building programs. Five open-ended questions completed the survey. They referred to preconceptions about: programming difficulties; what would help; what an editing
interface should support; what could be changed about existing programs; and, anything else to add.

4.2 Results of the first questionnaire

Of the 66 respondents to the first questionnaire, 43 said they had used a game editing tool before, and 23 said they had not. The top 5 most commonly cited game editing tools in order included: Unity (13); Gamemaker (13); 3DGameStudio (12); Unreal Engine (10); and, RPG Maker (5).

The distribution of responses to the 11 Likert-scaled questions included:
1. Most respondents were neutral on the question of being intimidated by code.
2. Most were either neutral or disagreed that existing programs were illogically laid out.
3. More than half agreed they could find the controls they needed on existing programs.
4. More than half agreed they could do most things they needed to with existing programs.
5. Most were neutral about the ease to which they could gain programming knowledge from existing programs.
6. Most agreed they had a desire to learn to program.
7. Respondents were evenly distributed across the question of whether they had the confidence to use a computer program to make their own game.
8. Most were neutral or disagreed that they understood how computer programming works.
9. Respondents were mostly evenly distributed or neutral on whether they had the confidence to make changes to a computer program on their own.
10. Most were neutral or agreed that it should be easy to make a game using an editor.
11. Respondents were evenly distributed on the question of whether or not they had made a computer program prior to this project.

Of the 5 open-ended questions, the top 5 words, terms or phrases cited in response to the question on preconceptions included those about:
1. programming difficulties: learning to code (17); understanding what code does (6); which language to use (6); what tools to use (5); and, knowing which controls to use (4).
2. what aspect of a computer program are the most helpful in overcoming problems related to finding: help (13); example code (8); tutorials (6); tools (4); and, step-by-step guides or instructions (4).
3. how a computer program interface should help them to learn how to program related to the provision of: tutorials (8); step-by-step guidance (8); preformed code examples (7); automatic syntax checking (6); and, basic hints as code is being typed (5).
4. how programs they had used before could be changed to better help understand how it works included: more tutorials (8); more instructions (8); better instructions (6); better program interface (6); and, more detailed help (5).
5. ‘anything else to add’ included: coding is difficult (6); which language to learn? (3); knowing how to program is important (3); there should be more basic programming (3); and, its hard to get experience (2).

It is clear from their responses that, although they expressed some confidence in the programs they had used prior to this project, they did not feel they had enough confidence to create a program from scratch. Also, they were largely dependent on external help – as is expressed in their open-ended questions about where to find help, the need for tutorials, and example code.

4.3 Second questionnaire

There were 17 questions in the second questionnaire, which included the simple yes/no question: ‘did you feel more confident about programming after completing this project?’ and ‘in what ways?’ (list them). This was followed by 10 Likert-scale questions referring to: intimidated by code; logical layout of the games editor; finding the controls of the games editor; facility with the games editor; gaining a better understanding of programming; desire to learn to program; programming confidence; understanding of programming; confidence with coding; confidence with using the code editor; and, ownership of games produced. The five open-ended questions that completed the survey referred to post-conceptions about: programming difficulties; what would help; how the editor could be improved; what could be changed about the editor to better support understanding code; and, anything else to add.

4.4 Results of the second questionnaire

Of the 69 respondents to the second questionnaire, 52 agreed they felt more confident about programming after completing the project, 17 did not. The most commonly cited reason why they felt more confident or not was that they felt they had either improved their programming or coding skills (44).

In relation to the 10 Likert-scaled questions:

1. Most respondents agreed or were neutral that they found programming less intimidating than at the beginning of this project.
2. Most respondents agreed or strongly agreed that the layout of the games editor was logical.
3. Respondents were mostly evenly distributed between neutral and strongly agree that all of the controls for games editor made sense.
4. Respondents were mostly evenly distributed between agree and disagree that they could do everything they wanted to with the games editor.
5. Most respondents agreed that they had gained a better understanding of programming.
6. Most respondents were either neutral or agreed they were confident they could use the editor to make a game on their own.
7. Most respondents agreed that they now understood better how code worked.
8. Most respondents agreed that they were confident making changes to code.
9. Most respondents agreed that they found it easy to make changes to their game using the editor.
10. Most respondents either agreed or were neutral about a sense of ownership of their game.

Of the 5 open-ended questions, the top 5 words, terms or phrases cited in response to the question on post-conceptions included those about:

1. programming difficulties: knowing what code to use (28); understanding JavaScript (11); new to the concept of coding (8); making the game do what they wanted (7); and, adding new code (6).

2. what aspects of the editor were the most helpful in making the game: comments next to code (54); being able to play the game whilst coding (10); version control (7); layout (6); and, uploading images (6).

3. how the editor could be changed to better help game-making: more comments and example code (27); great as it is (6); better error messaging (5); allow easier code changing (5); and, more instructions (5).

4. how the editor could be changed to help better understanding of code: more comments and example code (30); better labeling (5); more tutorials (4); better change indication/highlighting (6); and, more detailed help (4).

5. ‘anything else to add’ included: more example code (8); some tutorials (3); and, a chat function (2).

It is clear from the results of the second questionnaire that more than 75% of respondents felt they were more confident about programming and their coding skills after completing this project. This is despite many of them reporting at least some prior experience with programming. This is consistent with reports that, despite prior programming experience, many students still did not feel confident with self-directed programming tasks.

From the Likert results we see that their sense of intimidation or anxiety about programming had reduced since the beginning of the project. They found the editor logical, logically laid out and easy to use. However, they were still anxious about whether they could do everything they wanted to with the editor. This was despite reporting they had gained a better understanding of programming, how coding worked, making changes to code, and finding it easy to make changes to their game. And yet, they were still hesitant to say they were confident to make their own game, or feeling ownership for what they had produced.

From the open-ended questions we see they were still unclear about what JavaScript code to use and where to use it. This was despite the editor being easy to use, and users could play the game while coding was useful. A consistent theme was the request for more code comments, instructions, tutorials and example code. This is consistent with reports of early learners relying on external help rather than having the confidence to comprehend what code strings to write to achieve their goals.

5 Comparing the first and second questionnaire results

Finding a mean value for a Likert scale is largely redundant. As they values relate to a ranking of agreement to disagreement for a statement they are not evenly weighted. For example, the emotional response between strong disagreement and disagreement may not have the same perceived weighted value as between disagreement and neutral. In
another example, if responses are divided between agreement and disagreement the mean would be neutral which does not reflect the actual sentiment. Therefore, generating a mean value may not be useful. However, finding a median may tell us something about the overall sentiment. In the box-plot charts below each ranked value for each survey question is shown. It is only by comparing chart 1 (see figure 5) with chart 2 (see figure 6) that we can make a broad comparison in sentiment.

Fig. 5. Questionnaire 1 box-plot shows responses were mostly evenly distributed.

Fig. 6. Questionnaire 2 box-plot shows respondents are largely in agreement.

What we notice from these box-plots is that in the first survey participants were more evenly distributed whilst in the second survey they tended to be largely in agreement. Table 1 shows the probability that this comparison is significant. Question 6 from the first survey has been removed – ‘I would like to learn how to program’ – as it does not have a corresponding question in the second survey. All scores appear to be significantly increased between the two surveys except ‘confidence’ (question 7 in the
first survey and question 6 in the second survey). Also, a score for the item ‘easy’ (question 4 in the first and second survey) decreased across the project. Therefore, most participants appear to be positive about the task despite also reporting some difficulties.

Table 1. Statistical analysis of the survey responses shows some correspondences.

<table>
<thead>
<tr>
<th>Qu</th>
<th>Mean</th>
<th>STD Error</th>
<th>Qu</th>
<th>Mean</th>
<th>STD Error</th>
<th>diff</th>
<th>prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>q1</td>
<td>3.34</td>
<td>0.13</td>
<td>q1</td>
<td>3.68</td>
<td>0.09</td>
<td>0.33</td>
<td>p=0.05</td>
</tr>
<tr>
<td>q2</td>
<td>3.45</td>
<td>0.12</td>
<td>q2</td>
<td>4.05</td>
<td>0.09</td>
<td>0.58</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>q3</td>
<td>3.51</td>
<td>0.13</td>
<td>q3</td>
<td>3.85</td>
<td>0.09</td>
<td>0.33</td>
<td>p=0.10</td>
</tr>
<tr>
<td>q4</td>
<td>3.15</td>
<td>0.11</td>
<td>q4</td>
<td>3.9</td>
<td>0.1</td>
<td>-0.74</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>q5</td>
<td>3.04</td>
<td>0.11</td>
<td>q5</td>
<td>3.68</td>
<td>0.1</td>
<td>0.63</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>q6</td>
<td>3.15</td>
<td>0.15</td>
<td>q6</td>
<td>3.38</td>
<td>0.13</td>
<td>0.24</td>
<td>n.s.</td>
</tr>
<tr>
<td>q7</td>
<td>3.04</td>
<td>0.15</td>
<td>q7</td>
<td>3.97</td>
<td>0.09</td>
<td>0.92</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>q8</td>
<td>3.07</td>
<td>0.16</td>
<td>q8</td>
<td>3.92</td>
<td>0.1</td>
<td>0.86</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>q9</td>
<td>3.28</td>
<td>0.13</td>
<td>q9</td>
<td>3.74</td>
<td>0.1</td>
<td>0.47</td>
<td>p&lt;0.01</td>
</tr>
<tr>
<td>q10</td>
<td>2.87</td>
<td>0.19</td>
<td>q10</td>
<td>3.5</td>
<td>0.11</td>
<td>0.64</td>
<td>p&lt;0.01</td>
</tr>
</tbody>
</table>

6 Discussion

From the results of this project we see that this group of students is largely dependent on external help – as is expressed in their open-ended questions about where to find help, the need for tutorials, and example code. However, this is in contradiction with the abundance of these sorts of resources on the internet such as Stackoverflow, Code.org, Code Mentor and so on. Hence, while it is possible to learn the basics of coding from these sources, having access to help, tutorials and example code appears to instead make them dependent on these resources rather than giving them the confidence to embark on their own coding projects unassisted.

The current project was designed to address this. While it provided a lot of learning scaffolding in the form of help, tutorials, and example code it also fostered inter-student interaction. In other words, it did not rely on the resources available to the students to facilitate their code learning, rather it promoted active problem solving with the tools to implement solutions. It did this by forcing groups of students to work together towards a common goal and for other groups to peer-review their game productions. In this manner they were focused on solving specific problems rather than learning code alone. In the process, they overcame some of their anxiety about working with code and how to implement changes, even though they may not have fully understood what the structure of the code was.

7 Conclusion

A follow-up questionnaire was used to capture any shift in sentiment across this project. It required students to reflect on their experience in the project and comment on whether
their attitudes to the same sorts of questions asked in the first questionnaire had changed. Clearly students expressed a change in attitude to coding. They had changed their way of thinking about coding – from a mysterious, scary, unfathomable ‘code’, to empowerment and recognition that success is possible. Hopefully, some of the students will be inspired to practice more coding after this project.

From the first questionnaire we see that many of the participants who took part in this project had used a game editor before. Yet, there was a clear shift in sentiment that code was less intimidating after completing the project. They felt more confident about coding and understanding what code does. However, they still demanded more comments, coding examples, tutorials, and external help. This is symptomatic of the lack of confidence with the underlying principles of coding. For this group of students, their lack of fundamental skills prior to this project prevented them from taking charge of their own learning. They still felt reliant on external help after completing the project. This is despite a clear shift in sentiment in other ways. It remains to be seen whether their younger siblings who are learning to code now will feel the same in the next few decades. By learning the underlying principles of coding at an earlier age they should be less intimated by the complexities of coding later in their education. In the mean time, the current cohort of students needs to overcome their lack of confidence. This project goes some way towards that goal. It provides a format whereby students can experiment with code in a non-threatening environment. However, clearly, their demand for more help is troubling. While this project went someway to alleviating some of this cohort’s anxiety about coding clearly more investigation is warranted. Future projects may investigate whether text-based coding is the most useful format for learning to build apps. Other approaches might include node-based programming. Either way, clearly this is a pressing issue for which a solution is critical if this particular demographic is to achieve its goals of employment post graduation in a world that increasingly demands programming skills.

References

7. Code like a Girl - Providing girls with the tools, knowledge and support https://codelikeagirl.org/
8. Codeacademy www.codeacademy.com/
9. Code.org Leaders and trend-setters all agree on one thing https://code.org/quotes
11. Disrupting Engineering Education www.42.us.org
12. Farag, B., 2016, Please don’t learn to code, TechCrunch, https://techcrunch.com/2016/05/10/please-dont-learn-to-code/
17. Learn, Share, Build - Stack Overflow, https://stackoverflow.com/
22. Peter Norvig, director of research at Google http://norvig.com
26. Silicon Valley Coding School - Learn Coding Online www.svcodingschool.com.au
Effectiveness of Multimedia Annotations on Vocabulary Acquisition: The Technique Feature Analysis on Trial

Di ZOU 1, Fu Lee WANG 2, Reggie KWAN 3, Haoran XIE 1,*

1The Education University of Hong Kong, Hong Kong SAR, China
2Caritas Institute of Higher Education, Hong Kong SAR, China
3The Open University of Hong Kong, Hong Kong SAR, China

* hxie@edu.hk

Abstract. From the perspective of Nation and Webb’s (2011) technique feature analysis, this research examines the effects of multimedia annotations on vocabulary acquisition, comparing it to other frequently employed word learning strategies. One hundred and twenty undergraduate students participated in the study and were randomly assigned to four groups to complete four multimedia-enhanced word learning tasks. The post-test scores showed that the tasks of reading comprehension with pictorial annotations and doing cloze-exercises with textual annotations were similarly effective. It is also found that cloze-exercises with pictorial annotations were similarly effective as sentence-writing with textual annotations. Such results are consistent with the checklist for technique feature analysis, indicating that this framework is reliable in evaluating and predicting task effectiveness. It also shows that the involvement of imaging in an activity is conducive to word learning, more integration of pictorial annotations in language learning materials is therefore suggested.

Keywords: technique feature analysis; word learning, multimedia annotations, imaging

1 Introduction

Over the past decades, there has been a dramatic increase in studies and practices of multimedia learning. With the fast development of computer and mobile assisted language learning, integration of multimedia in word learning activities has been widely popularized (Mohsen & Balakumar, 2011). Given the importance of word knowledge in language learning, there has been an increasing number of studies on effective word learning strategies and factors that facilitate word learning (Zou, Xie, & Wang, 2015; Xie, Zou, Lau, Wang, & Wong, 2016; Xie, Zou, Wang, & Wong, 2017). Being an essential part of word learning in multimodality, multimedia annotations have been widely discussed in relevant literature (Chun, 2006). Multimedia annotations are also often referred to as multimedia glosses; they are defined as short definitions or notes.
which involve various modalities and modes: “text, picture, video, and sound” (Chun & Plass, 1996, p. 183).

1.1 Effectiveness of multimedia annotations

Compared to traditional annotations which are mainly comprised of texts, multimedia annotations are easier to understand and hence better promote learning of target words (Jacobs, Dufon, & Fong, 1994; Chun & Plass, 1996; Nation, 2001; Ko, 2005; Abraham, 2008). This is probably because images are more likely to be remembered than words, so words that are strongly associated with images can be learnt better (Underwood, 1989). Learners also report that multimedia annotations better meet their needs and preferences (Jacobs, Dufon, & Fong, 1994; Plass et al. 1998). Chun and Plass (1996), Al-Seghayer (2001), and Yoshii (2006) explained that multimedia annotations are conducive to retention as they provide learners with multiple access routes to the word and therefore strengthen a deeper memory trace. From the perspective of Schmidt’s (1990) noticing hypothesis, multimedia annotations facilitate word learning in that words with multimedia annotations are better noticed and recognized (Yanguas, 2009). Moreover, educators believe that multimedia annotation make better use of authentic materials (Jacobs, Dufon, & Fong, 1994).

1.2 Technique feature analysis

Nation and Webb (2011) proposed a checklist for technique feature analysis to better predict, evaluate and explain the effectiveness of diverse word-focused tasks. The TFA includes five main categories that are conducive to word learning, including motivation, noticing, retrieval, generation and retention. The category motivation includes three questions asking whether the activity has a clear word learning goal, whether it motivates learning, and whether learners decide what words to learn. The category noticing also includes three questions asking whether the activity focuses attention on target words, raises learners’ awareness of the learning of the words, and induces negotiation of the words’ meanings, forms or use. The four questions in the category retrieval include whether the activity involves retrieval of the word, whether the retrieval is productive and recall, whether there are multiple retrievals, and whether there is spacing between them. The category generation focuses on whether generative use is induced, whether it’s productive, and whether a marked change involving use of other words is entailed. The last category retention checks whether the activity ensures form-meaning linking, involves instantiation and imaging, and avoids interference (Nation & Webb, 2011). To sum up, there are eighteen questions in the checklist.

According to this checklist for technique feature analysis, the effectiveness of a task can be evaluated by checking how many factors in the list are involved in the activity (Nation & Webb, 2011). If the answer to a question is yes, one point is obtained; and if no, zero point is given (see Table 1). For example, the task doing a cloze-exercise with textual annotations has a score of 7 because (1) it involves a clear goal of matching the target words with appropriate contexts; (2) it motivates learning as meaningful contexts with semantic associations are given; (3) learners need to focus on the target words,
understand them and fill them in the blanks; (4) learners are aware of the learning of the target words as the activity focuses on the words; (5) receptive generative use of the target words is induced since learners need to compare different words so as to select those that best suit the given contexts; (6) successful linking of form and meaning is ensured when learners write down the target words in the blanks where the contexts are appropriate; and (7) no inference is involved.

Table 1. The checklist for technique feature analysis
(adopted from Nation & Webb, 2011, p. 7)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motivation</strong></td>
<td></td>
</tr>
<tr>
<td>Is there a clear vocabulary learning goal?</td>
<td>0 1</td>
</tr>
<tr>
<td>Does the activity motivate learning?</td>
<td>0 1</td>
</tr>
<tr>
<td>Do the learners select the words?</td>
<td>0 1</td>
</tr>
<tr>
<td><strong>Noticing</strong></td>
<td></td>
</tr>
<tr>
<td>Does the activity focus attention on the target words?</td>
<td>0 1</td>
</tr>
<tr>
<td>Does the activity raise awareness of new vocabulary learning?</td>
<td>0 1</td>
</tr>
<tr>
<td>Does the activity involve negotiation?</td>
<td>0 1</td>
</tr>
<tr>
<td><strong>Retrieval</strong></td>
<td></td>
</tr>
<tr>
<td>Does the activity involve retrieval of the word?</td>
<td>0 1</td>
</tr>
<tr>
<td>Is it productive retrieval?</td>
<td>0 1</td>
</tr>
<tr>
<td>Is it recall?</td>
<td>0 1</td>
</tr>
<tr>
<td>Are there multiple retrievals of each word?</td>
<td>0 1</td>
</tr>
<tr>
<td>Is there spacing between retrievals?</td>
<td>0 1</td>
</tr>
<tr>
<td><strong>Generation</strong></td>
<td></td>
</tr>
<tr>
<td>Does the activity involve generative use?</td>
<td>0 1</td>
</tr>
<tr>
<td>Is it productive?</td>
<td>0 1</td>
</tr>
<tr>
<td>Is there a marked change that involves the use of other words?</td>
<td>0 1</td>
</tr>
<tr>
<td><strong>Retention</strong></td>
<td></td>
</tr>
<tr>
<td>Does the activity ensure successful linking of form and meaning?</td>
<td>0 1</td>
</tr>
<tr>
<td>Does the activity involve instantiation?</td>
<td>0 1</td>
</tr>
<tr>
<td>Does the activity involve imaging?</td>
<td>0 1</td>
</tr>
<tr>
<td>Does the activity avoid interference?</td>
<td>0 1</td>
</tr>
<tr>
<td><strong>Maximum score</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>18</td>
</tr>
</tbody>
</table>

1.3 Word learning tasks

Among various word learning tasks, three of them are frequently examined by researchers, for example reading comprehension, cloze exercises and sentence-writing, as they are three most commonly practiced word learning activities (Zou, 2016, 2017). Results of previous studies have basically agreed that cloze exercises are more effective than reading comprehension, but less effective than sentence-writing (Kim, 2008; Keating, 2008; Zou, 2012). However, much of the research up to now has been restricted to the investigation of tasks with textual annotations, and little has been conducted to examine the effectiveness of these tasks when multimedia annotations are involved, although multimedia annotations can also be easily integrated in the three activities.
Inferred from the checklist of technique feature analysis, cloze-exercises with textual annotations may be similarly effective as reading comprehension with pictorial annotations as they both induce 7 scores. The difference between them is that cloze-exercises involves generative use, while reading comprehension does not; and reading comprehension with pictorial annotations involves imaging, but cloze-exercises with textual annotations does not (see Table 2).

Also, the task cloze-exercises with pictorial annotations may be similarly effective as sentence-writing with textual annotations as they both have 8 scores according to the checklist for technique feature analysis. The difference between them is that cloze-exercises with pictorial annotations involve imaging, while sentence-writing with textual annotations does not; and sentence-writing involves productive generative use, but cloze-exercises does not.

<table>
<thead>
<tr>
<th>Task 1: Reading comprehension with pictorial annotations</th>
<th>Generative use</th>
<th>Productive generative use</th>
<th>Imaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task 2: Cloze-exercises with textual annotations</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Task 3: Cloze-exercises with pictorial annotations</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Task 4: Sentence-writing with textual annotations</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

2 Method

One hundred and twenty non-English-major freshmen aged between 18 and 21 participated in the study. Their English proficiency levels were intermediate. These participants were asked to complete one of the four tasks randomly. To measure the effectiveness of these tasks, thirty participants from each group (see Table 3) were tested immediately after task completion and unexpectedly one week later. The two posttests were the same; the participants were asked to provide English synonyms or definitions of the target words and generate original sentences using them. The same procedure of Zou’s (2016) study was applied in this project.

2.1 Tasks

Task 1 provides the participants with a reading text and a list of ten target words with pictorial annotations. Task 2 provides the participants with the same reading text, but the ten target words were replaced by ten blanks, and the annotations for the target words were textual; the participants were asked to fill in the blanks with the most appropriate words. Task 3 also asked the participants to do cloze-exercises, but pictorial annotations were provided in this task. Task 4 provided the participants with textual
annotations and asked them to write sentences using the target words. The ten target words were *burglarize, dash, grin, inflammation, rake, scribble, shatter, shiver, tumble, and wrath*. They are all tangible to the senses and can be easily imagined.

An excerpt of the reading text is shown as follows:

“I have a test tomorrow. I need to read two chapters, but the pain caused by the inflammation of my neck makes it difficult to concentrate on the text. I can’t pass the test. What do I do? Shall I keep studying? Can I take the test some other time? Shall I give up?”

### 2.2 Pretest and posttests

A pretest was conducted to measure the participants’ initial knowledge of the target words. The format of the pretest is very simple; the participants were asked to indicate whether they knew the meanings of the target words before. The results showed that these participants had zero pre-knowledge of the words.

A modified version of Paribakht and Wesche’s (1997) vocabulary knowledge scale (see Table 3) was used in the posttests to measure the participants’ learning of the target words. This testing tool was used as the participants’ initial development of word knowledge was the focus of this research (Zou, Xie, Wang, & Wong, 2017; Zou, Xie, Wong, Wang, Kwan, & Chan, 2017; Xie et al., 2016; Zou, Wang, Xie, Wong, & Kwan, 2017). One posttest was conducted immediately after the participants completed the assigned tasks to measure their initial learning of the target words; and a delayed posttest was conducted one week after the experiment to evaluate the participants’ retention of the target words.

<table>
<thead>
<tr>
<th>Table 3. Modified vocabulary knowledge scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I feel I have learnt this word before, but I do not know what it means.</td>
</tr>
<tr>
<td>2. I think the word means ______.</td>
</tr>
<tr>
<td>3. I know this word means ______.</td>
</tr>
<tr>
<td>4. I do not know how to use this word in a sentence.</td>
</tr>
<tr>
<td>5. I can use this word in a sentence: ______________.</td>
</tr>
</tbody>
</table>

After marking the participants’ answers to this modified vocabulary knowledge scale, the scores were entered into SPSS. One-way ANOVA tests were run to check whether statistical significance existed among the four groups of participants’ immediate and delayed posttest scores.

### 3 Results

The participants who did the tasks of reading comprehension with pictorial annotations and doing cloze-exercises with textual annotations had similar posttest scores. The immediate posttest scores of the participants who did these two tasks were respectively 6.16 and 6.32; and the delayed posttest scores were respectively 4.07 and 4.18. Cloze-exercises with pictorial annotations were similarly effective as sentence-writing with
textual annotations. The immediate and delayed posttest scores of the cloze-exercises were 7.68 and 7.85, and those of the sentence-writing were 5.49 and 5.52. Results of the ANOVA tests also showed that these four tasks can be grouped into two homogenous subsets.

Such results are consistent with the checklist for technique feature analysis, as the TFA scores of task 3 and 4 are the same, and those of task 1 and 2 are the same. Also the scores of task 3 and 4 are higher than those of task 1 and 2. It therefore provides supporting evidence for the checklist for technique feature analysis, indicating that this framework is reliable in evaluating and predicting task effectiveness. Moreover, it shows that the involvement of imaging in an activity is conducive to word learning, as cloze-exercises with pictorial annotations were more effective than cloze-exercises with textual annotations.

4 Conclusion

This research examines the effectiveness of four word-focused tasks from the perspective of Nation and Webb’s (2011) technique feature analysis. One hundred and twenty undergraduate students participated in the study, the results of which showed that the tasks of reading comprehension with pictorial annotations and doing cloze-exercises with textual annotations were similarly effective, and that cloze-exercises with pictorial annotations were similarly effective as sentence-writing with textual annotations. Such results are consistent with the checklist for technique feature analysis, indicating that this framework is reliable in evaluating and predicting task effectiveness. It also shows that the involvement of imaging in an activity is conducive to word learning, more integration of pictorial annotations in language learning materials is therefore suggested.

Acknowledgement

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References


A Mind-Set Changing Project: Preparing Vocational and Professional Education and Training (VPET) Teachers with Technology Enhanced Learning (TEL) and E-pedagogies

Ricky Yuk-kwan NG, Rechell Yee-shun LAM
Centre for Learning and Teaching, Vocational Training Council, 27 Wood Road, Wan Chai, Hong Kong SAR, China
rickyng@vtc.edu.hk, rechelllam@vtc.edu.hk

Abstract. Vocational and Professional Education and Training (VPET) emphasises in-class hands on practice and face-to-face theory delivery, e-learning and e-pedagogies are less common. The resistance normally rises from the argument of VPET’s focuses on trade-specific hands-on skills in authentic workplaces and the motto of ’practice makes perfect’. Nonetheless, with students’ changing learning preferences and behaviours, the high accessibility of online and web-based information; VPET teachers are now confronting with challenges that trade-specific knowledge and demonstration of skills are widely available on internet and not solely transmitted by teachers. Furthermore, students’ motivation and engagement in learning tasks are also issues that need to be addressed. In response, a mind-set changing teacher training project was introduced and this paper shares the empirical experience on nurturing VPET teachers’ technology enhanced learning (TEL) and e-pedagogies competency so as to prepare them to cope with students’ learning preferences and behaviours for teaching effectiveness. These series of training and engagement activities were carried out in four stages 1) Conceptualisation; 2) Familiarisation; 3) Acceptance and 4) Action. These training and activities enable teachers to adopt TEL and e-pedagogies in their daily teaching. Results of the project indicated that a well-planned scheme that aligned with the institution’s strategy with gradual increment of intensity of e-elements infused in various training events allowed ease of acceptance and behavioural changes. Additionally, synergy from senior management, concurrent schemes, projects and awards to promote and encourage teachers to adopt TEL and e-pedagogies for innovative learning and teaching is also a critical factor in the teacher training scheme.

Keywords: technology enhanced learning (TEL), e-pedagogies, Vocational and Professional Education and Training (VPET), teacher training
Introduction

Teachers in Vocational and Professional Education and Training (VPET) stress in-class hands on practice and face-to-face theory delivery over the use of e-learning and e-pedagogies, although learning management platform (LMP) such as Moodle, Blackboard or other online tools were first introduced in the participating VPET institution of this study in the 1990s. It is not surprising to learn that most teachers’ e-learning activities rest on uploading and downloading course materials on the LMP without touching on the fundamental concept of using online materials to supplement and complement learning back then. The resistance normally rises from the argument of VPET’s focuses on trade-specific hands on skills in authentic workplaces and the motto of ‘practice makes perfect’. VPET teachers also approached e-Learning with doubts. To them, it seemed not feasible to practice hands-on tasks online or on simulation systems and devices. In an earlier interview, Ng and Lam found that teachers questioned how students could practise a simple task like tightening and loosening nuts and bolts on a simulator. They asserted that “in real life, you need to use a certain degree of strength to tighten and loosen nuts and bolts but, with today’s technology, you may not be able to achieve it unless you invest a fortune to develop the hardware and software. Another teacher said that people only live once – you will not hurt in simulated environments if you make mistakes but will surely be injured in real life” (Ng and Lam, 2015, p.6). Very often, mis-conception happened because e-Learning and technology enhanced learning aim not to replace face-to-face contacts and hands-on practices, they rather facilitate understanding of procedures, skills and provide repeated access to venues that are normally prohibited because of safety or confidential purposes. Pedagogically, e-Learning and technology enhanced learning (TEL) when complimented with blended and flexible learning will generate effective teaching and better learning experience for students (Tsang, Yuen and Cheung, 2016; Ng, Lam, Ng & Lai, 2016, 2017). Nonetheless, with students’ changing learning preferences and behaviours (they are enthusiasts in mobile devices, engaged in technologies and online activities for information retrieval 24 hours a day), the advancement of online and web-based networking information communication technology technologies (ICT) and the easy accessibility of mobile devices (e.g. smartphones and tablets that provide “just-in-time contemporary learning and can be accessed from any site” (Choy, 2006, p.2), VPET teachers are now confronting with challenges that trade-specific knowledge and demonstration of skills are widely available on internet. Students’ motivation and engagement in learning tasks should also be looked into. In an earlier study, Ng and Lam (2015) found that the readiness of the teachers regarding to TEL and e-pedagogies is a salient issue to be address. Furthermore, VPET stresses on mastery of hands-on skills but conversely, TEL and e-pedagogies emphasise self-paced online and virtual learning experiences; how would teachers be prepared to adopt the changes for teaching effectiveness? To further address the issue, a three-year mind-set changing project was introduced and this paper shares empirical experience on nurturing VPET teachers’ TEL and e-pedagogies competency so as to prepare them to cope with students’ learning preferences and behaviours for teaching effectiveness.
2 The Project

As teacher trainers in the Centre for Learning and Teaching (CLT) and responsible for teacher training and development in the participated VPET institution, the authors conducted environmental scan, analysed the institution, teachers and students’ needs in order to advise the senior management team on the institution’s e-learning strategy and direction. Allan and Seaman (2014) found that in United States, online learning growth significantly over the last decade and 66% of higher education institutions asserted that online education were their long-term strategy. Environmental scan found that e-Learning and TEL was adopted in Hong Kong’s tertiary education institutions to facilitate learning. Although nearly 95% out of the 3,000 teachers in the participated institution in this study were using the LMP to supplement their teaching, the most frequent activities were uploading course information, notes and extended readings. It was noticed that only 10% of teachers further developed their own complimentary, extended and blended-learning activities such as online tutorials exercises, assessments, forums or video sources. Teachers always regarded TEL as extra workload because of the revision of existing teaching materials and the design of learning and teaching activities, without mentioning the technological know-how. A number of researchers agreed that the most common training needs of teachers rested on technology skills (Barczyk, Buckenmeyer & Feldman, 2010, Arinto, 2013, Lane, 2013, Betts, 2014). A survey on training needs was conducted by CLT with a number of 287 responses from teachers showed that more workshops on e-Learning/Information and Communications Technology (ICT) in education would equip teachers and instructing staff to adapt TEL in their daily teaching. Churchill (2017) also contended that how technologies will be used in daily teaching largely depends on teachers’ understandings of the affordances and the possibilities of the technologies. On the other hand, students had different views on e-Learning. A study by the CLT in 2014 with 4,117 students studying in VPET indicated that all of them obtained information online via websites or social media. It was also found that more than 40% of them stayed online from 21 to 24 hours every day. The average number of devices (phones, tablets, notebooks, computers) owned by each student is 1.82 (Centre for Learning and Teaching, Vocational Training Council, 2014). The results indicated the online learning preferences and learning habits of students and suggested to blend face-to-face teaching with e-Learning or TEL to further enhance student motivation and interaction. It echoed Cronje’s point that “as students’ knowledge of what technologies can enable, brings with it a need for flexibility. Students wants to be able to attend set lectures if they so wish, but they also want the ability to view (or-re-view) those lectures in the form of online videos or online audio podcasts” (Cronje, 2016, p.132). In addition to the data collected from teachers and students, the authors also reviewed the e-Learning, TEL and e-pedagogies training activities (seminars, programmes, workshops and sharing sessions) that were developed and offered by CLT over the last three years for an understanding of the teachers’ participation and needs. In view of the percentage of acceptance and adaptation of e-Learning in daily teaching and with an aim to up-scale the usage of e-Learning as complimentary, extended or blended-learning activities, a project on implementation of E-Learning and TEL was generated in 2014 and proposed to various committee for
discussions. Under the proposal, an implementation plan adopting e-pedagogical approaches and TEL strategies would be rolled out to support the implementation of TEL. Members of various learning and teaching committees generally agreed to adopt E-learning and TEL to enhance effective learning and teaching, to enrich students’ learning experiences and the institution’s competitiveness in the sector. It was also suggested using e-Learning and TEL to accommodate the demographic changes of pre-vocational to in-services learners to cope with the increasing life-long learning and continuous professional development needs. The 3-year Implementation of TEL Project from 2015 to 2018 which included a series of seminars and workshops and engagement activities was then endorsed. Accompanied with the training seminars and workshops were a number of activities including collaboration on development of learning and teaching aids using various kinds of technologies such as learning and teaching platform customisation, video broadcasting lectures, augmented and virtual reality (AR/VR) and wearable technology and mass open online course (MOOC). These series of training and engagement activities were considered as a mind-set changing project that was carried out in four stages 1) Conceptualisation, 2) Familiarisation, 3) Acceptance and 4) Action in order to enable teachers to adopt e-Learning and TEL and e-pedagogies in their daily teaching. To ensure participation, blessings from senior management of the institution were given to academic disciplines’ leaders for smooth implementation of the project.

3 Implementation of the Project

A need analysis was conducted for an understanding of the teachers’ engagement in e-Learning and TEL by first reviewing the training provided and teachers’ participation. The year-round seminars and workshops offered by CLT were categorised into three different focuses namely 1) Developing as Professional, 2) IT Enhancement Programme and 3) Teaching, Learning and Assessment. In (Academic Year (AY) 2014/15), a review of the training workshops in the aforementioned categories revealed the following:

<table>
<thead>
<tr>
<th>Focuses</th>
<th>No. of headcount</th>
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<tbody>
<tr>
<td>Developing As Professionals</td>
<td>245</td>
</tr>
<tr>
<td>IT Enhancement Programme</td>
<td>574</td>
</tr>
<tr>
<td>Teaching, Learning and Assessment</td>
<td>3675</td>
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</table>

The results indicated that out of the three focuses, IT Enhancement Programme had the least participants (n=574) when compared to the other two and that was resulted from the pre-conception of the needs and usefulness of e-Learning. Teachers’ priorities were in Teaching, Learning and Assessment related training such as ‘Classroom Management’, ‘Outcome-based Learning and Teaching’, ‘Planning for Active Classes’, ‘Design Multiple Choices Assessment’ that enabled them to accommodate their urge needs in daily teaching practices. Short talked with teachers in training workshops
showed that most teachers regarded e-Learning and TEL as extra workload and they would like to further modify their existing teaching materials if extra time (less teaching load), training and support were given. To address the above and as planned, the training and engagement activities in the project on implementation of E-Learning and TEL (2015 to 2018) were to be carried out in four stages 1) Conceptualisation, 2) Familiarisation, 3) Acceptance and 4) Action, to gradually enable teachers to get to know e-pedagogies and adopt e-Learning and TEL and into their teaching practices.

3.1 ‘Conceptualisation’ and ‘Familiarisation’

In the ‘Conceptualisation’ and ‘Familiarisation’ stages in AY2015/16, training workshops on e-pedagogies and TEL were held regularly. To enhance participation and increase attraction, overseas and local guest speakers with expertise on e-Learning and TEL were invited to deliver seminars, workshops as well as sharing sessions to keep abreast participants’ awareness and conceptualisation of the trend and usefulness of e-Learning and TEL. A range of seminars and workshops with topics on ‘Harnessing Open and Flexible Resources (OER)’, ‘Mobile Design: Teaching Language and Literacy with Mobile Technologies’, Situated Knowledge Building and Mobile Technologies in the third Space: Moving Beyond 21 Century Learning’, ‘e-Books Production for Teaching and Learning Packages’, ‘Design Video Resources to Facilitate Self-directed Learning in Flipped Classroom’, ‘AR/VR Technology for Education and Training’ and ‘Using MOOCs to Enhance Learning and Teaching’ were organised with 612 headcounts. In addition to the above and with the aim to familiarise teaching staff with the LMP (Moodle), eleven workshops and three seminars ranged from ‘Kickstart with Moodle’, ‘Gearing Up for Moodle’, ‘Use of VeriGuide for Assessment’, ‘Sharing Session on Moodle Customisation Project’ and ‘Moodle Information Session’ were held with a number of 437 headcounts. The table below showed the total number of headcounts in the IT Enhancement Programme had recorded a significantly increase of 82.8% participation (n=1049) in AY 2015/16 when compared to AY2014/15 (n=574).

<table>
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<th>Focuses</th>
<th>No. of headcount</th>
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<tbody>
<tr>
<td>Developing As Professionals</td>
<td>254</td>
</tr>
<tr>
<td>IT Enhancement Programme</td>
<td>1049</td>
</tr>
<tr>
<td>Teaching, Learning and Assessment</td>
<td>3250</td>
</tr>
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</table>

Using Kirkpatrick’s (1994) four-level framework (Reactional, Learning, Behavioural and Results), the authors further evaluated the training activities’ effectiveness and impacts on the teachers’ readiness and acceptance to changes in their teaching practices. The model categorises the training outcomes to ‘Reaction’ focus on the trainees’ satisfaction, ‘Learning’ on the acquisition of knowledge, skills, attitudes, ‘Behaviour’ addresses the improvement of behaviour on the job and ‘Results’ on trainees’ achievement and productivity improvement. Feedback forms were used to collect instant reflections after each seminar and workshop in the first level (Reaction)
and the second level (Learning) of analysis. In general, the overall rating on the structure, content relevancy, alignment to learning outcomes, facilitation and materials and resources provided in the seminars and workshop was 4.6 on a scale of 1 to 5 (1= Strongly disagree, 5= Strongly agree). Qualitative feedback such as ‘very practical and can be used during my class’, ‘the introduction app was very useful for teaching’, ‘Spark video is useful’ and ‘MOOC introduction is useful’ indicated the teachers were benefited in terms of conceptualisation, familiarisation and application of e-Learning and TEL. However, feedback such as ‘more different useful applications on ICT teaching can be introduced’, ‘the new tolls for teaching are quite good and should teach all teachers in order to facilitate the use of them’, ‘more practices are needed’, ‘more time for practicing the tools’ and ‘would like to have more consultation on applying AR/VR technology to enhance teaching’ revealed that teachers were eager to learn more in order to adopt the latest learning technologies in their teaching. Views on staff’s performance after the training were collected from senior staff of respective academic disciplines in various committees’ meetings for the third and fourth levels (Behaviour and Result) of analysis. Senior staff observed that there were increasing self-initiated e-learning projects by teaching staff, including customisation of the Moodle platform with online assessments and discussion forums to suit specific modules’ teaching needs, the embedded of videos as lecturing and instructional materials to enable flipped learning, the request for support and further consultation on developing TEL packages and resources. Most of the teachers realised and recognised the benefits of facilitating better learning and teaching experiences to both students and teachers. The above showed a promising behavioural change amongst teachers towards the adaptation of e-Learning and TEL.

### 3.2 ‘Acceptance’ and ‘Action’

With the results indicating general acceptance of using e-Learning and TEL from the training and feedback from meetings, the project had progressed into the ‘Acceptance’ and ‘Action’ stages in AY2016/17. Alongside with the on-going training seminars and workshops, sharing sessions of the self-initiated e-learning projects by teaching staff were organised to share experiences so as to consolidate the acceptance from a wider population of teachers. The training headcount on IT Enhancement Programme remained around 1098 (Table 3) with slight increment. The reason that peers sharing and refinement of contents were made instead of repeating the training in a mass scale. It also allowed time for teachers to reflect and plan for the applications of TEL in the coming ‘Action’ stage.

<table>
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<td>IT Enhancement Programme</td>
<td>1098</td>
</tr>
<tr>
<td>Teaching, Learning and Assessment</td>
<td>3793</td>
</tr>
</tbody>
</table>

Table 3. Headcount of the training workshops in AY2016/17
The authors once again evaluated the training activities’ effectiveness using Kirkpatrick’s (1994) four-level framework (Reactional, Learning, Behavioural and Results). The overall rating on the structure, content relevancy, alignment to learning outcomes, facilitation and materials and resources provided in the seminars and workshop was 4.5 on a scale of 1 to 5 (1= Strongly disagree, 5= Strongly agree). Qualitative feedback such as ‘the case studies enriched the seminar’, ‘new apps can be applied on helping us on teaching’, the workshop can overcome how to use Mentimeter’, would like to share with students off lecture’, ‘live demonstration and practice in computer lab could facilitate my learning’, ‘workshop clearly showed how to create online assignment’, and ‘all useful, very practical’ indicated teachers’ positive views on using TEL. Senior staff of respective academic disciplines also revealed that a number of their teaching staff were eager to apply what they have learnt to enrich their teaching contents and activities in various committees’ meetings. The results indicated a gradually mind-set change and acceptance of the e-pedagogies and applications. In view of the above, it was considered the right time to progress the project into the ‘Action’ stage.

During the ‘Action’ stage, respective disciplines contributed subject contents while CLT provided instructional design and technological supports on production. A number of deliverables on the development of e-Learning and TEL resources that included customisations of Moodle platform, Mini-MOOCs, discipline-specific online learning resources, AR/VR applications, lecture capture system and wearable technologies (head-mounted devices and multi-function glasses such as HoloLens) were developed on a small piloting scale. These e-pedagogical approaches enable interaction and meaningful learning activities and tutorials that occur during the face-to-face time under teachers’ guidance. Together with appropriate instructional design and technology as enabler, these approaches provide students with a large degree of learning autonomy and nurture students for a higher degree of self-directness, self-management, persistence and independency. During the implementation, the collaboration and support from different units was the key success factor. CLT provided advice on instructional design and production of innovative technologies, assist in the development of e-Resources for disciplines, deliver training workshops and seminars, and organise sharing sessions. The nominated teachers of nine disciplines provided the content of modules for the TEL development while the institution’s information technology supporting division (ITSD) provided technical support and maintenance for those platforms and applications (Moodle, and Mini-MOOC). To ensure timely support, campuses’ technical teams provided on-site technical and production services. The deliverable of the implementation of TEL in AY2017/18 is shown below:

1. A Task Force on Implementation of TEL was set up with CLT, ITSU, Disciplines nominated teachers and campuses’ technical teams as Members to implement and report on the progress and effectiveness of application of TEL;
2. Production of one to two mini-MOOCs by each of the nine academic disciplines;
3. Nine sets of e-Resources for respective disciplines on selected modules;
4. Production of six AR exemplars and six wearable technology exemplars; and
5. Customised the Moodle platform to integrate the lecture capture system for one-stop access of all learning and teaching resources and ease of management.

The above intended deliverables of the project were agreed between staff representatives of all levels and signified an institutional-wide mind-set and behavioural change. The project implied that an emerging concept change and paradigm shift in learning and teaching. It also addressed the increasing importance of e-pedagogies.

3.3 Lesson Learned

Results of the project indicated that a well plan training scheme that aligned with the institution’s strategy with gradual increment of intensity of e-elements infused in various training events and engagement activities allowed ease of acceptance and behavioural changes. As the project is still on-going and the above intended deliverables are in progress, the following salient points are yet to be further addressed. Firstly, a close communication for timely dissemination of up-to-date knowledge in technological advancement and experiences through sharing sessions, internal publications and various committees will ensure penetration to all levels of staff in the institution. Secondly, effective TEL lessons rest on the planning, instructional design and the appropriateness of the technology being used. The TPACK framework (Technologies, Pedagogies and Content Knowledge) (Herring, Koehler and Mishra 2016) provided a promising guideline and method for content, instructional design and information technology experts for reference. Thirdly, technologies come and go, so does enthusiasm. Discrete consideration on the investment of resources on software, gadgets and facilities will minimise the risk of rapid outdating of technologies. To sustain motivation and engagement, it is suggested to launch concurrent schemes and awards to encourage and recognise teachers who adopt TEL and e-pedagogies for innovative learning and teaching. Lastly, the alignment of the e-Learning and TEL development to the institution’s learning and teaching strategy as well as blessings from senior management are also one of the successful factors.

4 Conclusion

With an aim to promote e-Learning and TEL to teachers, this mind-set changing project demonstrated a good example for practice sharing. This paper started with the pressing needs of e-Learning and TEL in today’s VPET and higher education institutions and argued the usefulness of TEL and e-pedagogies in VPET. A need analysis was conducted to diagnose teachers and students’ learning and teaching preferences and habits followed by the proposal of the 3-year Implementation of TEL Project. The process, intended deliverables and progress were then described. Salient points were also mentioned in order to shed light for further development and research.
References


Automatic Correction of Definite Article Redundancy Error in the English Compositions of College Students

Lei WANG ¹, Ting WANG ²

¹ School of Foreign Languages, Peking University 100871, China
² No. 1 Senior High School of Liaoyang, Liaoning Province 111000, China

wangleics@pku.edu.cn, cherrywangting@126.com

Abstract. The usage of articles involves complex grammatical, semantic and pragmatic knowledge and experience and it will become a difficult task to master even for a native English speaker. In addition to its complexity, English learners in China encounter confusion when using articles for their absence in Chinese language. In our 100,000-word corpus of about 500 English compositions by college students, article errors account for more than 50% of total errors and the definite article error, redundancy in particular, is obvious. Therefore, it is necessary to analyze and summarize these errors and explore ways to make improvement. If teachers' experience of marking these compositions can be put into the computer and the errors found are to be recognized automatically, the quality and efficiency of marking compositions will be improved.

Scholars have conducted research on the errors made by language learners in writing both theoretically and practically, and they have made considerable breakthroughs in Second Language Acquisition (SLA) with respect of writing. The learners' use of articles in English writing display a certain pattern with factors such as the influence from mother language, personal idiosyncrasy or common misunderstanding. Thus it is feasible to judge whether an article is used correctly in a certain context on a rule basis. This paper adopts a rule-based method, which lets the computer learn how to use articles from corpus and recognize the Definite Article Redundancy Errors (DAREs) committed by students in their English compositions with the help of both grammatical and contextual information. The rules obtained from corpus are deduced from authentic examples and possess authority and accuracy. The system also allows teachers to add or alter these rules flexibly by either examining the actual cases or updating their professional knowledge as they wish.

Keywords: automatic correction, definite article error, College English writing

1 Introduction

As a very important part of English language, articles usually account for 8.5 percent of total words in texts and play a crucial role in everyday communication [1]. As function words, articles in English language usually do not possess semantic
information and can only be used as modifiers that are placed in front of nouns to create a more accurate sense. For example, the meaning of the phrase "out of question" differs greatly from "out of the question" simply for the presence of the definite article error.

The usage of articles in English language involves complicated grammatical structure, semantic knowledge and pragmatic experience, etc. [2]. For instance, there are over 30 pages about articles in Longman Dictionary of English Grammar. Therefore, it will be very difficult even for native speakers to know all about them for the fact that it is a big knowledge system. Knight [3] once replaced all the articles in an English text with spaces and let native speakers restore them. The result showed that its accuracy reached merely 94% - 96%. For second language learners, especially those whose mother languages are Chinese in which there are no word classes such as articles, they often encounter confusion and errors when learning and using English. Most learners feel articles are the most incomprehensible part of their learning and often the last part to get a good command of [4].

Researchers both home and abroad have conducted research on the mechanism of committing errors when using certain words. Among them the theory of Error Analysis (EA) has made significant progress in Second Language Acquisition (SLA) and shifted linguistic study of language learning and teaching from external environment to the observation and investigation of learners themselves [5]. For L2 learners who attempt to learn and use English articles, EA can still serve as a powerful instrument of guidance. For the absence of articles in Chinese language, it seems harder for Chinese students to learn English articles well. In the secondary education of China, teachers spare no efforts in letting students know well about how to use English articles properly and testing students’ command of articles has always been a focus. For instance, questions about article usage appear often in the test papers of National Matriculation English Test (NMET). The following is one of the questions.

She is ____ newcomer to ____ chemistry but she has already made some important discoveries. (NMET94)

A. the; the B. the; / C. a; / D. a; the

As the English instructors for both high school and Chinese college students, the authors spend much time on marking students’ compositions in work and finds the article errors in students’ writing make up a large proportion of the total errors. In the 500 compositions of over 100,000 words collected for this study, the article errors account for around 50% and the redundancy the definite article “the” in front of nouns is a typical error. Please see Figure 3 in section 2.

Therefore, it is necessary to analyze and summarize the redundancy errors in article usage committed by Chinese college students. If the automatic recognition of article redundancy in English writing of college students can be realized, the quality and efficiency of composition marking by teachers can be greatly improved.

2 Literature Review

As to research on article acquisition and usage, Lee et al. [6] studied the acquisition of the definite article “the” of three Chinese children and obtained different findings...
compared with the former study results about foreigners’ learning English. Tarone & Parrish [7] conducted task-based research on the variation of L2 learners whose native languages are Arabic and Japanese through questionnaires, oral interviews and recitation and found their accurate tendency of article prediction before the same noun phrase, even though different tasks induced different noun phrases. Hakuta [8] studied the acquisition of English articles of a candidate learner and classified the article errors into redundancy (using articles where they are not necessary) and neglect (not using an article where it is necessary).

With the development of education in China, research on article usage of Chinese students begins to flourish. However, most of them lay an emphasis on the function or grammatical attributes of articles from a descriptive approach but from a quantitative one. Zhu [9] investigated college students’ acquisition of articles with an experimental method, while Yan [10] analyzed the causes of article errors based on a corpus. Li & Cai [11] specially studied the article errors of college students’ writing.

As for study on the automatic processing of English articles, Knight et al. [3] proposed a method based on decision tree in selecting articles for nouns, while Chang [12] did the same job by applying a method of transformation-based error-driven learning mechanism. Experiments showed that they can both improve the accuracy of selecting articles for machine translation systems. Ning [13] treated articles as tags and described the problem as a task of sequence tagging, which is one of the strategies of machine learning. The work adopted attributes such as word, POS and MI information of before-and-after words. The experiment showed that $F$-value reaches 80% with a corpus of patent extracts which includes 91,106 articles.

3 The Characteristics of College English Writing and Rules of Using Definite Article

In China, College English is a credit course and the Ministry of Education stipulated general guidelines and curriculum for it, which is included in its College English Curriculum Requirements [14]. In terms of writing, it requires:

- For writing, a student should propose his/her opinion on general topics and is able to write English abstracts for academic papers; can write short academic papers with depiction of various charts and tables; can write a composition of no fewer than 160 words with content, opinion, logic and fluency.¹

Therefore, we can see that college English writing is restricted in terms of both content and structure and it is plausible to deduce the correct usage of articles based on a complete set of rules. Figure 1 is the writing part of College English Test Band 4 (CET 4), which is a popular English test taken by many Chinese students.

| 2013年12月全国大学英语四级考试试卷 |

¹ In fact, there are three levels of requirements in College English Curriculum Requirements, which are “basic”, “relatively high” and “high”. We only give “relatively high” here as an example.
Part I  Writing  (30 minutes)

Directions: For this part, you are allowed 30 minutes to write a short essay entitled What Electives to Choose. You should write at least 120 words but no more than 180 words following the outline given below in Chinese:
1. 各大学开设了各种各样的选修课；
2. 学生因为各种原因选择了不同的选修课；
3. 以你自己为例……

What Electives to Choose

Student’s response

Fig. 1. The Writing Part for College English Test Band 4

Many college students expect to continue their study abroad, especially those countries with good universities such as the US or the UK. To do that they have to take English tests such as TOEFL organized by Educational Testing Service (ETS) or IELTS organized by the British Council. Both tests include a writing part. Let’s take TOEFL for example. Its writing part\(^2\) requires (See Figure 2):

SAMPLE TEST

Read the question below. In a real test, you will have 30 minutes to plan, write, and revise your essay. Candidates with disabilities may request a time extension. Typically, an effective response will contain a minimum of 300 words.

Question: Do you agree or disagree with the following statement?
A teacher’s ability to relate well with students is more important than excellent knowledge of the subject being taught. Use specific reasons and examples to support your answer.

REQUIREMENT

For the second task, you will demonstrate your ability to write an essay in response to a question that asks you to express and support your opinion about a topic or issue. Your essay will be scored on the quality of your writing. This includes the development of your ideas, the organization of your essay, and the quality and accuracy of the language you use to express your ideas.

Fig. 2. Requirement of The Wring Part of TOEFL

In the two sample responses given by ETS official website, they contain 447 words and 329 words respectively.

In the English education of Chinese universities, teachers often assign writing tasks to students who select English courses of various levels. Let’s take Level 3 of

\(^2\) http://www.baidu.com/link?url=lOOr8wvpkgvsUAr0dFcM7nvJFW9z7hyOkS2OaUdcSkGg-foPqUKbd3F3S1nW4vx6SHWMMc2ABN0g7ALv7J8NWIYq
College English Course in Peking University for example. Teachers will assign writing tasks at the beginning of each semester along with clear requirements and ask students to submit their work to a certain website by a certain deadline. The following is the writing requirement of Level 3:

Students are able to take notes, answer questions and writing abstracts in English; can write a short essay of 150 – 180 words within half an hour about certain topics and summaries with coherent content and correct grammar.

**WRITING INSTRUCTION**

Write a composition based on the following topic with no less than 150 words and no more than 200 words. (Please mark your total words at the end and submit your work to our website.)

**TOPIC:** How can student-teacher relationship be improved in college?

**One student’s response:**

As education developing quickly, there is a rising problem on student-teacher relationship.

Some students have words with their teachers during the (AE4) class or even worse. They talk less and hardly greet in the school. If the exacerbation of the relationship continues, the(AE) education will not even exist. It should be taken seriously.

In my opinion, three reasons lead to this phenomenon. First, the typical one-way education model. It makes students receivers rather than participants. Second, less communication. There is widespread apathy among the(AE) students. And finally, the reduction of mutual trust between teachers and students. Teachers and students merely dream about the resurgence but they never put it into practice.

To solve this problem, communication must be established. Only when they talk to each other, can they trust each other. They need to know what exact role they play. Friendship appears. Then the indifference will no longer be there. Once they become friends, teaching will be more effective and enjoying.

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Fig. 3. The Writing Requirement of Level 3 and One Sample Response

From the above we can see that the compositions required for college students have a maximum of 500 words and limited vocabulary with topics close to students’ life. The authors make a statistics on the corpus (with a total number of 150,552 tokens and 3981 types and a type/token ratio 2.6%) before-mentioned and please refer to Table 1 for details.

---

3 There are other errors in this student’s composition that are erased from the sample for its irrelevance to our research.

4 AE indicates “Article Error”, which is one of the error marks used by the author in marking students’ compositions.
Table 1. The Statistics of Composition Corpus

<table>
<thead>
<tr>
<th>No.</th>
<th>Nouns or verbs</th>
<th>Counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>people</td>
<td>840</td>
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<tr>
<td>2</td>
<td>know</td>
<td>684</td>
</tr>
<tr>
<td>3</td>
<td>life</td>
<td>654</td>
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<tr>
<td>4</td>
<td>world</td>
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<tr>
<td>5</td>
<td>China</td>
<td>501</td>
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<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

The curriculums of college English education usually require students to pass CET 4 and will not compel students to learn English beyond its requirements. But if a student passes band 4 and wants to take band 6, he or she is free to further learn English and teachers are exempted from the responsibility to instruct him or her. The *College English Curriculum Requirements* also provide suggested vocabulary for both teaching and learning and the following Figure 4 lists parts of the vocabularies for both CET 4 and CET 6:

<table>
<thead>
<tr>
<th>Band 4 vocabulary</th>
<th>Band 6 vocabulary</th>
</tr>
</thead>
<tbody>
<tr>
<td>abandon</td>
<td>abbreviation n.</td>
</tr>
<tr>
<td>ability</td>
<td>absorb n.</td>
</tr>
<tr>
<td>able</td>
<td>abolish vt.</td>
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<tr>
<td>abnormal</td>
<td>absent a.</td>
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<tr>
<td>aboard</td>
<td>abide vt.</td>
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<tr>
<td>about</td>
<td>absurd a.</td>
</tr>
<tr>
<td>above</td>
<td>absent a.</td>
</tr>
<tr>
<td>abroad</td>
<td>absence n.</td>
</tr>
</tbody>
</table>

Fig. 4. Suggested Vocabulary of CET 4 and CET 6 (part)

From Table 1 and the above vocabulary lists we can see that students generally apply a limited vocabulary when writing compositions in the above-mentioned writing tests. The words used by students in our corpus exceed the CET 4 vocabulary are merely 64 and the CET 6 are 37.

Therefore, we adopt a rule-based method and take both pragmatic (word counts) and semantic (contextual information) factors into account in order to make accurate judgment about the redundancy of definite article “the” in students’ compositions. The set of rules is generalized from several authoritative grammar books together with experience from teachers of secondary and higher education. Meanwhile, we allow

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5 http://wenku.baidu.com/view/ae44f24d33687e21af45a910.html
6 Only nouns and verbs are counted.
teachers to add or alter the rules flexibly according their actual teaching practice based on their professional knowledge. Table 2 is the example of the set of rules:

<table>
<thead>
<tr>
<th>ID</th>
<th>Rule</th>
<th>Formal description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Noun or NP followed by “of”</td>
<td>If noun or NP + “of”, then “the” + noun or NP</td>
<td>We must deal with the problem of inflation.</td>
</tr>
<tr>
<td>2</td>
<td>Noun or NP followed by “that”</td>
<td>If noun or NP + “that”, then “the” + noun or NP</td>
<td>I agree with the view that music is important.</td>
</tr>
<tr>
<td>3</td>
<td>Most of the Noun or NP</td>
<td>If “most of” + noun or NP, then “the” + noun or NP</td>
<td>Most of the problems are solved.</td>
</tr>
<tr>
<td>4</td>
<td>No “the” before abstract noun</td>
<td>If abstract noun, then NOT “the” + abstract noun</td>
<td>history, music, love, freedom, power</td>
</tr>
<tr>
<td>5</td>
<td>“the” before special noun or NP</td>
<td>If special noun or NP, “the” + special noun or NP</td>
<td>the United States, the poor, the whole country</td>
</tr>
</tbody>
</table>

### 4 System Design and Realization

To achieve our goal, we also need to build lexicons of abstract nouns and special NPs mentioned in Table 2 in addition to formalizing the rules. By collecting those special NPs from the Internet and various other resources, it is relatively easy for us to compile them into a lexicon. However, to build a lexicon of abstract nouns seems to be a mission impossible for several reasons.

First, there are millions of words in English and many of them are nouns. To classify the nouns simply into two groups – those that are abstract an those that are not – will be a huge task if it is to be done by human labor. Second, we know to give a clear definition of being “abstract” is difficult for different individuals may hold different opinions on a certain word. For example, in the sentence “Yesterday I bought an Apple computer.”, the word “computer” is generally considered as being concrete. Whereas in the sentence “Humans are entering an age of computer”, whether the word “computer” is abstract or concrete will be controversial.

Thanks to the very characteristics of College English writing, we are able to limit the huge number if nouns into a couple of thousands, i.e. the requirement of CET 4 or CET 6 for instance. Thus it is possible for us to classify the nouns into two groups even manually. With the knowledge that uncountable nouns are usually considered as being abstract, we find that in the *Oxford English-Chinese Dictionary* uncountable nouns are marked with a tag “[U]” as is shown in Figure 5. Thus our method is we make an intersection between the vocabulary sets in Figure 4 and the nouns in the Oxford
dictionary and leave those with the mark “[U]” as the basic entries of the lexicon. Then the entries are examined manually to make sure we select those real abstract nouns.

education

n [U]

1. (system of) training and instruction (esp. of children and young people in schools, colleges, etc) designed to give knowledge and develop skills 教育; 教育体制: A child receives its early education at home. 幼儿在家接受早期教育. * primary/secondary/tertiary/adult education 初等/中等/高等/成人教育 * No country can afford to neglect the education of its young people. 任何国家都不能疏忽对年轻人的教育.

2. knowledge, abilities and the development of character and mental powers that result from such training (接受教育而获得的) 知识, 能力, 修养, 智力: intellectual, moral, physical, etc education 智育、 德育、 体育等

3. …

Fig. 5. An example entry of the *Oxford English-Chinese Dictionary*

Table 3 illustrates the lexicon of the Proper Nouns and Special NPs collected from various sources.

Table 3. Table 3. Proper nouns and special NPs that require “the”

<table>
<thead>
<tr>
<th>ID</th>
<th>Entry</th>
<th>Class</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>the United States</td>
<td>proper noun</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>the United Kingdom</td>
<td>proper noun</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>the poor</td>
<td>special NP</td>
<td>must be followed by verbs</td>
</tr>
<tr>
<td>4</td>
<td>all the country</td>
<td>special NP</td>
<td>“all the” cannot be seperated</td>
</tr>
<tr>
<td>5</td>
<td>the Internet</td>
<td>proper noun</td>
<td></td>
</tr>
<tr>
<td>...</td>
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<td>...</td>
<td>...</td>
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</tbody>
</table>

Figure 6 provides a flowchart that shows how a student’s composition is processed and the DAREs will be detected and corrected automatically. We hope that with this system teachers’ workload of marking students’ writing can be alleviated.
5 Conclusion

In learning or using a foreign language, errors shall be regarded as the mark of learners’ L2 progress. The inappropriate use of articles reflects learners’ confusion to some extent. Therefore, we ought to allow the existence of errors as such and fully understand the process of causing the errors in language learning. Teachers ought to make appropriate arrangement of teaching materials to ensure students can have a good command of the special kind of words unfamiliar to their own language and meanwhile the errors they make can be recognized by any methods in order to improve their teaching and facilitate students’ learning.

Acknowledgment

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References

Teaching College English to Large Classes with Multi-mode Blended Learning

Zexuan CHEN

1 School of Foreign Studies, Southern Medical University, No. 1838, North of Guangzhou Avenue, Guangzhou, Guangdong Province, China
2 School of Information Technology in Education, South China Normal University, No. 55, West of Zhongshan Avenue, Guangzhou, Guangdong Province, China

serlinachen@163.com

Abstract. Considering the fact that mainland China is struggling with large language classes, generating poor learning outcomes, a multi-mode blended learning approach was developed to look for a solution to this status quo. An empirical study was conducted to test out the teaching effect of the developed model. Researcher of the present study taught College English to four large classes (80-100 students/class) with the multi-mode blended learning approach. Empirical results from a one-semester (16 weeks) teaching experiment indicate that the multi-mode blended learning approach brings with large classes five benefits: improved learning outcomes in terms of listening, speaking, reading, writing, and translating competence.

Keywords: large class; multi-mode blended learning; College English; learning outcomes

1 Introduction

The National Council of Teachers of English has been issuing position statements on smaller language class size to ensure better academic performance (NCTE 2014). However, as is noted by Wang & Zhang (2011), the size of language class at any educational level of mainland China is increasing rapidly, due to the lack of quality teachers and educational resources. There is no denying the fact that Chinese teachers at elementary or secondary schools have been confronting with the challenge of teaching a class with more than 50 students, whereas teachers at college level might even have a class with over 100 students (ibid). Large class seems to be one of the best policies to meet the challenge of increasing student-teacher ratio, however, it may in turn lead to compromised learning outcomes.

Technology-enhanced blended learning may become a pedagogical alternative, as it is featured with improved pedagogy, increased access/flexibility, increased cost effectiveness (Graham 2004: 7), as well as the potential to increase students’ learning outcomes (Dziuban et al. 2004: 5), and improve the teaching of large groups (Marsh et al. 2003).
However, few researchers have been probing into the more sophisticated process of blended learning (Hung 2015; Köse 2010; etc.) and the effects of teaching large classes with the blended learning approach. Therefore, by taking into account the many factors that could influence the learning outcomes of blended learning, the author developed a multi-mode blended learning approach and conducted an empirical study to test out its teaching effect, in an attempt to find out a solution to alleviate the pressure caused by large classes.

2 Previous Studies

Previous studies on large classes and blended learning, especially the theoretical models and framework of the blended learning approach, have shed some light on the present research.

2.1 Challenges Posed by Large Class

In terms of class size, Murphy (1998) described small class to be containing 13-17 students, and large class to be containing 22-25 students. While NCTE (2014) suggested that small class in elementary school usually means fewer than 20 students per class.

“It is difficult to set a definition of what a large class is” (Rhalmi 2013), but compared with all the above descriptions of class size, those classes containing 50-100 students in mainland China could be classified into the group of large class. This means that a large majority of teachers and students in mainland China are currently struggling with poor teaching and learning experience because of large classes.

Pedagogical shortcomings of large classes could yield a variety of teaching problems. Boily et al. (2014) reported extreme difficulties in teaching reading with large classes; while Rhalmi (2013) discussed difficulties in getting satisfactory perception of students’ needs, catering for different student levels, engaging students in the learning process, and developing intimate relationship with students, etc.

2.2 Blended Learning

Blended learning seems to be one of the potential solutions to improve the quality of instruction for large classes.

The term “Blended Learning” originated in the business world in connection with corporate training (Sharma & Barrett 2007), then was employed in higher education (MacDonald 2006) and lastly it appeared in language teaching and learning (Whittaker 2013: 11). There is little consensus on the definition of blended learning (Smythe 2012) as scholars have different interpretations of the term itself.

Driscoll (2002) defined “Blended Learning” in four different concepts: (1) to combine or mix modes of Web-based technology to accomplish an educational goal; (2) to combine various pedagogical approaches to produce an optimal learning outcome with or without instructional technology; (3) to combine any form of instructional
technology with face-to-face instructor-led training; (4) to mix or combine instructional technology with actual job tasks in order to create a harmonious effect of learning and working.

Most scholars echo the third definition and argue that: blended learning “combines online learning with face-to-face learning (Harriman, 2004)”; “Blended Learning” is learning that “combine face-to-face instruction with computer mediated instruction” (Bonk & Graham 2006: 5), to name just a few.

Driscoll’s second and third definitions have pointed out the importance of pedagogy and instructors in the implementation of blended learning, which might guide instructors to focus on the pedagogical design and the rational combination of the online and offline instructions.

Inspired by the literatures discussed above, the author would define the term “Blended Learning” as “a rational combination of online and face-to-face learning”.

3 The Multi-mode Blended Learning Model

When it comes to the blended learning model, most previous studies seem to draw a clear boundary between face-to-face lecture and online learning or actually fail to explore the more sophisticated combination of online and face-to-face instruction (Hung 2015; Köse 2010; Staker & Horn 2012; etc.). According to their models, the more traditional face-to-face lecture would be delivered in class, without any/much support from the Internet, whereas the online learning would be simply completed individually before class supported with Web 2.0 technologies.

However, the author of the present study has observed a dynamically intertwined process of online learning and face-to-face instruction within a blended learning context. Furthermore, previous blended learning models seem to have little implications for managing large classes (Köse 2010; Staker & Horn 2012; etc.). Therefore, the author designed a multi-mode blended learning model (see Fig. 1) for teaching large language class.

![Fig. 1. Multi-mode blended learning model: teaching college English to large classes](image)

Fig. 1 shows the essential elements of the developed multi-mode blended learning model, which consists of four key components, four fundamental components and eight major elements.

3.1 The Key Components
The four key components are: (1) online learning, (2) face-to-face learning, (3) out-of-class learning; and (4) in-class learning, respectively.

Four double arrows connect the four key components within a circle, suggesting that the four fundamental elements are frequently interconnected and intertwined.

Meanwhile, the arrow pointing from online learning to in-class learning suggests that online learning could probably happen in class as well as out of class; whereas the arrow pointing from face-to-face learning to out-of-class learning indicates that face-to-face learning could probably happen not only in class, but also out of class.

3.2 The Fundamental Components
The four fundamental components are: (1) learning modes; (2) interactions; (3) thinking skills; and (4) assessments. Two sets of arrows point from online and face-to-face learnings to the four fundamental components, suggesting that both online and face-to-face learnings would be accompanied with different learning modes, various interactions, hence develop different levels of thinking skills and implement comprehensive methods of assessment. To understand the four fundamental components better, each component would be explained in more detail:

3.2.1 Learning Modes
Learning in this blended learning model is composed of individual learning and collaborative learning. Among which, collaborative learning is fulfilled within a group and has been found to be a great solution to large class instruction.

As for most of the individual learning, students would be guided to finish all the self-paced learning (text reading, audio listening, video watching, graph viewing, etc.) and assignments before or after class supported with Moodle—a learning management system.

Collaborative learning could occur either out of or in class, either online or in a face-to-face condition. Before/after class, groups might be assigned to brainstorm on a topic in a face-to-face setting or online, and complete a collaborative task online supported with Wiki technology (e.g. Teambition, Wikispaces, Canvanizer, etc.).

Collaborative learning in class might be achieved by having face-to-face brainstorming or discussion while drawing a Mindmap within the group or complete a collaborative writing online using Wiki technology.

3.2.2 Interactions
Out-of-class teacher-student interaction occur mostly on Moodle (online), including teacher feedback on student works or individual questions, teacher’s participation on
the forum discussion (posting a hashtag or following a hashtag), etc. Whereas in-class teacher-student interaction could happen either online or offline. The teacher would always walk around the classroom while groups are exploring on certain topics, and provide different groups with personal assistance and guidance. At the same time, the teacher might organize the whole class to post to a forum in Moodle or an online virtual “bulletin” board (e.g. Padlet), where the teacher and students can interact synchronously online in a face-to-face setting.

Whereas student-student interaction could be either out of or in class, either online or offline (anywhere, anytime). Out-of-class student-student interactions could be various, including face-to-face discussion or online discussion, or peer evaluation in Moodle, etc. Meanwhile, peer interactions in the class might take the form of online collaboration using Wiki technology, offline collaboration using paper and pen, etc.

3.2.3 Thinking Skills
Lower-order thinking skills are composed of remembering and understanding, while higher-order thinking skills consist of applying, analyzing, evaluating and creating (Anderson et al. 2001).

According to the proposed model in this paper, most lower-order thinking skills could be developed before class via online learning, where students are guided to remember certain facts/words, etc., and relearn texts, audio, videos, graphs, redo pre-class quizzes until they understand all of the contents.

On the contrary, face-to-face instruction section and after-class learning tasks would basically focus on developing students’ higher-order thinking skills. The teacher would invite students to apply, analyze, evaluate and create in the teacher-student interaction, student-student interaction, online and offline collaboration, etc.

3.2.4 Assessments
The developed blended learning model tends to use both formative and summative assessments to evaluate student achievement.

Formative assessment of students’ learning outcomes would consist of assignment completion rate in Moodle, fulfillment of peer evaluation tasks in Moodle, group works of online collaboration using Wiki technology, group sharing and presentation in the face-to-face section.

Summative assessment would be carried out at the end of the blended learning journey (usually at the end of a semester or a schooling year).

4 Teaching Large Classes with Multi-mode Blended Learning

During March-July, 2017, the author conducted an empirical study at one university in Guangzhou, Guangdong Province of China to test out the teaching effect of the proposed model.
4.1 Research Question

By following the multi-mode blended learning model, the author taught college English to four large classes within a whole semester, in an attempt to answer the research questions listed below:

- Is the model effective in improving listening skills?
- Is the model effective in improving speaking skills?
- Is the model effective in improving reading skills?
- Is the model effective in improving writing skills?
- Is the model effective in improving translating skills?

4.2 Participants

Four classes of sophomores (Grade 2016) were randomly chosen to participate in the present study. They were all large classes with 80-100 students in each class.

4.3 Experimental Procedure

The teaching experiment, lasted for one semester (16 weeks, 80 min every week), is based on a blended learning series course, consisting of one course introduction at the very beginning of the semester, seven blended learning sections and one final exam at the end of the semester (see Table 1).

<table>
<thead>
<tr>
<th>week</th>
<th>CI</th>
<th>BL1</th>
<th>BL2</th>
<th>BL3</th>
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<th>BL5</th>
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</table>

Table 1 indicates that every two weeks makes a blended learning section, in which students would spend 80 min in the first week fulfilling the online learning tasks, and spend another 80 min in the following week to participate in face-to-face instruction.

Note that in the present study, students have the freedom to finish their online learning assignments anywhere, anytime, in the condition that they complete pre-class learning activities before deadline. On the contrary, time and place for the face-to-face instruction are preset, so that teacher and students can see each other regularly.

As for assessment, the seven blended learning sections from Weeks 2-15 would keep record of students’ performance (formative assessment), while the final exam serves as the summative assessment.
4.4 Research Instruments

The research instruments in the present study include pre-test and post-test questionnaires. The questionnaires were designed in alignment with the Intermediate Requirement (second level of the requirements) for language skills put forward by the Higher Education Division of Ministry of Education (China) in the College English Curriculum Requirements (Higher Education Division of Ministry of Education 2007: 38-40). Every questionnaire is composed of five parts (listening, speaking, reading, writing, and translating skills), with 3 items in every part, 15 items altogether.

Both of the pre-test and post-test questionnaires invite the students to evaluate their own listening, speaking, reading, writing, and translating skills using Likert Scales. The pre-test and post-test questionnaires test the same skills but with different wordings in the statements.

4.5 Data Collection and Analysis

Students were invited to fill out the pre-test questionnaire in Moodle at the very beginning of the semester, and answer the post-test questionnaire in Moodle at the end of the course. Students would choose from 1-5 to describe their own situations.

According Moodle record, 284 students filled out the pre-test questionnaire, and 173 students answered the post-test questionnaire (It is a pity that most of the students were busy preparing for the many final exams at the end of the semester hence and failed to fill out the questionnaire). In order to ensure consistency of the data, the author of the present paper excluded data from the participants that only answer the pre-test or the post-test questionnaire (Note that Moodle could automatically record the name and student ID of the questionnaire fillers), and made a list to match all the answers of pre-test and post-test questionnaires from a same participant. Finally, 145 pairs of pre-test and post-test questionnaires are ready for statistical analysis.

The data of the valid questionnaires were put into the SPSS (23.0) for reliability analysis. Result indicated that the questionnaires enjoyed a relatively high reliability ($\alpha=0.947$). After that, a paired sample T test was run to find out whether the students had benefited from the multi-mode blended learning model.

5 Teaching Effect

T test scores for the 15 items were collected (see Tables 2-6), presenting both the average scores of pre-test and post-test questionnaires, and two-tailed P values.

5.1 Listening Skills

Table 2 presents the paired samples T test results of students’ skills in understanding talks or lectures, radio or TV broadcasts, courses of specialty in English.
Table 2. Paired samples T test results of participants’ listening skills

<table>
<thead>
<tr>
<th></th>
<th>M (pre-test)</th>
<th>M (post-test)</th>
<th>P(two-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>talks or lectures</td>
<td>3.3448</td>
<td>3.5724</td>
<td>.002*</td>
</tr>
<tr>
<td>radio or TV broadcasts</td>
<td>2.4138</td>
<td>2.7034</td>
<td>.007*</td>
</tr>
<tr>
<td>courses of specialty</td>
<td>2.1517</td>
<td>2.4276</td>
<td>.017*</td>
</tr>
</tbody>
</table>

Note: The mark “*” indicates significant difference.

Results from Table 2 suggest that participants have significant improvement in overall listening skills (P values are: 0.002<0.05, 0.007<0.05, 0.017<0.05, respectively).

Therefore, the author of the present paper would argue that the teacher-student and student-student interaction in and out of the class, especially the Moodle-based video watching activity before class (participants are allowed to replay the videos until they understand the teaching contents) is beneficial in improving students’ listening skills. Actually, Caruso et al. (2017) had similar findings and argued that online listening tasks were “a key element in the development of listening skills”.

5.2 Speaking Skills

Table 3 presents the paired samples T test results of students’ skills in speaking fluently in daily conversations, expressing complex emotions, opinions, and describing personal experiences in English.

Table 3. Paired samples T test results of participants’ speaking skills

<table>
<thead>
<tr>
<th></th>
<th>M (pre-test)</th>
<th>M (post-test)</th>
<th>P(two-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>speak fluently in daily conversations</td>
<td>2.6897</td>
<td>2.8828</td>
<td>.081</td>
</tr>
<tr>
<td>express complex emotions, opinions</td>
<td>2.4345</td>
<td>2.6966</td>
<td>.025*</td>
</tr>
<tr>
<td>describe personal experiences</td>
<td>3.0690</td>
<td>3.2207</td>
<td>.185</td>
</tr>
</tbody>
</table>

Note: The mark “*” indicates significant difference.

Results from Table 4 suggest that participants have made some but not significant progress in having daily conversations and describe personal experiences (P values are: 0.081>0.05, 0.185>0.5). This phenomenon might result from the teacher’s failure to carry out related training. However, the paired samples T test suggests that participants have made significant progress in expressing complex emotions and opinions (P=0.025<0.05).

Table 4. Paired samples T test results of participants’ reading skills

<table>
<thead>
<tr>
<th></th>
<th>M (pre-test)</th>
<th>M (post-test)</th>
<th>P(two-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>articles from popular newspapers</td>
<td>2.7103</td>
<td>2.9931</td>
<td>.013*</td>
</tr>
<tr>
<td>texts of intermediate level</td>
<td>2.6759</td>
<td>3.0345</td>
<td>.003*</td>
</tr>
<tr>
<td>summary of literature</td>
<td>1.9448</td>
<td>2.3655</td>
<td>.000**</td>
</tr>
</tbody>
</table>

Note: The mark “*” indicates significant difference, while “**” indicates very significant difference.
Therefore, the author of the present paper infers that the assignments and group collaboration that aim at developing higher-order thinking skills, fulfilled before and in the class, are helpful in improving students’ communication skills and speaking skills.

5.3 Reading Skills

Table 4 presents the paired samples T test results of students’ skills in reading English articles from popular newspaper, texts of intermediate level and summary of literature.

As is noted in Table 4, participants have made significant improvement in the two subskills of reading articles from newspaper and texts with an intermediate level of difficulty (P values are: 0.013<0.05, 0.003<0.05, respectively). Meanwhile, participants reported great difficulty in understanding summary of literature in their areas of specialty, but have made very significant improvement (P=000<0.001).

Therefore, the author of the present paper infers that the videos on reading strategies provided in Moodle (participants are allowed to replay the videos until they master the strategies) are helpful for the students, and the reading tasks and assignments in Moodle provide students with opportunities to apply the strategies into practice, hence reinforce the reading skills.

This finding supports previous study by Schechter et al. (2015) that blended learning approach is effective in enhancing reading skills.

5.4 Writing Skills

Table 5 presents the paired samples T test results of students’ skills in writing practical texts on everyday topics, abstracts of thesis in specialty and well-structured short thesis in English.

<table>
<thead>
<tr>
<th>can write English…</th>
<th>M (pre-test)</th>
<th>M (post-test)</th>
<th>P(two-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>practical texts on everyday topics</td>
<td>3.0207</td>
<td>3.2897</td>
<td>.023*</td>
</tr>
<tr>
<td>abstracts of thesis in specialty</td>
<td>2.0276</td>
<td>2.4138</td>
<td>.000**</td>
</tr>
<tr>
<td>well-structured short thesis</td>
<td>2.3379</td>
<td>2.7586</td>
<td>.000**</td>
</tr>
</tbody>
</table>

Note: The mark “*” indicates significant difference, while “**” indicates very significant difference.

As is noted in Table 5, participants have made significant progress in writing practical texts on everyday topics (P=0.023<0.5). At the same time, participants reported poor performance in writing English abstracts of thesis in their own specialties, and difficulty in writing well-structured short thesis in their own specialties. However, they have made very significant improvement (P=0.000<0.001). This result echoes Milad’s (2017) finding that blended learning could help students improve academic writing skills.

In brief, the author of the present paper would argue that the videos on writing strategies provided in Moodle (participants are allowed to replay the videos until they succeed in developing the strategies), the asynchronous, synchronous forum/ virtual
“bulletin” board discussion, and online collaboration are beneficial for improving students’ writing skills.

### 5.5 Translating Skills

Table 6 presents the paired samples T test results of students’ skills in translating texts on general topics, literature in specialty and using proper translation techniques.

<table>
<thead>
<tr>
<th>can ...</th>
<th>M (pre-test)</th>
<th>M (post-test)</th>
<th>P(two-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>translate texts on general topics</td>
<td>2.9241</td>
<td>3.1931</td>
<td>.037*</td>
</tr>
<tr>
<td>translate literature in specialty</td>
<td>1.9310</td>
<td>2.3241</td>
<td>.000***</td>
</tr>
<tr>
<td>use proper translation techniques</td>
<td>2.7655</td>
<td>3.0759</td>
<td>.004*</td>
</tr>
</tbody>
</table>

Note: The mark “*” indicates significant difference, while “**” indicates very significant difference.

As is noted in Table 6, participants have made significant progress in use appropriate translation techniques to translate texts on general topics (P values are: 0.037<0.05 ; 0.004<0.05). At the same time, participants reported poor performance in translating literature related to their own specialties. However, they have made very significant improvement in the subskill (P=0.000<0.001).

Therefore, the author of the present paper infers that the videos on translating strategies provided in Moodle (participants are allowed to replay the videos until they master the strategies) are insightful for the students, and the translating tasks and assignments in Moodle provide students with opportunities to apply the strategies into practice, hence reinforce the translating skills.

### 5.6 Summary of the Section

According to the participants’ reports, they have made (very) significant improvement in terms of listening, speaking, reading, writing and translating skills.

It is interesting to note that the participants have made significant (but not very significant) improvement in the fundamental subskills of listening, speaking, reading, writing and translating; however, they have made very significant progress in the ability to handle works related to their own specialties. Possible explanation for this phenomenon is that the teacher and students had given much weight to the skills of reading English literature, writing short thesis and translate literature in students’ area of specialty.

### 6 Conclusion

Large language class instruction has posed great challenges to both teachers and students; furthermore, learning that occurs during the blended learning process could be far more sophisticated than a simple combination of online learning and face-to-face instruction.
Therefore, the author of the present paper develops a multi-mode blended learning model to teach large classes.

The developed model is composed of four key components (online learning, face-to-face instruction, out-of-class learning, and in-class learning), and four fundamental components (learning modes, interactions, thinking skills, and assessments).

With the help of the developed multi-mode blended learning model, teachers can divide a large class into groups and provide students with both online and face-to-face learning opportunities to interact and collaborate out of/in the class.

During this process, teachers can design a variety of Web 2.0 technologies enhanced activities to create chances for individual and collaborative learning, teacher-student and student-student interactions, and at the same time, develop lower-order and higher-order thinking skills, implement formative and summative assessments.

Results of the empirical study, as is described in the present paper, prove that the developed multi-mode blended learning model is effective in improving college students’ listening, speaking, reading, writing and translating skills in large class setting.

Therefore, a tentative conclusion can be made that the developed multi-mode blended learning model could be applied to optimize the procedure in teaching large classes and improve learning outcomes as well.

7 Limitation

It’s a little bit pity that the present study only collected 145 pairs of pre-test and post-test questionnaires out of the 284/360 participants that filled in pre-test questionnaires. In future’s data collection, the researcher would try to collect data in a more effective way, for instance, by asking the students to fill in the questionnaire in the final face-to-face section.

Another limitation is that the present paper failed to conduct language proficiency tests before and after the teaching experiment. Future study would be suggested to carry out pre/post-test of the participants’ language proficiency to reveal more detailed information of the teaching effect.

Acknowledgement

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References


The Analysis of Timeout Behaviors in Online Tests

Huixiao LE, Jiyou JIA

Department of Educational Technology, Graduate School of Education, Peking University.
5th YiheYuan Road, Hai Dian, Beijing, 100871, China
lehuixiao@pku.edu.cn, jjy@pku.edu.cn

Abstract. Based on a dataset of more than 7.4 million records of learners’ doing online tests activity in an online platform, and the concept of Online Learning Activity Index (OLAI), this paper analyzed the Timeout Behaviors in online tests and attempts to answer the following two questions: what are the characteristics of those online learners with timeout behaviors in online tests? Does the amount of questions in a test influence learners’ timeout behaviors? Descriptive statistics and correlation analysis are conducted to find the general pattern underneath the cases.

Keywords: Online learning, Online test, Online learning activity index, Learning Analytics

1 Introduction

1.1 Background

“Lexue 100” (Happy Learning for 100 Points, http://www.lexue100.com) is a web-based interactive learning system for school mathematics. A large number of corresponding quizzes are designed for the different versions of mathematics textbooks that are used in different provinces and metropolis in China. Each quiz is composed of a series of gap-filling or single-choice questions. So the question’s standard answer is predefined and can be compared with the user’s trial answer. The quiz score and feedback are instantly provided to the user, as soon as he or she submits the trial answers. Answering quizzes is the main learning activity in this system. Users are allowed to pass only if every answer gets right, meaning that if the first try is wrong, they will have to try again until the answer hits the point.

By mining learning activity data of some learners on this platform, figures like Fig.1 are often met when checking the histogram of learners’ time consumptions to complete a specific test on the platform. In these histograms, there is an apparent peak at 3600 seconds on the time axis.
When a learner does a test, his time consumption to complete the test will be recorded. If the time reaches an hour and the learner has yet not submitted the answers, the session between the client and server will expires, and a value of 3600 will be recorded as his time consumption of doing this test.

In this research, Timeout Behavior is defined as the behavior exhibited by a learner who failed to submit the answers before the time limitation of the test runs out. Such a learner is named as Learner with Timeout Behaviors (LTB), while the opposite (those who always manage to finish test in time) is named Learner with No Timeout Behaviors (LNTB). The reasons for the generation of a Timeout Behavior can be varied, such as equipment failure by doing tests, the learner ceases to do the test deliberately, and so on.

1.2 Research Questions

This research focus on the following two research questions:

1. What are the characteristics of LTBs and LNTBs? Do they have some featured distinctions?
2. Does the amount of questions in a test will influence learners’ Timeout Behaviors?

For the first problem, it’s an attempt trying to discover the pattern or distinction between LTBs and LNTBs, which would be an interesting topic in the field of Learning Sciences. To answer the first problems, emphasis should be laid on employing an indicator which could represent learners’ records of completing a test. Furthermore, comparisons between LTBs and LNTBs should be done.

For the second problem, the answer could offer not only the relationships between learners’ Timeout Behaviors when doing a test and the amount of questions of the test, but also suggestions to optimize a test, by setting a decent amount of questions in a test so as to reduce the happening of Timeout Behaviors.
2 Relevant Studies

According to Jia & Yu (2017), Analysis of online learning activities of has become an emerging field of research. Some scholars discussed the significance, necessities, and technical solutions of Learning Analysis such as Gu and Zhang (2012), Zheng and Yang (2016).

Wei (2011) applied conventional statistic methods combined with data visualization, clustering analysis and social network analysis to the analysis of data on a Moodle platform, and revealed the overall situation of interaction between the instructors and learners in online courses meanwhile discovered the learners’ preference of visiting some modules and time to log in. Jia, Miao & Wang (2014) conducted detailed analysis to data generated from MOOCs of Peking University, trying to find out the impact of a learner’s online learning activities on his scholastic attainments on a course’s level. Results of correlation analysis showed a strong positive relation between a learner’s grades of daily quizzes together with his liveness in participating learning activities and scholastic attainments.

Jia & Yu (2017a) developed Learning Activity Index (LAI) and Online Learning Activity Index (OLAI) to evaluate how well a student completes an activity in terms of speed, quality and quantity. It showed that scores were strongly and positively correlated with OLAI, and OLAI can predict learning achievements in a satisfactory manner. Moreover, Jia & Yu (2017b) design the personalized instructional strategies adaptive to the learner’s OLAI and the OLAI of the learning group.

2.1 OLAI

According to discussions in section 1.2, this research adopts OLAIMMA as the indicator to represent the learners’ performance when completing an online test. “OLAI is used to demonstrate how well an online learning activity is going on”. The value of OLAI is the sum of its three dimensions – “Speed”, “Quality” and “Quantity”.

Whenever a learner completes a test (including the situation when time runs out), the server will insert a new record including the time used to complete the test (usetime), the difference between a usetime and a standard time given by the system (difference), and a list that contains his every input into the input boxes (result). By parsing the result list, the amount of questions in a test (question_number), the attempts he made to answer a question (tries), times of his giving wrong answers (wrongs) and times of his guessing to cope with some questions (guesses) can be got. Listed are the formulas which describes how “Speed”, “Quality” and “Quantity” can be calculated:

\[
\text{Speed} = \frac{\text{difference}}{\text{usetime} + \text{difference}} \quad (1)
\]
\[
\text{Quality} = \frac{\text{question_number} - \text{guesses}}{\text{question_number} + \text{tries}} \quad (2)
\]
\[
\text{Quantity} = \frac{\text{question_number}}{\text{standard_number}} \quad (3)
\]
\[
\text{OLAI} = \text{Speed} + \text{Quality} + \text{Quantity} \quad (4)
\]
OLAIMMA (OLAI Mean of All Activities) can reflect the general performance of a learner in a certain period of time. Analogously, it also has three dimensions: “Speed”, “Quality” and “Quantity”. Using OLAIMMA and its three dimensions, a relatively thorough indicator to describe a learner’s general learning behavior is obtained.

3 Learners as research subject

For all the learners involved in the dataset, take all the records as the time extent, calculate each’s OLAIMMA and a feature vector $\alpha$ with 4 dimensions is obtained, representing a learner’s general performance in terms of “Speed”, “Quality” and “Quantity”.

$$\alpha = (\text{Speed}, \text{Quality}, \text{Quantity}, \text{OLAIMMA})$$

(5)

Screen all the 98,720 learners involved, remove those learners who has less than 5 records involved in the dataset, and pick those who has at least one record in which the time used reaches 3600, 9,255 learners are found to be LTBs, accounted for 13.7% of the population, while the rest of the learners are LNTBs (57,992 learners).

Using $r_c$ to reflect the tendency of a learner to have Timeout Behaviors, $r_c$ can be defined as follows. In formula 6, $c_t$ is the total counts of a learner’s records in which the time used reaches 3600, $c$ is total counts of the learner’s records in the dataset.

$$r_c = \frac{c_t}{c}$$

(6)

3.1 Descriptive statistics

Fig. 2 is the histogram of LTBs, with $r_c$ being the x-axis and count be the y-axis.

![Fig. 2 rc-count histogram of LTBs](image)

The maximum $r_c$ in LTBs is 0.61 while the minimal is 0.00029. The mean and variance of $r_c$ is 0.04 and 0.0027. A more detailed description of LTBs is given in Table 1.
Table 1. r*c value, count and proportion in LTBs

<table>
<thead>
<tr>
<th>r*c value</th>
<th>count</th>
<th>proportion in LTBs</th>
</tr>
</thead>
<tbody>
<tr>
<td>[0,0.03)</td>
<td>5,637</td>
<td>60.90%</td>
</tr>
<tr>
<td>[0.03,0.06)</td>
<td>1,926</td>
<td>20.81%</td>
</tr>
<tr>
<td>[0.06,0.1)</td>
<td>886</td>
<td>9.57%</td>
</tr>
<tr>
<td>[0.1,0.3)</td>
<td>743</td>
<td>8.03%</td>
</tr>
<tr>
<td>[0.3,0.61)</td>
<td>62</td>
<td>0.067%</td>
</tr>
</tbody>
</table>

We compare LTBs and LNTBs in the perspective of “Speed”, “Quality” and “Quantity”, and make histograms of these two groups:

![Histograms of LTBs and LNTBs](image)

Fig. 3. Comparison of between LTBs and LNTBs, taking different dimensions of α as x-axis

Fig. 3 shows a figure consist of four histograms, in all the four histograms, red portion represents the LNTBs and green portion represents LTBs. The upper left one reveals the relation between “Speed” and count, meanwhile the x-axis of the upper right one is “Quality”, “Quantity” for the lower left one and “OLAIMMA” for the lower right one. A more detailed comparison is given in Table 2.

Table 2. Detailed Comparison of LTBs and LNTBs in four dimensions of α

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Group</th>
<th>Mean</th>
<th>Variance</th>
<th>Maximum</th>
<th>Minimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Speed”</td>
<td>LTBs</td>
<td>-0.52</td>
<td>0.63</td>
<td>0.58</td>
<td>-27.77</td>
</tr>
<tr>
<td></td>
<td>LNTBs</td>
<td>-0.22</td>
<td>0.17</td>
<td>0.84</td>
<td>-25.45</td>
</tr>
<tr>
<td>“Quality”</td>
<td>LTBs</td>
<td>0.89</td>
<td>0.002</td>
<td>0.99</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>LNTBs</td>
<td>0.91</td>
<td>0.002</td>
<td>1</td>
<td>0.27</td>
</tr>
<tr>
<td>“Quantity”</td>
<td>LTBs</td>
<td>2.11</td>
<td>0.42</td>
<td>9.87</td>
<td>0.34</td>
</tr>
<tr>
<td></td>
<td>LNTBs</td>
<td>1.82</td>
<td>0.57</td>
<td>8.78</td>
<td>0.09</td>
</tr>
<tr>
<td>OLAIMMA</td>
<td>LTBs</td>
<td>2.48</td>
<td>1.13</td>
<td>10.03</td>
<td>-25.60</td>
</tr>
<tr>
<td></td>
<td>LNTBs</td>
<td>2.52</td>
<td>0.83</td>
<td>9.44</td>
<td>-24.10</td>
</tr>
</tbody>
</table>

From the perspective of “Speed”, LTBs and LNTBs are in right-skewed distribution, the mean “Speed” value of LNTBs is greater than LTBS, with a less variance. From the
perspective of “Quality”, the mean and variance of “Quality” value are nearly equal. From the perspective of “Quantity”, the mean “Quantity” value of LTBS is greater than that of LNTBs while the variance is less LNTBs. From a more general point of view – OLAIMMA, LTBS’ mean value of OLAIMMA is greater than LNTBs and the variance is less.

Furthermore, for a specific learner, $\alpha$ can describe his or her general behaviors when doing online tests. Taking two dimensions from “Speed”, “Quality” and “Quantity” as the two axis of the scatter diagram each time, plot all the learners’ value. Fig. 4 is obtained.

In Fig. 4, the red dots represent LNTBs and the green dots represents LTBS. The upper left one takes quality-quantity ($x$-$y$) as two axes, the upper right one takes speed-quantity and the lower one takes quality-speed.

3.2 Correlation analysis

Taking $r_c$ and quality, $r_c$ and quantity, $r_c$ and speed, $r_c$ and OLAIMMA in the whole population (bind LTBS and LNTBs together) as the parameters of Pearson correlation analysis, the result is given in Table 3.

<table>
<thead>
<tr>
<th></th>
<th>$r_c$ - quality</th>
<th>$r_c$ - quantity</th>
<th>$r_c$ - speed</th>
<th>$r_c$ - OLAIMMA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson correlation coefficient</td>
<td>-0.17</td>
<td>0.17</td>
<td>-0.32</td>
<td>-0.044</td>
</tr>
</tbody>
</table>

The result shows that $r_c$ has weak negative correlation to “Quality”, weak positive correlation to “Quantity” and moderate negative correlation to “Speed”. Meanwhile, $r_c$ is uncorrelated to OLAIMMA.
3.3 Discussion

From the result of analysis above this issues deserve a prominent place in this section: It’s hard to find a significant distinction between LNTBs and LTBs under the circumstance that $\alpha$ is used to represent the features of a learner’s general behavior when doing online tests. Actually, the “Speed” value is directly related to Timeout Behaviors. It’s obvious that formula 1 implies that if someone has Timeout Behaviors, his “Speed” value of OLAI will be significantly influenced and be set to a minimal value of all the learners who do the same test.

The “Quality” value shows a weak negative correlation with $rc$, there could be two possible explanations for this: 1. The LNTBs are more likely to be more skilled in handling the test, which implies that they may have a better acquirement of knowledge. 2. Timeout Behaviors also implies that the test is ended with several questions not answered. In this way, they will get a worse “Quality”. Nevertheless, which may be the real reason (or both could be) of the negative correlation between “Quality” value and $rc$ remains a problem.

The “Quantity” value shows a positive correlation with $rc$, and the reason for this could be that all the learners are obligated to do the tests - if failed, another chance will be given until he passes the test. So once a record shows a Timeout Behavior, it also indicates that this time, the learner should have the test again, which also means that he will do more questions, accounting for a higher value of “Quantity”. However, if this should be the only reason or there should be some other reasons for the positive correlation remains to be discovered.

OLAIMMA is the sum of the three values mentioned above, so it’s not so surprising that it should indicates no significant differences between the LNTBs and LTBs.

4 Tests as research subject

According to section 1.2, another research problem is to find out if the amount of questions in a test will influence learners’ tendency to have Timeout Behaviors when doing the test.

Of all the 7.4 million records in the dataset, there are 26,555 tests with more than 20 record counts (at least 20 learners have completed that test). Among those 26,555 tests, there are 8,983 tests are TTBs, accounted for 33.9\% of the population. $rt$ is the indicator which reflects the proportion of leaners who fail to complete the test before time runs out.

$$rt = c_l / c$$  \hspace{1cm} (7)

In formula 7, $c_l$ is the count of the records of a test in which the time used reaches 3600 seconds and $c$ is the total count of the records of the test in the dataset.
4.1 Descriptive statistics

For every test in TTBs, the mean value of $r_t$ is 0.025 and the variance is 0.0013. The value falls into 0.000119 to 0.43, among which the proportion of $r_t$ less than 0.1 accounts for 96.3% of TTBs.

A histogram is made to compare the TTBs and TNTBs (Fig. 5). In Fig. 5, red portion is TNTBs and green portion is TTBs. The x-axis is the amount of the questions in a test and the y-axis is the count.

![Fig. 5. Histogram of amount of questions in a test, comparing TTBs and TNTBs](image)

For all the tests in TNTBs, the mean value of the amount of questions in the test is 32.66 and the variance is 1.067.04. While for TTBs, the mean value reaches 45.96 and the variance is 2.466.79. Taking the question amount in a test as the x-axis and $r_t$ as the y-axis, the scatter diagram is shown as Fig. 6.

![Fig. 6. Scatter diagram of TTBs](image)

4.2 Correlation analysis

Taking the question amount in a test and $r_t$ as two parameters, the Pearson correlation coefficient between the two factors is 0.233, which indicates that the question amount and $r_t$ has weak positive correlation.
4.3 Discussion

Result shows that the amount of questions in a test has a positive correlation to \( r \), which means that learners may be more likely to cease or give up answering questions when facing a test with a larger number of questions.

5 Conclusion

This research mines data from xuele100.com and tries to answer the two questions: what are the characteristics of those online learners with timeout behaviors in online tests? Does the amount of questions in a test will influence learners’ timeout behaviors? Online Learning Activity Index (OLAI) is applied as the indicator to represent the characteristics of online tests. Through descriptive statistics and correlation analysis, the research comes up with two main findings:

1. Taking OLAI and its three dimensions as the features, it’s hard to find some significant distinctions between the LTBs and LNTBs.
2. Learners may be more likely to cease answering questions when facing a test with a large number of questions.

Future study directions will focus on developing a new model to represent the characteristics of LTBs and LNTBs, with the aim of discovering the hidden distinction between the two groups. At the meantime, how to optimize the amount of questions in an online test is also a topic worth studying.

Acknowledgement

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References


Effects of Integrating a Concept Mapping-based Summarization Strategy into Flipped Learning on Students’ Learning Performances in Reading Comprehension

Gwo-Jen HWANG, Mei-Rong Alice CHEN*, Meng-Hsuan LIN, Han-Yu SUNG

Graduate Institute of Digital Learning and Education, National Taiwan University of Science and Technology
No.43, Keelung Rd., Sec.4, Da’an Dist., Taipei Taiwan

*mralice@mail.ntust.edu.tw

Abstract. The capability of reading comprehension is one of the essential skills for learning different topics and has been recognized as a challenging objective in Chinese curriculum. In this study, a concept mapping-based summarization strategy was incorporated into flipped learning for improving students’ reading comprehension. The participants of the study were 45 fifth graders from two Mandarin Chinese classes at an elementary school in Taiwan. All of the students did not have previous flipped-learning experience. A pre-test and post-test of reading comprehension as well as pre- and post-questionnaires for measuring the students' reading motivation, self-efficacy, and cognitive load were conducted. The experimental results show that the proposed approach not only improved the students’ summarization skills, but also highly-motivated students showed better self-efficacy and minimize cognitive load. Consequently, the study concluded that employing the concept mapping with summarization strategy into flipped learning and students’ summarization ability are directly related, but it may be indirectly related to reading comprehension.

Keywords: flipped classroom, concept map, summarization strategy, reading comprehension, self-efficacy

1 Introduction

One of the main objectives of Mandarin Chinese courses at elementary schools in Taiwan is to help students improve reading comprehension skills. Traditional lecture and class activities are in a way to fulfill this objective. Students need to learn from the lecture through the teachers to the textbook reading before they can take part in the class activities in class. Also, elementary students are required to be able to read and summarize the reading materials, but their reading proficiency differs considerably among them. Therefore, it’s time consuming and difficult that students can be trained

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all kinds of reading skills in the class. Flipped learning could be one of the approaches to solve the dilemma as mentioned above. There is more practicing and interaction time with peers and teachers in class. Unlike the conventional classroom lecture, the flipped learning makes the most of the student learning (McKeachie & Svinicki, 2013). The use of Flipped Classroom method involves students to preview the course reading and material before the class, which allows teachers to devote more time to demonstrating the activities, and observing students as they work together with their peers in the classroom. Besides, it will enable teachers make use of the precious class time to foster students higher order thinking (Wainwright 2011; Khan, 2012).

The relationship of reading comprehension through concept mapping lies in what students need to find relevant and essential concepts among the words and paragraphs in the texts when reading the article and use the characteristics of the concept map to draw the connection between ideas (Liu, Chen, & Chang, 2010). After students complete the concept map, they can easily review the relationship between the ideas of the article again. This learning model can develop schemata (units of knowledge) (Kintsch & Van Dijk, 1978), and provide meaningful learning to integrate the understanding of the article (Mintzes, Wandersee, & Novak, 1998).

Efficient readers can monitor themselves, reinforce their self-awareness, and use appropriate strategies to read and comprehend the contents (Bereiter & Bird, 1985). Summarizing strategy can help students to discern the most important ideas in a text. It requires students to comprehend, analyze and synthesize ideas from a text. (Williams, 1988). Therefore, this study presents an approach of integrating a concept mapping-based summarization strategy into flipped learning in Mandarin Chinese courses at an elementary school: students view a video of textbook materials before class, and then they work on concept map worksheet and summary with their peers in the class.

An experiment has been conducted in two Mandarin Chinese classes at an elementary school to response the following research questions:

1. Can integrating a concept mapping-based summarization strategy into flipped learning approach help students improve their summarization skills in comparison with the conventional summarization strategy?
2. Can integrating a concept mapping-based summarization strategy into Flipped class approach help students improve their reading comprehension in comparison with the conventional summarization strategy?
3. Can integrating a concept mapping-based summarization strategy into Flipped class approach help students increase their reading motivation in comparison with the conventional summarization strategy?
4. Can integrating a concept mapping-based summarization strategy into flipped learning approach help students increase their self-efficacy in comparison with the conventional summarization Strategy?
5. Do students learning in integrating a concept mapping-based summarization strategy into the Flipped class approach and the conventional summarization Strategy have significantly different cognitive loads?
6. What is the relationship between students' cognitive loads, reading motivation, self-efficacy, reading comprehension, summarization skills?
2 Research background

2.1 Reading comprehension strategy

Reading comprehension can help learners build up meaning through the text passages which is one of the objectives in reading instruction. The learners should be capable of constructing meaning and link connections based on their prior knowledge and the readings. The more prior knowledge the learners have acquired about a subject before reading, the more they can link the connections between what they know and what they read. Making connections is a strategic component to reading comprehension. For example, the learners can read the texts and find the typographical prompts: headings, subheadings, and paragraphs, as guides of text structure. This was the approach used by Taylor and her colleagues in their "hierarchical summarization" research (Taylor & Beach, 1984). In their study, the learners tried to recognize and write the main ideas that integrate or bond with the other ideas of the passages into a logical whole. Summarizing involves students to piece together and condense the main ideas and supporting details of several paragraphs into a concise key point text. There are six principles of summarization strategies for reading comprehension (Kintsch & van Dijk 1978). The summarization strategies were adapted from the first three principles proposed by Brown and Day (1983): (1) deleting unnecessary material, (2) deleting trivial material, (3) deleting material that is redundant substituting a superordinate term for a list of items).

2.2 Concept mapping

Concept mapping can process and visualize information to support students understand reading texts (Palinscar & Brown, 1984). Researchers have indicated concept mapping is an applicable instruction approach for facilitating students to structuralize and present conceptual information using their visualization skills to improve their study skills (Gurlitt & Renkl, 2010). Concept mapping could help learners locate the links between causes and effects, foster creativity and strengthen students’ information organization (Novak & Musonda, 1991). Additionally, concept mapping can raise learners’ metacognition when they are acquiring knowledge so it can be used to benefit the way they learn. It has been perceived as a beneficial instrument that can facilitate students' understanding and retention during the learning procedure (Pankratius, 1990; Ruiz-Primo et al., 2001). Moreover, it is an efficient tool that empowers students to simplify the associations between concepts (Zwaal & Otting, 2012) and increase their information retention through the process of recognizing and organizing the relationships between concepts. Learners are required to have the knowledge representation in the mental or conceptual structure in mind to understand an idea (Halford, 1993). A concept map can make overt such a representation. The capability to build a concept map also illustrates two essential properties of understanding, the representation and the organization of ideas. This study was adopted an expert concept map which is drawn by teachers to help
students organize their knowledge, organize their understanding and improve teaching efficiency (Hall, Dansereau, & Skaggs, 1992).

3 Instructional designs

3.1 Video used in the flipped learning

In the flipped learning, the video was created and edited by using Camtasia Studio by two experienced teachers and adopted readings from elementary Mandarin Chinese Text Books of Hanlin Publishing. Three readings were taught: “Never too late”, “Exploring Sihcao Green Tunnel”, and “Spirit of Universal Fraternity for All Eternity”. The selected readings are structuralized so that students can understand the video content fully before attempting the summary. The animation, sentence structure analyzing, the main idea of the paragraph, and summarization strategies are included in the video. Each video lasts 15 minutes.

Fig. 1 shows the animation of the reading contents- “Having a dream is extraordinary.” Fig. 2 demonstrates a sentence structure-“not only… but also…” . For example, “52-year-old Clerk was not only suffering from diabetes and arthritis but also had a thyroid surgery.” Fig 3 displays summarization strategies. “Rules of deletion are deleting trivial and repetitious information from the text passage: erasing phrases that repeat, deleting redundant adjectives and over illustration.”

![Fig. 1. Animations in Flipped class video](image-url)
3.2 Concept map design

All participants were instructed the same class teaching activities and materials and were distributed a pre-test, post-test, and questionnaires. In the experimental group, the
class activities and teacher-students interaction were as follows: PowerPoint-based lectures, questions asking, group discussion, and filling in an expert concept map worksheet as Fig. 4.

Fig. 4. An example worksheet for experimental group—an expert concept map

Fig. 5. An example worksheet for control group

In the control group, the teacher delivered a lecture of the reading article. The students then discussed in groups and filled in a worksheet as Fig. 5 about the main ideas of paragraphs.
4 Method

To verify the impact of the "Integrating a Concept Mapping-based Summarization Strategy into Flipped class" on the student's learning outcomes and learning achievement, quantitative and qualitative instruments of data collection examined the participants’ outcome of this study model as in Fig 6. illustrated.

Fig. 6. Variables and instruments involved in the study

4.1 Participants

In this study, a total of forty-five fifth graders from two Mandarin classes at an elementary school participated in the experiment. They were instructed by the same teacher, and they had minimal to zero relevant experience in the flipped-learning. One class was allocated to a concept mapping-based summarization strategy into Flipped class Model (n=20) as an experiential group while the other learned with conventional summarization strategy into Flipped class Model (n=25) as a control group.

4.2 Procedure

This study was conducted in 8 weeks in the computer lab classrooms. Both experiential and control groups completed a pretest of reading comprehension, prequestionnaires of reading motivation, and self-efficacy. There were three readings included in this experiment. Before the class lecture, students were required to write down new words, phrases or sentences in the monitoring worksheets they do not understand while watching course animated videos. Each video includes the cartoon animation of the
readings, sentence structure analyzing, the main idea of the paragraph, and summarization strategies.

In the class, the teacher first taught Chinese characters, phrases, and sentences which students did not understand in the monitor worksheets. Then, the classes were taught to identify the main ideas of the reading and demonstrated one paragraph of summarization. In the experimental group, students first discussed in groups, then completed concept map worksheet and summary. On the other hand, students discussed the main idea of each paragraph then summarized the reading.

After all the class activities, a proficiency reading test, summarization, a post-reading comprehension test, reading motivation, self-efficacy, and cognitive load questionnaires were conducted. Six students from each group were selected to have an interview. Fig 7 displays the data collection process of the study, and Fig. 8 exhibits procedure of the study.

**Fig. 7.** Process of the data collection
4.3 Instruments

To examine the participants’ reading proficiency, they completed pre-and post-tests of reading comprehension tests. The test questions were created by Ministry of Education (2011) according to Progress in International Reading Literacy Study (PIRLS). There were descriptive passages ($\alpha=0.7$), narrative passages ($\alpha=0.71$) including 17 multiple choice and three short answer questions in the pretest. In post-test, expositive passages ($\alpha=0.74$), narrative passages ($\alpha=0.75$) were included and consisted of 15 multiple choice and five short answer questions. The total number of questions for each Reading Comprehension is 20. The total is 100 points. The Motivation for Reading Questionnaire (MRQ) was adapted from Wigfield and Guthrie (1997) (Motivation for Reading Questionnaire, MRQ), after revising the MRQ to assess different aspects four aspects of reading motivation. There were seven items of extrinsic motivation ($\alpha=0.90$), eight items of intrinsic motivation ($\alpha = 0.856$), five items of reading efficacy ($\alpha=0.91$), and four items of social motivation for reading ($\alpha=0.78$).

Self-Efficacy scale was revised from the self-efficacy subscale of the Motivated Strategies for Learning (Pintrich et al., 1991). It consists of 8 items ($\alpha=0.913$) in the cognitive load questionnaire (Hwang et al., 2013). All items of questionnaires were presented on a one to five Likert scale.

**Fig. 8.** Procedure of the study
The seven questions of the interview were chosen from the Interview Questionnaire (Hwang et al., 2009). Summary Rubric was adapted from the Garner’s process (Garner et al., 1985). The scores were graded against the chosen Summary Rubric by the two experienced teachers. The reliability was measured at alpha. 0.9. The means were calculated as participants’ scores.

5 Results

5.1 Summarization

After the learning activities, the analysis of covariance (ANCOVA) was employed to analyze the summarization scores of the two groups using the first summarization scores as the covariate and the post summarization scores as dependent variables, and Summarization Strategy approach as an independent variable. Table 1 shows the ANCOVA results, which the scores of the two groups reached a significant level with $F=8.127$, $p <.05$. There was a significant difference between the two groups. The mean value was 2.69 for the experimental group which was higher than 1.45 for the control one. The students who adopted the "Integrating a Concept Mapping-based Summarization Strategy" show summarization skills significantly better than those who learned with “traditional Summarization Strategy into Flipped Class.”

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Adjusted mean</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>20</td>
<td>2.85</td>
<td>0.34</td>
<td>2.69</td>
<td>8.127**</td>
</tr>
<tr>
<td>Control</td>
<td>25</td>
<td>1.44</td>
<td>0.27</td>
<td>1.45</td>
<td></td>
</tr>
</tbody>
</table>

Note: ** $p < .01$

5.2 Reading comprehension

From the ANCOVA analysis in Table 2, no significant difference was found between the scores of experimental and control groups $F = 0.69$ ($p > .05$). From the results, the control group (M =66.38) higher than the experimental group (M = 61.80).

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Adjusted mean</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>20</td>
<td>60.05</td>
<td>2.91</td>
<td>61.81</td>
<td>0.69</td>
</tr>
<tr>
<td>Control</td>
<td>25</td>
<td>67.40</td>
<td>2.56</td>
<td>66.37</td>
<td></td>
</tr>
</tbody>
</table>

There can be two reasons that the results of this study are not in line with the prediction. One of the possible reasons for such unexpected findings may be partially attributable to the insufficient training time of the participants. The experimental time was only last for 3 weeks. We infer that students might not have acquired the Concept Mapping-based Summarization Strategy yet. It really takes time to acquaint students with this new learning approach. Therefore, they are not familiar sufficiently to apply this new approach in their reading. Another reason is
the difficulty of the test questions. The test questions were according to Progress in International Reading Literacy Study (PIRLS) which including higher order thinking. In addition, test questions intend to evaluate students overall understanding of a reading and demonstrate their ability to think critically. However, most students in both groups simply leave short-answer questions blank. Therefore, this might be the cause of insignificant results.

5.3 Reading motivation

Table 3 shows the t-test results of the pre- and post-questionnaire scores in the two groups. It is found that after participating in the learning activities, the experimental group students’ extrinsic motivation, intrinsic motivation, reading efficacy, and social motivation did not show significant improvement while control group students’ extrinsic motivation ($t=2.45$, $p<.05$), intrinsic motivation ($t=3.10$, $p<.001$) were significantly reduced.

<table>
<thead>
<tr>
<th>Group</th>
<th>Variable</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre extrinsic motivation</td>
<td>20</td>
<td>3.05</td>
<td>0.76</td>
<td>0.0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Post extrinsic motivation</td>
<td></td>
<td>3.05</td>
<td>0.69</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pre intrinsic motivation</td>
<td>20</td>
<td>3.40</td>
<td>0.82</td>
<td>0.0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Post intrinsic motivation</td>
<td></td>
<td>3.40</td>
<td>0.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>Pre Reading efficacy</td>
<td>20</td>
<td>2.80</td>
<td>0.95</td>
<td>0.33</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Post Reading efficacy</td>
<td></td>
<td>2.75</td>
<td>0.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pre social motivation</td>
<td>20</td>
<td>3.11</td>
<td>0.85</td>
<td>0.1</td>
<td>0.92</td>
</tr>
<tr>
<td></td>
<td>Post social motivation</td>
<td></td>
<td>3.10</td>
<td>1.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>Pre extrinsic motivation</td>
<td>25</td>
<td>3.56</td>
<td>0.77</td>
<td>2.45*</td>
<td>0.02*</td>
</tr>
<tr>
<td></td>
<td>Post extrinsic motivation</td>
<td></td>
<td>3.16</td>
<td>0.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pre intrinsic motivation</td>
<td>25</td>
<td>3.56</td>
<td>0.77</td>
<td>3.1**</td>
<td>0.00***</td>
</tr>
<tr>
<td></td>
<td>Post intrinsic motivation</td>
<td></td>
<td>3.16</td>
<td>0.62</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pre Reading efficacy</td>
<td>25</td>
<td>3.04</td>
<td>0.61</td>
<td>1.16</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>Post Reading efficacy</td>
<td></td>
<td>2.88</td>
<td>0.53</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pre social motivation</td>
<td>25</td>
<td>3.25</td>
<td>0.69</td>
<td>1.73</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Post social motivation</td>
<td></td>
<td>2.92</td>
<td>0.76</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *$p<.05$; *** $p<.001$

The effect is significantly decreased in the control group which means concept mapping based summarization strategy worked better for maintaining student motivation.

5.4 Cognitive load

The cognitive loads of the two groups were analyzed and compared. The result is shown in Table 4. It is found that there is no significant difference between the two groups of students ($t = -1.533$, $p > 0.05$).
Table 4. t-test results of the cognitive load levels of the two groups

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>20</td>
<td>2.51</td>
<td>0.76</td>
<td>-1.533</td>
<td>0.133</td>
</tr>
<tr>
<td>Control</td>
<td>25</td>
<td>2.85</td>
<td>0.69</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

T-Test result of the cognitive load levels of the two groups shows no significant different. As previous studies claim that effective instructional strategies can be used to minimize cognitive load in learners. Both groups’ learners use the summarization strategies which help. With the concept map one decrease slightly more than the conventional summarization one used alone.

5.5 The relationship among students’ cognitive loads, reading motivation, self-efficacy, reading comprehension, summarization skills

Intrinsic motivation of experimental group students was significantly correlated with other variables. Extrinsic motivation was significantly correlated with reading performance, self-efficacy and reading comprehension.

Table 5. The correlations of experimental group

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Extrinsic motivation</th>
<th>Intrinsic motivation</th>
<th>Reading efficacy</th>
<th>Social motivation</th>
<th>Self-efficacy</th>
<th>Cognitive load</th>
<th>Summarization skills</th>
<th>Reading comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>extrinsic motivation</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>intrinsic motivation</td>
<td>.710*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reading efficacy</td>
<td>.707**</td>
<td>.489*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>social motivation</td>
<td>.744*</td>
<td>.641**</td>
<td>.557*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>self-efficacy</td>
<td>.703*</td>
<td>.688*</td>
<td>.725**</td>
<td>.407*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cognitive loads</td>
<td>.037</td>
<td>-.093</td>
<td>-.060</td>
<td>.134</td>
<td>-.138</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>summarization skills</td>
<td>.078</td>
<td>.463*</td>
<td>-.103</td>
<td>.240</td>
<td>-.100</td>
<td>-.127</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>reading comprehension</td>
<td>.589*</td>
<td>.704**</td>
<td>.394</td>
<td>.345</td>
<td>.457</td>
<td>-.104</td>
<td>.483*</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: *p< .05, ** p< .01, *** p< .001

In the control group, extrinsic motivation, intrinsic motivation, and cognitive load are significantly correlated. Without the help of concept map, learning motivation and learning performance are not directly correlated. In short, it shows that with the help of the concept map, better self-efficacy and learning performance for highly-motivated students.
Table 6. The correlations of control group

<table>
<thead>
<tr>
<th></th>
<th>Extrinsic motivation</th>
<th>Intrinsic motivation</th>
<th>Reading efficacy</th>
<th>Social motivation</th>
<th>self-efficacy</th>
<th>cognitive loads</th>
<th>summarization skills</th>
<th>Reading comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>extrinsic motivation</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td></td>
<td></td>
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</tr>
<tr>
<td>reading efficacy</td>
<td>.568**</td>
<td>.695**</td>
<td>1</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>social motivation</td>
<td>.116</td>
<td>.204</td>
<td>.184</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>self-efficacy</td>
<td>.474*</td>
<td>.616**</td>
<td>.416*</td>
<td>-.311</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cognitive loads</td>
<td>-.435*</td>
<td>-.423*</td>
<td>-.225</td>
<td>.313</td>
<td>-.479*</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>summarization skills</td>
<td>-.037</td>
<td>.159</td>
<td>-.215</td>
<td>.278</td>
<td>-.114</td>
<td>.085</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>reading comprehension</td>
<td>-.061</td>
<td>.175</td>
<td>-.205</td>
<td>.021</td>
<td>.024</td>
<td>-.048</td>
<td>.623**</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: *p < .05, **p < .01, ***p < .001

6 Discussion and Conclusion

In this study, integrating a concept mapping-based summarization strategy into Flipped class in Mandarin Chinese course is proposed for improving students’ reading comprehensions, summarization skills. Similar results also show in the previous study. Summarization strategies help students improve their summarization skills (Jitendra, Hoppes, & Xin, 2000). Using concept mapping to scaffold learning for students has proven effective (Kazakoff, 2009). It was found that the students who learned with this proposed strategy showed significantly better summarization skills than those who learned with the conventional ones.

Since the comprehensions test scores between the two groups did not show the significant different, the test design was not directly reflected the concept map connection into the test items. There are two plausible causes. It is time-consuming for acquiring the strategies. Strategy use is integrated with the process of reading for meaning. However, students do not seem ready to apply strategies to increase their comprehension of text meaning. All learning needs time to assimilate, absorb and make the connection with our prior knowledge. In addition, the pretest and post test questions not only focus on retrieve explicitly stated information but also types of the questions are challenging for Taiwanese students. They had a hard time in short answer questions because they are not familiar with it. So both groups left short answer questions blanks which might lead to insignificant results. Therefore, there are some factors that a researcher should take into consideration in the future from this study. First, the acquisition of new skills can be technically demanding. Second, levels of the difficulty of acquiring skills should be considered.
Third, a certain amount of time is required. Fourth, promote dynamic instructional strategies in reading for stimulating critical and creative thinking. Fifth, flipped video assignments at students' levels should be included.

To sum up, there are several contributions of this study. First, the results show that combining a concept mapping with summarization strategy into flipped learning mode show summarization skills significantly improved more than those who learned with traditional one. Second, highly-motivated students show better self-efficacy, learning performance and minimize cognitive load from the findings in this study. It is concluded that concept mapping with summarization strategy into flipped learning and students' summarization ability are directly related, but it may be indirectly related to reading comprehension.

References

Can Entrustable Professional Activities Drive Learning: What We Can Learn from the Jesuits

Spencer H. L. WAN

School of Medicine, Western Sydney University, Australia
honlamwan@gmail.com

Abstract. Entrustable Professional Activities (EPAs) has recently been the buzzword in medical education and in the realm of the healthcare professions. Medical professional bodies and medical educators worldwide envision the development of EPAs as a promising approach to overcome the difficulties in assessing their trainee’s competencies in a work-integrated learning (WIL) clinical environment. Albeit numerous research has been done on how EPAs can be used as a stopwatch type of competencies assessment method helping to ensure medical trainees are judged to be the best based on well-tested as well as agreed-upon meaningful standards, the prime and essential question of how best EPAs could drive students’ daily self-directed learning for their continuous professional development of expertise remains largely unanswered. Amid this leading-edge development in the competency-based medical education (CBME) along with the important role healthcare has to play in the 21st century’s global society, there is an increasing need to understand current processes of change and the impact this will have on preparing medical professionals and on healthcare in the coming future. With this endeavour in mind, this paper provides an update on the progress of this gradually establishing approach to competency-based medical education, identifies the essence of this emerging novel workplace-based assessment method in relations to a review of the contemporary competency-based medical education, and finally explores how Jesuit’s wisdom could be used in furthering EPAs’ potential impact on attainment of medical education’s mission.

Keywords: Entrustable professional activities (EPA), work-integrated learning (WIL), Jesuit, medical education, competency-based assessment process, clinical settings

1 Background

There is an interesting phenomenon in the contemporary medical education worldwide - the seemingly endless quest for the adoption of a competency-based medical education (CBME) as a better alternative to the traditional time-based education.

Over centuries, there have been numerous calls for reform in medical education and had stimulated countless project efforts at international, national and state levels, large and small, aiming to move forward medicine to a competency-focused model ever since
the release of the Abraham Flexner's legacy report (Flexner, 1910) on how future doctors should be prepared (Frank et al., 2010; Hodges, 2010; Cooke et al., 2009; Irby et al., 2010). Apparently, these past reforms were undertaken for good reasons, however, they had not attained educational excellence in the training and development of doctors as envisioned by Flexner (Hodges, 2010). This is also evident in the ongoing researches and expanding literature around gaps in the competence of medical graduates and new residents and on preparedness and readiness of medical graduates for their actual practices in hospital and clinics (Chen et al., 2015). And not until recently that, the development of Entrustable Professional Activities (EPAs) has been seen by many as a practical approach to the implementation of competency-based medical education.

2 Medicine as Professional Education

One way of understanding the rationales behind these changes and their revolution processes and the aftermaths is to first consider the nature of medicine as a professional education.

In much the same way of educating professionals in all other disciplines, medical education has a mission of both preparing and readying graduates for precise professional performance practices (in medicine/medical care) along with an indispensable social responsibility of in service of the public. Apart from proficiency of knowledge, ensuring students to have strong moral values and personal qualities of putting the patient's interest first, and responsible care of patients are central to medical education excellence. In other words, the education of medical professional is not solely about transmitting abundant scientific knowledge, but also imparting gradually both cognitive and procedural clinical skills for the care of the changing needs of patients. While broadening medical students' scientific knowledge can enable them to form solid clinical reasoning basis, providing them with the opportunity to practise clinical skills under the appropriate guidance of experienced doctors.

The seeds of in search of medical education excellence and medical education reform can be traced back to the time of William Halsted in 1890s. At that time, the prevailing medical training was fundamentally in the form of apprenticeship, and thereby the kind of training that a doctor encounters can be as diverse as the practices, locations and personalities of the doctors and surgeons offering the training. In an effort to standardise and turn medical training into a profession, Halsted stipulated a set of medical training requirements to include merit-based acceptance, fixed training duration, structured curriculum content and mandatory supervised practice toward the end of training (CanMed, 2010).

Another wave of change was led by Flexner who had raised the North American medical education into a university level undergraduate medical programme with strong science grounding as well as a curriculum content that was amenable to a classroom testing methods for knowledge and an evaluation of performance of clinical skills (Hodges, 2010). Since then, the medical education has been mostly based on a curriculum that is subject-centred and time-based with knowledge as main focus of summative evaluations and rigorous assessment. Despite there was an exponential expansion
of a doctor’s bodies of knowledge and skills for their medical practices as compared to Flexner’s time, it has been difficult for medical schools to integrate the knowledge, skills and values necessary for their students’ proficient practices into medical education programmes at either undergraduate (UME) or residency (PGME) levels. Importantly, there was growing concern that medical graduates may have acquired extraordinary knowledge, while the real final test of their level of authentic proficiency, however, will not be merely what they know but what they can actually perform at the workplace—in the context of real-life medical practice.

Just as the calls for reform in the past, competency-based medical education (CBME) was proposed as a renewed interest in tackling these concerns at a time when the environmental forces for changes were once again strongly felt. In 2010, the Carnegie Foundation for the Advancement of Teaching made another strong call-to-action aiming to standardise learning outcomes, individualise learning processes; develop of habits of inquiries and improvement; promote progressive formation of professional identities; and suggest multiple forms of integrations of knowledge, skills and values (Cooke et al., 2010). The call was so influential that some educators even regarded the contemporary competency-based medical education as an evolution from the outcomes movement in the 20th century and it has generated a shift in focus to accountability, curricular outcomes, and lessening the reliance on set courses and number of work hours in curricular design in the hope of reshaping medical education. Recently, competency-based model is perceived as one of the most appealing new medical education development and approach for meeting 21st century’s major stakeholders’ needs, improving efficiency and reducing costs to the healthcare and educational systems (Frank et al., 2010, Glover, et. al, 2011).

A careful review of the literature uncovered that several determining factors may has been contributing to the momentum of the ongoing reforms and undermining the effectiveness and efficient attainment of the mission of medical education.

- Complexity of medical competence: lies at the heart of medicine as a professional practice are the complexity of competence required for the actual practice (i.e., with elements of work-integrated learning and workplace performance outcomes), the difficulties in determining and assessing whether those competencies have been adequately acquired and effectively applied (i.e., performed) by the learner in the real-life medical practice (i.e., whether the learner is truly competent), and their paramount impacts on the well-being of human life—ultimately, it’s a life art and science. Frankly, this may be one of the reasons for the prevalence and dominance of the apprenticeship model with a time-based focus in the history of medical education;
- Distinctiveness of work-integrated learning, workplace curriculum and workplace performance: the learning of medicine demands for a well-designed contextual-based workplace curriculum and environment for the learning and the assessment of work-integrated learning(WIL), for which is a crucial element posing additional problems to the provision of adequate supervised medical practice.
- Medicine as a formal professional education is relatively young and is still on her way of in search of excellence in the teaching, learning and delivery of desirable impacts and outcomes;
• Apparently, the teaching, learning and assessment of medicine as a professional education has become increasingly complex as they were designated to fulfil the ever changing demands and needs of the society.

3 Entrustable Professional Activities and CBME

To understand what Entrustable Professional Activities are and where they fit, it is necessary to first analyse the competency-based system they belong to.

As Frank described the competency-based model as, “...an approach to preparing physicians for practice that is fundamentally oriented to graduate outcome abilities and organised around competencies derived from an analysis of societal and patient needs. It de-emphasises time-based training and promises greater accountability, flexibility and learner-centeredness.” (Frank et al., 2010:636).

Competency is commonly defined as “the ability to do something successfully and efficiently,” (MedEdWorld Glossary) and competency-based medical education (CBME) was perceived by many as one of the most important development in the field for the past two decades since it was considered a big step forward helping to move away from using the hours worked to serve as a simple proxy that has been shown to result in incompetence of medical students and residents.

It is evident in the growing literature that CBME has been increasingly adopted by medical profession as a pragmatic approach to medical education. Basically, CBME is generally perceived as an outcome oriented model that can guide the educational process toward acquisition of the knowledge, skills, and attitudes required for effective professional practice in service of the public by focusing on both the processes and outcomes of medical education rather than the duration or the total time of a doctor’s training. In this approach, it involves competency goals setting, curricular and experiences designed to help students attain the designated goals, integrating instruction in the full range of competencies throughout the educational milestones, guiding and evaluating student learning through formative assessment of competence, and revising standards and activities in light of student competence outcomes (CanMED).

4 Discussion

4.1 Assessing Competency and Challenges of Workplace Assessments

With recent emphases of patient-centred care and workplace-based assessment (WBA) in medicine, implementing effective methods of evaluating competency in clinical settings has become an integral part of the evaluation of students in contemporary competency-based medical education.

The challenge lies in the effective measurement of a student’s actual performance in the workplace given limited direct observation in the real-world setting.

Although tools for direct observation of medical trainees performing clinical skills on patients in simulated settings such as OSCE and Mini-Clinical Evaluation Exercise
(Mini-CEX) has been well-established with proven validity (Kogan et al., 2009), limitations such as time constraints in busy workplace environment (Day et al., 1990) still persist.

4.2 Understanding EPAs

Entrustable professional activity is a rapidly expanding method for assessing medical trainees. It is defined as ‘tasks or responsibilities that faculty entrust to a trainee to execute, unsupervised, once he or she has obtained adequate competence’ (ten Cate et al., 2014; El-Haddad et al., 2015).

As it was suggested, EPA tasks aim to measure the general attributes of trainees performing day to day activities to establish competency rather than completing a checklist of hurdle requirements (ten Cate et al., 2007).

In addition, EPAs are context or speciality specific as they should be articulated in terms of explicit, actual units of work and “job to be done” that are suitable for focused entrustment decisions (ten Cate et al., 2007).

After EPAs are identified, they can be matched to a coordinated set of domains of competence in forming speciality specific assessment framework. Supervisors can then use the framework along with a pre-determined supervision scale for focused entrustment decisions.

Although EPAs do not aim to measure competencies directly, EPAs do provide a link between work outcomes (i.e. performance) and competencies (i.e. abilities) at work if they are carefully chosen and clearly defined in terms of representative components of professional work in the workplace and are coordinated in relation to the most relevant domains of competence (ten Cate et al., 2014; ten Cate et al., 2015).

Specifically, instead of directly assessing each of the many separate and abstract competencies required to undertake a complex professional job, this approach takes supervisor’s “entrustment” decision and the learner’s performance in daily work activities into account as a surrogate measure of the learner’s competence.

4.3 The Case for EPAs

Moving into the 21st century, the rise of competency-based medical education curricular has prompted a transformation in the realm of education at medical schools with heavy emphasis on performance outcomes, from individual practices to national standards, and from pre-clinical to clinical training and professional career pathways (Frank et al., 2010).

Numerous research has been done on the concept of defining competence, competency-based medical education, competency-based assessment methods and tools, and competency and performance assessment in the workplace. While a wide range of competencies assessment methods, tools and approaches are proposed including 360-degree assessment, multi-source feedback (MSF), patient-input, workplace-based assessment, and Observed Structured Clinical Examinations (OSCEs) and Mini-Clinical Examinations (Mini-CEXs) etc., there’s still a lack of consensus on how best to measure and
assess trainees and students’ competencies in a real-world setting (i.e. workplace) and in medical education with work-integrated learning in particular (Kwan et al., 2016).

For many medical schools, it was typical for their programmes to use a combination of discrete measurement methods and tests to assessing their trainees and students’ competencies, and more than often their assessment results were problematic with obvious limitations on reliability and caused diverse levels of performance expectation for graduate’s transition among medical education institutions (Govaerts et al., 2007; Govaerts et al., 2013).

Noting this inadequacy, medical educators, academic researchers and practitioners around the globe have been actively seeking alternative viable and practical competence assessment approaches, and most importantly exploring ways to reach agreeable standards in managing professional competence assessments at both local and national levels.

Of these massive and intensive efforts, EPAs have been singled out as one of novel, promising and practical approach toward effective competence assessments for work integrated learning (WIL) type of education, and especially medical education and professional training (Kwan et al., 2016; Chen et al., 2015; Englander et al., 2016; El-Haddad et al., 2015).

Since the direct measurement of competence is not the objective of EPA, but rather the measurement of trust based on general attributes of trainees performing day to day activities, EPA does not require the cumbersome process of defining each aspect of competence (ten Cate et al., 2007).

Research to date has revealed that many leading medical schools, accreditation institutions and medical education community worldwide in the United States, Canada, Germany, Netherland have already incorporated their own institutional list of EPAs in both their undergraduate and postgraduate medical education curricula, and ongoing pilot studies of its effective implementation in various disciplines/environments are also underway (Kwan et al., 2016; Chen et al., 2015).

4.4 The potentials of UME Level of EPAs

Medical professional bodies such as the Association of American Medical Colleges (AAMC) and the Canadian Medical Educational Directives for Specialists (CanMEDs) have published reports that a substantial progress has been achieved in evaluating, validating and expanding on this EPA framework approach.

For example, a list of 13 Core Entrustable Professional Activities (core EPAs) for Entering Residency framework was offered by the AAMC. A five-year-long pilot on this core EPAs framework has begun with ten medical schools across the United States for a better transition of undergraduate to graduate medical education (Englander et al., 2016).

As regards, the academic research community has called for follow-ups and longitudinal researches on its effective applications and implementations across various medical professional disciplines and along the physician professional training and development continuum and especially at undergraduate level (Chen et al., 2015; El-Haddad et al., 2015).
5 Entrustable Professional Activities and The Way Forward

The advent of entrustable professional activity (EPA) is already taking place in both North America and Europe, and the UK and Canada, but for the present moment, it is just an enhanced assessment tool that can help training programs implement a broader competency-based educational model (Glover et al., 2011). By incorporating EPAs, there seems to be an assumption that competency-based medical education will enable the medical field to guide the workplace’s training and assessment of the medical students so that upon graduation they will demonstrate competence in the multiple domains of practice required to meet the needs of the 21st century global society, but this has yet to be proven. Let alone the fundamental problem is that what we come to think of as medical/professional competency and academic ability and medical/professional culture may vary over time depending on the desires of the stakeholders at the time (McGaghie, 2014). This may be one of the reasons why there have been centuries relentless callings for redefining medical competency and medical professionalism for better patient care.

Although the recent development of competency-based medical education (CBME) can be regarded as a huge step forward by moving from time-based to competence-based, from inputs focused to outputs focused, and from assuming to assessing, and when it is equipped with the promising development of EPAs, may relieve the difficulties in assessing trainee’s competencies in a work-integrated learning (WIL) clinical environment and may stimulate their clinical learning, it is still a great challenge to tackle the clinical inertia culture (guidelines culture)- the source of difficulties in entrustment decision making while assuring those essential stimulations necessary for driving students’ daily self-directed clinical learning for their continuous professional development (Glover et al., 2011; McGaghie, 2014; Ten Carte, 2016).

Also, this may be the reason why it seems that it was so close yet so far from solving the problems and/or meeting the patients’ needs almost every time when reform and change were sought.

6 Jesuit’s Medical education, Jesuit’s Heritage and EPAs

Ensuring quality educational outcomes is not a simple task, there is a huge difference in the development of medical professionals as compared to the development of professional skills and expertise. Clearly, the assessment of workplace performance and/or work-integrated learning require not solely well-developed standards (fixed targets), but also that certain extent of expert judgements, and the assessment of the learner’s quality of performance requires information regarding the individual as a whole person than just discrete technical skills or functional aspect alone.

With respect to medical education, the Jesuits have a pretty distinguishing view and rich heritage of how to nurture commitment to health care’s excellence from all involved (students, faculty, and all medical professionals). Generally, Jesuit medical education is largely based on the experience and heritage of the Jesuit Founder- Loyola. Since 1592, person-centered focus has been promoted as a hallmark of Jesuit education
and that has led to several specific practical actions and later became their heritage and formed their unique Jesuit culture and character. As it is described by the Jesuits, its founder advocated the urgency to share what his followers and he received, and to use their learning and leadership, their life experience and values, and compassion in service to the people in need of these special qualities of life and hope. Thus, it is this culture that helped to form the mission of all Jesuit’s medical schools and hold them accountable to their unwavering desire and relentless commitment to do better in all that they do in patient care.

And through this ‘Magis Standard’, that “calls them to be their very best by placing themselves at the service of four core values” namely respect, care, concern, and cooperation for better patient care (“Loyola Univ. Health Sys. - Mission & Ministry - Medical Education & Health Care in the Jesuit Tradition”, 2008).

Essentially, the Jesuit’s unique emphasis on thoughtful steward leadership, their interactive way of teaching and learning, and ongoing self-reflection on experience are the invisible drives behind their relentless improvement efforts in all they do as they strive for excellence in patient care beyond treating disease to the healing of the human spirit in the communities they serve.

It is envisaged that these Jesuit’s culture and characteristics are essential to advancing the design of work-integrated learning, workplace-based clinical curriculum and thereby the formation of flexible and adaptable EPAs that can enable entrustable decision making, tackle clinical inertia culture, stimulate self-directed and cooperative learning, and avoid what Hodges amused as a modern ‘i-Doc’ model. Because this ‘i-Doc’ model is thought to be a new way to organise medical education but essentially modelling on an industrialism’s mindset, with which medical schools still concentrate solely on one aspect of capabilities—functions (McGaghie, 2014; Glover, 2011) of various batches of end products, not of a human being (medical school graduate, resident or practising physician), to manufacture “highly desirable products adapted to user needs and desires” (Hodges, 2010). Therefore, it is expected that Jesuit’s wisdom could be better unveiled and used in furthering EPAs’ potential impact on attainment of medical education’s mission.

Reference

23. Ten Cate, O., & Scheele, F. Viewpoint: Competency-Based Postgraduate Training: Can We Bridge the Gap between Theory and Clinical Practice? Academic Medicine, 2007, 82 (6)


34. McGaghie, W. C. Competency-Based Medical Education: Origins and Prospects.


Perceived Online Learning Environment and Students’ Learning Performance in Higher Education: Mediating Role of Student Engagement

Zhang TAO¹, Bin ZHANG², Ivan Ka-wai LAI³

¹Guangxi Teachers Education University, Nanning, China, 530001
²Department of Logistics Management and Engineering, Zhuhai College of Jilin University, Zhuhai, China
³Faculty of International Tourism and Management, City University of Macau, Avenida Padre Tomás Pereira, Taipa, Macau

¹t173538073@126.com, ²zhangbin1218@sina.com, ³ivanlai@cityu.mo

Abstract. Colleges and universities have focused on increasing the number of online courses and programs offered to remove the obstacles in terms of time and space. Partial Least Squares Structural Equation Modeling (SEM) is used to explore the relationships among the parameters. The results of this study indicate a positive relationship between perceived online learning environment and university students’ learning performance mediated by students’ engagement. Therefore, educators should develop online student engagement strategies in order to increase online student engagement. Furthermore, for improving online students’ learning performance, educators should invest their resources to develop a good online learning environment.

Keywords: online learning environment; learning performance; engagement; online courses

1 Introduction

Recently, through the ease and comfort of computers and other internet devices, colleges and universities have focused on increasing the number of online courses and programs offered (Meyer, 2012; A Chauhan 2014) to remove the obstacles in terms of time and space (S Marino et al., 2008; Stahl et al., 2006). However, at the meantime, the student drop-out rate of online learning is very high (Park & Choi, 2009; Shea & Bidjerano, 2014). The aim of this study is to test the relationship between perceived online learning environment (OLE) and university students’ learning performance mediated by students’ engagement. Partial Least Squares Structural Equation Modeling (PLS-SEM) is used to explore the relationships among the parameters.

This article is organized as follows. As a theoretical base of the study, the OLE is firstly described and the learning performance is then outlined. Then, the research
model is constructed and hypotheses regarding the effects of perceived designed-related, system-related, content-related, and contact-related OLE on students’ LP under the mediating of student’s engagement are developed. The empirical results of PLS-SEM analysis are presented. Finally, findings, conclusion, limitations, and future research directions are discussed.

2 Theoretical background and hypothesis development

Introduction

2.1 Perceived Online Learning Environment (OLE) and Learning Performance (LP)

Online learning is defined as access to learning experiences via the use of some web-based technological tools (Benson, 2002; Carliner, 2016). OLE is referring to that learning is occurring in a specific web-based area (Asunka, 2008; Barnard-Brak, Lan, & Paton, 2010; Zhang & Kenny, 2010; Moore et al., 2011). Students’ perceptions of their learning environment influence the quality of performance they achieve (Suksudaj et al., 2015). OLE also emphasizes that students are more advantageous compared with students in conventional classroom environments (VV Busato et al., 1998; Stein et al., 2005), which make it possible for students and teachers to share knowledge and ideas without having to be at the same place at the same time. Interaction technologies in online learning, like Electronic Classroom Response System (ECRS) and Information Communication Technology (ICT) Facility (Balakrishnan, 2017), can enhance the academic performance of students (Reinecke, 2017; Nouh, Thamer, 2016). On the other hand, some empirical studies indicated that students’ academic performance does not vary based on the learning environment (Brock, 2008), some other studies have demonstrated that students’ interest generated by multimedia can negatively affect learning (Bartsch & Cobern, 2003; Mayer, 2001). Therefore, the following hypothesis is proposed:

H1: Perceived online learning environment is positively related to students’ learning performance.

2.2 Perceived Online Learning Environment and Student Engagement

Student engagement has been defined as “the extent of students’ involvement and active participation in learning activities” (Yang, 2011), “the effort, both in time and energy, students commit to educationally purposeful activities” (Greene et al., 2008), or “student psychological investment in learning in terms of motivational interpretations and goals as described in achievement goal theory” (Järvelä et al., 2008). The theoretical models of the student engagement consist of behavioral engagement, psychological engagement and cognitive engagement (Peng, 2016). One of the critical features of student engagement is described as “the institution deploys its resources and
organizes the curriculum and other learning opportunities to get students to participate in activities” (national survey of student engagement, NSSE), the online learning environment is one kind of resources institution managed. So there is a correlation between OLE and students’ engagement.

H2: Perceived online learning environment is positively related to students’ engagement.

2.3 Student engagement and learning performance

Student engagement is widely recognized as an important influence on learning achievement (Kahu, 2013), and has been cited as having an overall positive correlation with academic achievement (Fredricks et al., 2004). In fact, “engagement in educationally purposeful activities” was listed as one of eight measures of student success (Kuh et al., 2001). In light of the above discussion, student engagement should be associated with learning performance. The online learning mostly occurs depending on the engagement of the learners (Delen et al., 2014), the engagement is affected by OLE, so learning engagement may mediate the relationship between OLE and learning performance. According to the proposed hypotheses, the research model is showed in Fig. 1.

H3: Students’ engagement is positively related to students’ learning performance.

H4: Students’ engagement mediates the relationship between perceived online learning environment and students’ learning performance.

![Fig. 1. The Research model](image-url)
3  Research methodology

3.1  Instrument development

For the survey instrument, existing measures in related literature were identified which had been repeatedly tested and where strong content validity was exhibited. These measures were then adapted to this research. The process of pretesting was launched in an institution with a sample size of 50 college students. Then, the instrument was refined based on the pretest results and suggestions from interviewees. To make sure the participants understanding the survey instrument, some explanations of the constructs will be provided. The instrument and reference sources are shown in Table 1.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Items</th>
<th>Reference Research</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived OLE</td>
<td>Content</td>
<td>Cheong, 2005</td>
<td>I think that the information I got is valuable from last online course</td>
</tr>
<tr>
<td></td>
<td>system</td>
<td></td>
<td>I think that my last online course provided very reliable service</td>
</tr>
<tr>
<td></td>
<td>Image (interface)</td>
<td>Volery, 2000</td>
<td>I think the webpage of last online course is friendly</td>
</tr>
<tr>
<td></td>
<td>ease of use</td>
<td>Davis, 1989</td>
<td>I would find it easy to get the system to do what I want it to do</td>
</tr>
<tr>
<td>Student Engagement</td>
<td>accomplishment</td>
<td>Boekarts et al., 2000</td>
<td>I finished my last online course fully</td>
</tr>
<tr>
<td></td>
<td>learning joyfully</td>
<td>Skinner et al., 2008</td>
<td>I enjoy learning new things in last online course</td>
</tr>
<tr>
<td></td>
<td>level of effort</td>
<td></td>
<td>I worked as hard as I can in last online course</td>
</tr>
<tr>
<td>Learning Performance</td>
<td>achievement</td>
<td>Xu, 2010</td>
<td>I got a very well academic score in last online course</td>
</tr>
<tr>
<td></td>
<td>satisfaction</td>
<td>Lin, 2012</td>
<td>I feel satisfaction on last online course</td>
</tr>
<tr>
<td></td>
<td>willing to re-use</td>
<td>Cheong, 2005</td>
<td>I intend to use online course as much as possible</td>
</tr>
</tbody>
</table>

3.2  Data collection

The study was conducted using an internet-based survey. The participation in the survey was voluntary. Participants could withdraw from the survey at any time. After collecting the data, data were coded and analyzed using mixed methods.
A total of 229 participants, who were students in a bachelor-level or above, has been invited to complete the survey. 55 responses were dropped due to incomplete responses or have no experience about online learning. The total number of valid responses was 174 which included 4.0% freshmen, 21.3% sophomores, 25.3% juniors, 37.9% seniors, and 11.5% graduated students. Among the 174 respondents, 19.5% were males and 80.5% were females.

3.3 Measurement mode

Data analysis was performed using PLS-SEM. It is because PLS-SEM has greater power for small sample sizes than covariance-based method. It also does not have a strict demand of normal distribution assumption on sample data. In this study, SmartPLS version 3.2.7 was used (Ringle et al., 2016). Follow the recommendation from Hair et al. (2012), PLS bootstrap resampling procedure with an iteration of 5,000 sub-samples replacement from the initial sample 174 was performed. All the p-values are 0.000, so the model is stable.

4 Data analysis

4.1 Reliability and Validity

Measurement reliability was assessed using internal consistency scores, calculated by the Cronbach’s Alpha value. Internal consistencies of all variables are considered acceptable since all $\alpha \geq 0.70$, signifying acceptable reliability. As can be seen in Table 2, the composite reliability for all constructs exceeds 0.7. Thus, all constructs in the model exhibit good internal consistency. Discriminant validity was assessed based on the squared correlations between variables and the square root of each construct’s average variance extracted (AVE), when the AVE is greater than squared correlations, the discriminant validity is approved. The results show in Table 2 is suggesting discriminant validity is satisfied.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Cronbach’s Alpha</th>
<th>Composite Reliability</th>
<th>AVE</th>
<th>Discriminant Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Performance</td>
<td>0.731</td>
<td>0.881</td>
<td>0.787</td>
<td>Learning Performance</td>
</tr>
<tr>
<td>Perceived OLE</td>
<td>0.712</td>
<td>0.838</td>
<td>0.634</td>
<td>Perceived OLE</td>
</tr>
<tr>
<td>Student Engagement</td>
<td>0.776</td>
<td>0.871</td>
<td>0.692</td>
<td>Student Engagement</td>
</tr>
</tbody>
</table>
The \( \chi^2/\text{degree of freedom} \) ratio is 2.763, smaller than the value of 3 which is recommended by Schermelleh-Engel and Moosbrugger (2003), and the Standardized Root Mean Square Residual (SRMR) Index = 0.091, is smaller than 0.1 which recommended by Kline (2011) and Bentler (1999). The two indices are above the acceptable fit of the structural model (Cangur & Ercan, 2015).

4.2 Structural model for hypotheses testing

The hypotheses proposed above were tested collectively using PLS-SEM. The values of R-square represent the amount of variance explained by the independent variables. The estimates of the path coefficients indicate the strengths of the relationships between the dependent and independent variables. Together, the values of R-square and the path coefficients indicate how well the data support the hypothesized model.

Fig. 2 illustrates the value of R-square and the path coefficients of the proposed research model. Learning performance is found to be significantly determined by the two exogenous variables perceived OLE and student engagement. The value of R-square is 0.631 which means that the above mentioned variables explain 63.1% of variance in the learning performance. Likewise, student engagement is found to be slightly determined by perceived online learning environment with an R-square of 0.150. Thus, the perceived online learning environment explains 15.0% of variance in the student engagement.

Hypotheses 1 explore the relationship between perceived OLE and students’ performance, which posited that perceived OLE should influence the student performance positively, this hypothesis is supported \((\beta=0.423, p \leq 0.01)\). PLS results provide support for H2, which asserts that online learning environment has an obvious positively impact on student engagement \((\beta=0.387, p \leq 0.01)\).

Students' engagement was positively associated with learning performance \((\beta = .528, p \leq 0.01)\).

Online learning environment had a significantly positive influence on learning performance mediated by student engagement.

Thus, all the 4 hypotheses are supported by the PLS results.

![Path analysis](image)
5 Discussions and Conclusion

Although a number of studies have examined the relationship between learning environment and students’ learning performance in traditional education, a fewer literature revealed the relationship between OLE and students’ learning performance with the mediating effect of students’ engagement. In the terms of theory building, this study shows the importance of students’ engagement in the online education. For the online education, it does not like traditional education where students must attend the class and teachers can force students’ participation, it is hard to control students’ participation in the online environment. Therefore, educators should develop online student engagement strategies in order to increase online student engagement. Gamification is the one that can keep online students engaged. Students like to play games and get rewards when they complete the exercises after learning a course.

The results of the study indicate that for having a good student learning performance, a good OLE is very important. The educators should invest their resources to develop attractive contents, establish good online learning platforms and internet infrastructure, and build a good online education image.

In this study, the value of R-square of students’ engagement is small. This implies that students’ engagement would be influenced by other factors. Therefore, further research is expected to find out the factors for enhancing the online student engagement.

This study was conducted in Guangxi, China and the sample size was small, a further study with larger sample size in more provinces of China is recommended to improve the data representativeness.

References


Designing and Evaluating Postgraduate Courses Based on a 5E-Flipped Classroom Model: A Two-case Mixed-method Study

Khe Foon HEW, Yanzhen ZHU, Chung Kwan LO
Division of Information and Technology Studies, Faculty of Education, The University of Hong Kong, Hong Kong SAR, China
kfhew@hku.hk

Abstract. In recent years, the flipped classroom approach has attracted much attention from educators around the world. However, we still understand little about how we can structure the pre-class and in-class activities in a coherent way that could engage students. The purpose of this study is to examine the use of the 5-E instructional model in order to foster students’ active learning in a flipped learning environment. A two-case mixed-method study was conducted, involving the teachers and students from two different postgraduate courses Engaging Adult Learners and E-Learning Strategies. Both the quantitative and qualitative data collection methods such as student survey and interviews were conducted. The results suggested that 92% of participant strongly agreed or agreed that flipped learning is more engaging than traditional classroom instruction, and 81% reported that the flipped classroom approach gave them more time to discuss issues or solve problems. Interview data suggested three main reasons for the overall positive student perception of flipped classroom’s impact on their learning: promoting more in-depth learning, cultivating self-directed learning, and improving peer communication and collaboration.

Keywords: flipped classroom; inverted classroom; 5E instructional model; postgraduate education

1 Introduction

Flipped learning has become increasingly popular in recent years. In a flipped classroom, in-class teacher-led instruction is replaced with individual homework or group activities (Pierce & Fox, 2012), and learning content was introduced prior to class. More and more studies have been conducted to investigate the practices of flipped classrooms. In fact, the number of published papers has been significantly increasing after 2012 (Giannakos, Krogstie, & Chrisochoides, 2014).

Scholars, for example have implemented and examined the use of the flipped classroom approach in clinical pharmacy (See & Conry, 2014), actuarial science (Butt, 2014), mathematics (Love, Hodge, Grandgenett, & Swift, 2014), nutrition (Gilboy,
Heinerichs & Pazzaglia, 2015), nursing (Simpson & Richards, 2015), chemistry (Reid, 2016), and business (Findlay-Thompson & Mombourquette, 2014).

Yet despite the increasing number of empirical studies that examined the use of flipped learning, several research gaps still exist. First, a majority of studies have hitherto focused on undergraduate students in the Western world such as the USA (see Bishop & Verleger, 2013; Karabulut-Ilgu, Jaramillo Cherrez, & Jahren, 2017; O’Flaherty, & Phillips, 2015; Lo, 2017; Lo, Hew, & Chen, 2017 for a review). Relatively few studies have been conducted on postgraduate learners in an Asian country. Second, there is still no adequate conceptual-based framework to guide the overall design and implementation of flipped classrooms in actual practice (Abeysekera & Dawson, 2015; Karabulut-Ilgu et al., 2017; Song, Jong, Chang, & Chen, 2017). Song et al. (2017), for example, lamented that a large number of studies failed to present theoretical or conceptual underpinnings for their pedagogical designs of flipped classrooms.

This study aims to overcome the aforementioned research gaps. Specifically, we report the use of the 5-E instructional model to foster students’ active learning in two flipped courses. Before presenting the two flipped classes, we first provide an overview of the 5-E instructional model.

2 Conceptual framework: 5E instructional model

The 5-E instructional model (Table 1) is originally proposed in science education (see Bybee et al., 2006 for a review). Prior research (e.g., Balci, Cakiroglu, & Tekkaya, 2006; Bilgin, Coşkun, & Aktaş, 2013) shows that the 5-E model can lead to a positive effect on students’ science achievement. Currently, the 5-E instructional model is widely used in various subject areas. In her undergraduate research methods course, Mullins (2017) used this model to structure the learning activities. Each activity was inquiry-based and a series of questions was designed following the five phases. For example, guiding questions were set to facilitate students’ exploration of the provided information such as charts and narrative materials. Mullins (2017) further compared this 5-E supported instructional approach to traditional teaching. She found that students in the 5-E supported learning environment outperformed those in a traditional lecture setting in the final exam.

However, in the contexts of flipped learning, very few published studies grounded their flipped classroom design in some established frameworks of instructional design (Abeysekera & Dawson, 2015; Karabulut-Ilgu et al., 2017; O’Flaherty & Phillips, 2015). Lo (2017) thus proposes using 5-E instructional model to design flipped History courses. He first argues that the engagement and evaluation phases should be delivered both outside and inside the classroom. In other words, teachers should recall prerequisite knowledge for video lectures and in-class learning activities as well as assess students’ out-of-class learning and in-class learning outcomes. He further suggests providing online resources for students’ exploration and explaining the materials through instructional videos before class meetings. The in-class time can thus focus on the elaboration phase in which students can apply their knowledge to problem-
solving. However, Lo (2017) acknowledges the need of conducting empirical research which examines the efficacy and challenges of using 5-E instructional model in flipped learning.

**Table 1. Phases of the 5-E instructional model.**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engage</td>
<td>Serves to interest the students in the material and engage them in the process of learning; it usually took the form of simply introducing students to a real-world scenario, phenomenon, or problem.</td>
</tr>
<tr>
<td>Explore</td>
<td>Allows the students to explore the content and construct their own understanding before introducing any terminology.</td>
</tr>
<tr>
<td>Explain</td>
<td>The instructor introduces terminology to facilitate concept building.</td>
</tr>
<tr>
<td>Elaborate</td>
<td>Requires the students to apply their new conceptual understanding to problem situations in order to broaden the domain and strengthen the framework of these concepts.</td>
</tr>
<tr>
<td>Evaluate</td>
<td>Can be both formative (e.g., online quiz) and/or summative assessments (e.g., unit exam) that test students’ understanding of the concepts they have just learned.</td>
</tr>
</tbody>
</table>

In fact, only a scarcity of studies used the 5-E instructional model to inform their flipped classroom design. In their master-level engineering course, Svensson and Adawi (2015) used pre-class videos to implement the engagement and exploration phases whereas the in-class time was dedicated to the explanation, elaboration, and evaluation phases. For example, their students were required to explain what they had explored during class preparation and the teacher clarified their misconceptions (Svensson & Adawi, 2015). At the end of their course, 23 out of 35 students responded to their course survey. Most of the respondents (91.3%) agreed that the flipped lessons could improve their learning and lead to a better understanding of concepts. However, without a control group (e.g., a non-flipped class), it is questionable to conclude that such positive result is due to the proposed course design.

In Jensen, Kummer, and Godoy’s (2015) study of undergraduate biology education, both their flipped class and non-flipped class were designed using the 5-E instructional model. They first defined two components of their course: (1) The content attainment part which covered the engagement, exploration, and explanation phases; and (2) the concept application part which focused on the elaboration and evaluation phases. In their non-flipped class, students’ content attainment was completed inside the classroom and the concept application part was handled after class. In the flipped class, students’ content attainment was facilitated before class through video lectures and the concept application was done inside the classroom. As a result, Jensen et al. (2015) found that there were no significant differences between these two classes in terms of learning gains and student satisfaction. Although they argue that flipped learning offers no additional benefits over a 5-E supported non-flipped approach, they recommend further research to confirm their findings.
3 Method

The present study aims to extend our collective understanding of flipped learning in two ways. First, we extended our study to a Hong Kong university context; more specifically to two different postgraduate courses: (a) Engaging Adult Learners, and (b) E-Learning Strategies. Second, we investigated the use of the 5-E instructional model in order to foster students’ active learning. The following three questions guided the present study:

a) What are the students’ attitude toward flipped learning? Attitudes or people’s overall evaluations of an entity are important to study because they are predictable and very powerful effects on behavior (Greenwald, 1989).

b) What are students’ opinions about the impact of the flipped classroom approach on their learning?

c) What suggestions for improvement do students have for the flipped courses?

A multiple case study approach was employed in this study. Yin (2003) maintains that the case study approach is most appropriate when it investigates a contemporary phenomenon within its real-life context. The phenomenon under investigation is the implementation of 5-E supported flipped classrooms in two postgraduate courses. The phenomenon will be studied in real-life contexts. The two courses will be briefly described in the following sections.

3.1 Course 1: E-Learning Strategies

Participants in this course were 21 graduate students between ages 22 and 28. This course explored issues relevant to the design and management of e-learning in educational contexts encompassing five specific types of learning: factual knowledge, conceptual knowledge, problem solving, procedural learning, and attitude change. It investigated the various instructional strategies that could promote the mastery of each aforementioned types of learning. The course was based on 8 sessions of 3 hours duration each. Lessons in the first 5 sessions were flipped and the last three sessions were for student in-class class presentations.

Fig. 1 shows an example of how the 5-E instructional model was utilized in the E-Learning Strategies course. For example, in Topic 3: Attitude learning, we posted a video that contrasted good attitude and negative attitude as a pre-class activity. This video served as a trigger to engage students. Students then explored and explained the topic of attitude by reflecting on their own experiences by answering three questions before class: (a) have you ever have a negative attitude? (b) What was the situation? (c) How did you change the negative attitude?

During the in-class session, the instructor facilitated discussions on questions, such as “what is attitude and how can we change it”, and “how do we write good lesson objectives, including attitude learning”. The instructor also facilitated discussions on the strategies that good instructors use to teach attitude learning. These questions, scenarios, and discussions served as trigger points to elaborate on good instructional
design practices. To **evaluate** the students’ understanding of the contents, they were asked to work in groups of fours to create their own actual lesson on Moodle.

### 3.2 Course 2: Engaging adult learners

Participants in this course were 26 graduate students between ages 22 and 40. This course introduced participants to the key characteristics of adult learners. It also discussed the applications of various strategies that are particularly pertinent to adult education such as self-directed learning, collaborative learning, experiential learning, problem-based learning, workplace learning, and transformational learning theory. Participants were required to design a course based on one of these strategies. The course was based on 8 sessions of 3 hours duration each. Lessons in the first 4 sessions were flipped, while the last four sessions were used for individual consultations with the instructor, as well as for student in-class class presentations.

![Fig. 1](image_url) An example of how the 5E model was used in the E-Learning Strategies course.

Fig. 2 shows an example of how the 5-E instructional model was utilized in the *Engaging Adult Learners* course. For example, in Topic 4: How do we engage adults in online learning environments, we posted a video that described the increasing demand for e-learning, and posted the following question as a pre-class activity: “Imagine you are applying for a position as an adult educator in a large organization. In the interview, you are asked to voice 3 important questions that we should consider
if we wish to design an e-learning course for adult learners. What would you say?” The video and question served as a trigger to engage students before class. Students explored the question by reflecting on their own experiences, and/or searching for relevant literature. Students then explained their viewpoints by posting them on the class WeChat.

During the in-class session, the instructor facilitated in-depth discussions on issues including the six main factors that engage adult learners in an online course, key reasons why adults drop out of online course, and the implications of human brain for online learning. These issues served as trigger points to elaborate on strategies to engage adult learners. To evaluate the students’ understanding of the contents, they were asked to design a bite-sized lesson for adult learners. Requirements for the lesson included: having only one learning objective, learning time between 5-10 minutes, making the lesson relevant to adults, using problem-centered and active learning strategies, and using at least one attention-grabbing strategy.

Fig. 2. An example of how the 5E model was used in the Engaging Adult Learners course.
3.3 Data collection and analysis

Data were collected from two sources: a questionnaire and semi-structured interviews. The questionnaire consisted of 12 five-point Likert-scale questions; and was administered at the end of the two courses. The questions made comparisons between the flipped classroom and the traditional classroom and focused on students’ learning experience in the flipped course delivery. Based on the questionnaire data, descriptive statistical analyses were conducted in order to determine the students’ perception of flipped learning.

Lincoln and Guba (1985) point out the virtue of the interview by stating that, “it permits the respondent to move back and forth in time – to reconstruct the past, interpret the present, and predict the future.” (p. 273). Interviews were thus chosen as one of the data collection methods because the participants’ experiences of flipped learning were now in the past, and also because their perceptions and opinions could not be observed. In this study, we used the semi-structured interview format, where the interviews were focused and guided by interview questions such as how has the flipped classroom approach impacted your learning, how do you prepare for this class differently than other non-flipped classes, what did you find most helpful to your learning during the in-class time, what did you find least helpful to your learning during the in-class time, how has the flipped classroom approach differed from other classes as to how you interact with your classmates, how has the flipped classroom approach differed from other classes as to how you interact with your instructor, and what is your overall perceptions toward flipped learning?

4 Results and Discussion

Overall, the results indicate that graduate students’ perception of flipped classroom tends to be positive and graduate students were actually more engaged in this innovative classroom. Answers to the research questions are discussed respectively in this section.

4.1 What are the students’ attitude toward flipped learning?

Altogether 42 participants (n = 21 from each course) completed the survey. Table 2 summarizes the results of the questionnaire.

The results indicate that 92% of participant strongly agreed or agreed that flipped learning is more engaging than traditional classroom instruction, and 95% reported that they would recommend the flipped classroom approach to their friends. Eighty-six percent of participants indicated that flipped learning gives them greater opportunities to communicate with other students, while 83% agreed or strongly agreed that they liked watching the lessons on video. Ninety-three percent of participants reported that they liked doing the online activities at their own pace, and 81% reported that the flipped classroom approach gave them more time to discuss issues or solve problems. Close to 80% of participants perceived that the flipped classroom approach improved their learning significant. Although 83% of participants reported that they liked to
watch lessons on videos, only 64% said that they preferred a video-recording of the lesson to a traditional teacher-led lesson.

### Table 2. Results of the questionnaire survey (n = 42 participants).

<table>
<thead>
<tr>
<th>Item</th>
<th>SD</th>
<th>D</th>
<th>N</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Flipped Classroom is more engaging than traditional classroom instruction</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>52%</td>
<td>40%</td>
</tr>
<tr>
<td>I will recommend Flipped Class to my friends</td>
<td>2%</td>
<td>0%</td>
<td>2%</td>
<td>52%</td>
<td>43%</td>
</tr>
<tr>
<td>The Flipped Classroom gives me greater opportunities to communicate with other students</td>
<td>0%</td>
<td>7%</td>
<td>7%</td>
<td>50%</td>
<td>36%</td>
</tr>
<tr>
<td>I like watching the lessons on video</td>
<td>0%</td>
<td>2%</td>
<td>14%</td>
<td>29%</td>
<td>55%</td>
</tr>
<tr>
<td>I like doing the online activities at my own pace</td>
<td>0%</td>
<td>5%</td>
<td>3%</td>
<td>38%</td>
<td>55%</td>
</tr>
<tr>
<td>I prefer a video-recording of the lesson to a traditional teacher-led lesson</td>
<td>0%</td>
<td>5%</td>
<td>31%</td>
<td>36%</td>
<td>29%</td>
</tr>
<tr>
<td>I like to self-pace myself through the course</td>
<td>0%</td>
<td>5%</td>
<td>12%</td>
<td>38%</td>
<td>45%</td>
</tr>
<tr>
<td>I am more motivated to learn in the Flipped Classroom</td>
<td>0%</td>
<td>5%</td>
<td>21%</td>
<td>33%</td>
<td>40%</td>
</tr>
<tr>
<td>The Flipped Classroom gives me more time to discuss issues or solve problems</td>
<td>2%</td>
<td>2%</td>
<td>14%</td>
<td>33%</td>
<td>48%</td>
</tr>
<tr>
<td>The Flipped Classroom has improved my learning significantly</td>
<td>2%</td>
<td>2%</td>
<td>17%</td>
<td>40%</td>
<td>38%</td>
</tr>
</tbody>
</table>

### 4.2 What are students’ opinions about the impact of the flipped classroom approach on their learning?

Twenty-four participants consented to be interviewed. Qualitative analysis of the student interview data suggested the following three main reasons for the overall positive student perception of flipped classroom’s impact on their learning. These reasons include: promoting more in-depth learning, cultivating self-directed learning, and improving peer communication and collaboration.

**Promoting more in-depth learning.** In a flipped course, students are required to learn some course materials before class meetings by reading, or watching instructional videos. More in-class time can thus be spent on active learning activities such as group discussion and problem-solving activities. Completing pre-class activities helps prepare students for the class activities (Madden & Martinez, 2015). Students also had time to review the videos at their own pace (Ojennus, 2016). Students with limited understanding of the materials could revisit the videos many times (Mok, 2014). In addition, there are greater opportunities for students to apply knowledge in solving problems in flipped classes (Madden & Martinez, 2015). Students overall reported that a flipped classroom can promote more in-depth learning than a traditional classroom:

“I can master the basic knowledge before the class, so during the in-class time, there is no time wasting on surface learning. I can learn the knowledge and skills deeply through in-class discussion.” (Participant #4)

“The pre-class activity helps me better understand the topic in class so I can better engage in it during in-class sessions.” (Participant #1)
“The flipped classroom approach gives the instructor more time collecting students’ feedback based on their answers or sharing so the instructor could adjust the teaching approach and find where they should emphasis during the class time.” (Participant #15)

*Cultivating self-directed learning.* Self-directed learning is “a process in which the individual takes the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes” (Knowles, 1975, p. 18). The use of pre-class activities in a flipped classroom implementation can help cultivate students’ self-directed learning as suggested by the following comments:

“I would watch the videos that professor provides. After watching the videos, if I can’t fully understand the points, I would like to search on the internet and read other articles and videos about it.” (Participant #5)

“It improved my self-learning ability as we need to watch videos to learn new concepts before class.” (Participant #11)

*Improving peer communication and collaboration.* Flipped classroom also helps increase interactions with the instructor and classmates during in-class sessions (Ojennus, 2016). Many of the in-class activities such as group discussion promoted students’ interactions with their peers:

“Non-flipped classes require students to learn basic knowledge in class, so professors spend more time on giving lectures, and less time is distributed on group discussion. I think flipped classroom provides more opportunities for us to communicate and collaborate with classmates, which is beneficial for our deep learning.” (Participant #5)

“There are not only opportunities for discussing and collaborate with students in the same group but also we can interact with all classmates. The use of social media messaging WeChat in this course is totally a new and engaging way.” (Participant #4)

“A lot more interaction, cooperation and collaboration with classmates than non-flipped classes. Since everyone comes to class with good preparation, people are confident to share their own ideas in class.” (Participant #12)

4.3 What suggestions for improvement do students have for flipped courses?
Notwithstanding the overall positive participant satisfaction, there are several suggestions for improvement concerning the use of flipped classrooms in practice. First, some students were burdened by the apparent increase in workload because they were asked to complete the pre-class activities. Several previous studies reported that some students were unhappy being asked to do work before class that was traditionally done in a face-to-face class format (Simpson & Richards, 2015). These students consider the out-of-class activities as burdensome in terms of time (Young, 2015). Therefore, one participant in the current study proposed that:

“The pre-class tasks should not be very hard. The time that is required to complete it shouldn’t be too long.” (Participant #3)

Hence, we recommend that instructors consider covering the more basic and introductory materials through instructional videos as a pre-class task, while the more difficult content being handled inside the classroom (Anderson & Brennan, 2015; Lo et al., 2017). Furthermore, we recommend instructors carefully consider the total time required to complete all the pre-class tasks. Although it may be difficult to predict the optimum workload for out-of-class activities, a majority of students tend to spend about 20 minutes on these tasks (McGivney-Burelle & Xue, 2013; Vazquez & Chiang, 2015).

The second suggestion for improvement is to consolidate the main points after each in-class sessions:

“My suggestion is adding a consolidation part in class. That is, before dismissing class, instructor or students themselves could summarize what have been learnt today. Otherwise, sometimes we get distracted by discussion and collaboration.” (Participant #11)

In the present study, the instructor mainly focused on facilitating in-depth discussions on important issues, or providing students the opportunities to work together on group activities during the in-class sessions. Consolidation of the main or important points raised in the discussions and group activities was, unfortunately, left out in many of the sessions. We therefore recommend that instructors leave some time for the students to reflect individually at the end of every in-class session, and provide a closure of the session by highlighting the main takeaways.

The third suggestion for improvement is to provide opportunity for students to ask the instructor questions during the pre-class sessions:

“After watching the video, maybe classmates are confused about some concepts. If we can make full use of the online discussion forum to post questions there, it will help us learn more.” (Participant #5)

The lack of opportunity to ask questions and get immediate feedback may hinder understanding of the video material at the time the material is presented (Hotle & Garrow, 2016). Although students may ask questions later during in-class sessions, they may have forgotten what they wish to ask because most students did not take notes.
while watching the videos (Hotle & Garrow, 2016). Lo et al. (2017) therefore suggested that instructors provide support through online discussion boards or other social networking sites such as Twitter in their flipped courses. Using these technologies would allow instructors and peers to provide timely feedback outside the classroom

5 Conclusion

In the past several years, we have witnessed an unprecedented growth in the use of flipped classrooms. Yet, despite having various studies of flipped learning, we still understand little about how we can structure the pre-class and in-class activities in a coherent way that could engage students. In the present study, we examine the use of the 5-E instructional model in two different postgraduate courses Engaging Adult Learners, and E-Learning Strategies. Overall, our findings suggested that most students preferred the flipped classroom approach, and reported that flipped learning is more engaging than the traditional classroom instruction.

The findings of this study should, however, be viewed with some caution due to the relatively small participant sample size. Future research examining a larger sample size of postgraduate students would be useful to help us generalize the results. Although it is useful to understand students’ perception and preference of using the flipped classroom approach, it is also important to examine whether the postgraduate students can acquire and use the knowledge comparable to traditional classroom settings. Therefore, in subsequent studies, we plan to carry out experimental studies that will interrogate this very issue. Finally, we also plan to examine how the use of different video formats may affect postgraduate student learning in flipped classrooms. Commonly used video formats include PowerPoint slide presentation with voice-over, video screencast of the instructor writing code in a text-editor, video of instructor drawing freehand on a digital tablet video captured from a live classroom lecture, instructor recorded in a studio with no audience, and close-up shots of instructor’s head filmed at an office desk (Guo et al., 2014). Investigating the various video formats is important because it can help us utilize the right format to develop video lectures that can engage students.

References


Study on the Future Classroom

Ji Ping ZHANG

East China Normal University, Shanghai, China

jpz@ecnu.edu.cn

Abstract. No classroom change, no educational reform or innovation! Educational reform and talent cultivation need us to transform or change our traditional classroom. Studying on the future classroom, it will well contribute to deep understand the classroom and how to redesign and implement the classroom. This presentation will discuss why we need to focus on the classroom, what we need to change and what we have done, and some successful cases in mainland will be presented.

Keywords: Future classroom; Redesign and implementation; Educational reform and innovation; ICT in teaching and learning
Instructional Design of Multimedia Courseware Design and Production Based on Flipped Classroom in Universities - Take the Trigger as an Example

Qian DONG
Graduate School of Education, Peking University, Beijing, China
st16625m@gse.pku.edu.cn

Abstract. Under the flipped classroom teaching mode, students watch micro video resources to learn autonomously before class, cooperate with each other by sharing doubts and exchanging ideas for a better understanding of knowledge, rethink and evaluate themselves, share achievements after class so as to achieve meaningful learning. “Multimedia courseware design and production” course is practical and widely used as a professional course for students majoring in educational technology in universities. In this paper, we take the use of PPT in the trigger as an example, based on the flipped classroom teaching mode of teaching design. We hope to enhance the students' autonomous learning ability, cultivate their cooperative spirit of inquiry.

Keywords: flipped classroom, multimedia courseware design and production, instructional design, trigger

1 Concepts of Flipped Classroom

1.1 Concept of flipped classroom

Flipped classroom is also called reversal class and upside down the classroom, which was first proposed in 2000 and developed initially in 2011. For the concept of flipped classroom, some scholars focus on the application of information technology and learning resources, they think flipped classroom is a new teaching model that in the information technology environment, teachers provide educational videos as a main form of learning resources. Students finish watching and learning educational videos and other learning resources before class. Teachers and students interact with each other about questions of homework and complete the inquiry activities. Some scholars emphasize the flipping of teaching progress, they summarize the concept that flipped classroom is a new teaching model that students watching videos to exchange teachers’ instruction in the classroom, they put more effort on finishing exercise and interact with each other. It flips teaching arrangement of teachers teach in class while students do homework after class. Some scholars believe that flipped classroom is also called reversal class, it changes the roles of teachers and students in traditional teaching and

replans time schedule in class which realizes the innovation of traditional teaching mode. Still, some scholars from the perspective of teaching activities to define flipped classroom, they think flipped classroom is a kind of means that teachers use technical resources to make teaching content that need to be taught and arranged for students in class into videos. Students learn based on themselves under the guidance before class. Teachers and students discuss with each other to solve problems. Teachers are no longer just a knowledge imparters and students are not just passive knowledge receivers as well.

It can be said that different scholars have different emphasis on the definition of flipped classroom, but they reflect features of flipped classroom, such as the flipped teaching structure, increase interaction between teachers and students and promote internalization of knowledge. We believe that we should understand and grasp the concept of flipped classroom from many dimensions no matter from the perspective of application of information technology and learning resources or flipped teaching process and teaching activities.

1.2 Features of flipped classroom

As a new type of teaching mode, compared with traditional teaching mode, there are three features of flipped classroom:

First of all, flip the role of students and teachers. In flipped classroom teaching model, teachers transform from knowledge imparters and classroom manager in traditional classroom into instructors and facilitators of students’ study. Students change from passive receivers of knowledge in traditional classroom into active investigators. In this model, the role of teachers and students flip which makes the students become the subject of the whole learning process.

Secondly, flip the teaching structure. It changes the traditional teaching structure of “teachers teach in class and students do homework after class” into “students learn before class and carry out inquiry learning in class”. In traditional class, students do not really become the subject of the classroom and active learners. Students do not have enough time to carry out inquiry activities limited by the instructional design of teachers and passive participation of students and classroom time is relatively tight. Flipped classroom flips the position of teach and learn, namely, from “teaching before learning” to “learning before teaching”, which makes students enter the classroom with problems. It may help facilitate communication between teachers and students and cultivate ability of independent thinking and collaboration among students.

Thirdly, flip the teaching method. Flipped classroom can help realize an individual learning method and student-centered teaching way which makes the classroom more colorful. From the perspective of teaching idea, flipped classroom has transformed the traditional teaching idea from “teacher-centered” teaching method to “student-centered”. From the perspectives of teaching resources, flipped classroom has transformed the traditional resources from textbook, blackboard-writing, courseware to rich resources, such as knowledge map, guidance case, micro lesson video and so on. From the perspective of learning style, flipped classroom breaks the learning style from tradition individual way to group learning, that is, it encourages students to set up
groups and collaborate with each other and do inquiry activities in depth. From the perspective of evaluation method, the evaluation method is no longer a tradition way to test only by paper examination, but becomes richer, such as learning experience, small paper, electronic magazine, mind map, case work etc. Students can independently choose their evaluation way, which can reflect learning effect and any proof of mastery of knowledge can be the evaluation way.

<table>
<thead>
<tr>
<th>Table 1. comparison of traditional classroom and flipped classroom</th>
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<tbody>
<tr>
<td><strong>Roles of teacher and student</strong></td>
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<tr>
<td>Roles of teachers</td>
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<td>Classroom manager</td>
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<td>Roles of students</td>
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<td><strong>Teaching structure</strong></td>
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<td>Teaching idea</td>
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<td>Teaching resources</td>
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<tr>
<td>Learning style</td>
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</table>

2 Instructional Design of Flipped Classroom in University Curriculum

2.1 Limitations of traditional classroom instructional design

The general process of traditional classroom instructional design is that teachers carry out frontal analysis before class, and then determine the instructional objectives, combined with teaching content, instructional objectives, learner characteristics, they choose appropriate teaching environment and methods and design teaching activities; teachers teach while students listen to teachers in class; complete their homework and teachers finish teaching evaluation and reflection after class. From the above general process, we can see that there are some limitations in traditional classroom instructional design.

First, in traditional classroom, people pay more attention on teaching nor learning. The instructional design is all around “how teachers teach”, ignoring “how students learn”.

Secondly, traditional way of teaching emphasizes on passive learning, which is not benefit for students’ independent thinking. One of the mistakes of traditional education model is to emphasize passive learning rather than encouraging students to participate actively in learning. Another mistake that has the same influence is that standardized
education does not give full develop the ability of the brain to associate learning as much as possible. In traditional classroom instructional design, most teachers impart knowledge and different students passively accept knowledge according to the unified teaching rhythm of teachers. They don't have enough time to understand and digest, which is not conducive to students' independent thinking and train students' associative learning ability. In addition, the students' active participation in the teaching activities are less, such as group discussion and teacher-student communication, which makes it difficult to mobilize the initiative and enthusiasm of students.

Thirdly, teachers cannot be aware of the students' studies in time, and students' problem can’t be solved timely. On one hand, in traditional classroom instructional design, teachers teach in class for most of the time, which make it not easy to detect students' learning gap, and cannot detect the course schedule constraints timely. Students in the learning process of questions cannot be solved in time with the course teaching content forward. Some of the students' lack of understanding of the previous learning content affects the learning of the content behind. On the other hand, some students are afraid or unwilling to ask teachers questions or communicate with them so that teachers can’t know if the students understand what they have taught. Some students try to solve problems independently. But they are faced with the difficulties of spending more time and energy finding past textbooks, learning material lost and other difficulties, which affect students' learning progress.

Fourth, it cannot realize teachers' hierarchical teaching, neither can satisfy the needs of students' individualized learning as well. The instructional design in traditional classroom of course schedule is unified, teachers impart knowledge according to the predetermined instructional design. Students learn in accordance with the unified pace, which causes some students have mastered the learning content, however, some students cannot keep up with teachers. In addition, students are unable to decide where to learn, what time to learn, what to learn and how long it is. Therefore, the traditional classroom instructional design cannot realize the teaching of teachers at different levels and meet the students' individualized learning.

2.2 An analysis of feasibility of introducing flipped classroom into university curriculum

School level.
First of all, generally speaking, compared with primary and secondary schools, colleges and universities have more decision-making power in their school running, such as course setting, course arrangement and flexible evaluation method. Secondly, colleges and universities can provide more powerful environmental support and resource support. Universities have invested more funds in in infrastructure construction, for example, they are rich book resources and perfect in network facilities and multimedia teaching and hardware facilities. In recent years, with the development of educational informatization, colleges and universities have launched excellent educational resources in different subjects, such as excellent courses, MOOCs and soon. In summary, colleges and universities have more decision-making power which is easier to introduce and apply flipped classroom teaching model under the strong support of
environment and resources. Therefore, it is of practical significance to introduce the instructional design of college curriculum based on flipped classroom model.

**Teacher level.**
In the first place, often, college teachers have higher educational level and knowledge level, they have stronger learning ability and can be easier to accept new ideas and try new things, which makes it easier to apply flipped classroom model into practice. Secondly, college and university teachers mostly use multimedia teaching equipment to prepare lessons and they can skillfully use modern teaching media and have strong information literacy, which provides great possibility to introduce the instructional design of college curriculum based on flipped classroom model. Finally, with the help of flipped classroom teaching model, students preview before class, participate activities in class and review after class. It is possible to enrich more interaction between teachers and students, such as discussions and inquiry activities which can be conductive to improve class listening, enhance communication and help students recollect the old knowledge.

**Student level.**
In the first place, college students have accumulated a certain degree of knowledge, to some extent, they have a strong self-learning ability and information literacy. In other words, compared with students those in pre-school, primary and secondary school, college students are more likely to adapt to flipped classroom teaching model. Next, college students hail from all corners of the country, there are certain differences in learning, such as learning content, learning content and so on. Flipped classroom can better meet the learning characteristics of college students. Finally, college curriculum arrangement is flexible, community activities are rich, the free time of college students’ is different. Flipped classroom teaching model can meet students’ individual needs and arrange their learning independently.

It is necessary and feasible to do instructional design based on flipped classroom of the college curriculum through the narration of three aspects of the above schools, teachers and students.

### 2.3 Flipped classroom instructional design

Flipped classroom instructional design model is in accordance with teaching steps: before class, in class and after class. Each step is divided into teacher activities and student activities.

**Pre-class instructional design.**

*Teacher activities.*
Teachers need to write documents that will be used in students’ autonomous learning stage, such as learning manual, knowledge map, guiding case, video lectures etc. and
complete making multimedia teaching courseware and video recording. After this, teachers need to share all the teaching resources for students’ learning.

A general guiding case is divided into four parts: learning objects, key points, learning methods, learning content. Students should know what to learn, how to learn and what degree they need to achieve. Therefore, using guiding case, students can learn and find problems before class and improve the efficiency in class. So teachers should design the general guiding case carefully.

The core idea of micro course is to promote students’ individuality, autonomy and efficiency of learning⁷. In the process of making micro videos, teachers should pay attention to the segmentation of knowledge reasonably, such as the content of the speech need to be clear and easy to understand, the frame is full of change and with unflagging passion.

**Student activities.**
Student activities before class are divided into three stages: autonomous learning, practical inquiry, summary and reflection. Students first acquire and save learning resources provided by teachers and they know learning method and steps through learning manual, and then they learn autonomously and carry on the practice inquiry under the guidance of knowledge map. In the process of practice inquiry, they find problems and try to solve them in many ways. At last, they review the learn contents, collect and record learning queries, submit learning portfolios and set a question and its corresponding answers that related to the curriculum content.

**Instructional design in class.**

**Teacher activities.**
Teacher first ask questions to students for discussion in class. During this period, teachers walk in the classroom and provide help for students, for example, conduct individual tutoring and answer questions to the group. Then teachers put forward the common problems encountered by students in this class and explain it to the whole. After this, teachers arrange a series of task and help students complete them. Next, teachers need to guide students to complete personal evaluation and group evaluation. It should be noted that teachers can’t simply think that “question is communication” or “the more students discuss, the better the effect is”, they need to pay close attention to the quality and depth of communication. Besides, teachers can put forward questions that can arouse students’ thinking and communication according to the level of students watching videos before class, encourage them discuss it actively which ensures the effectiveness of interaction in class⁸.

**Student activities.**
Students set up a learning group in class and discuss the questions raised by teacher. Each group discusses the question and takes a representative to make a statement. Furthermore, students need to complete the tasks assigned by teachers. If there are any problem, they can ask their classmates for help or seek their teachers to individual tutor. After completing the task, students need to sum up what they have learned and finish
evaluation of learning performance which contains self-group evaluation, inter group evaluation and teacher evaluation. The content of self-group evaluation includes whether the group members cooperate and communicate deeply, whether the participation is balanced, whether the internal members are active and so on. Group evaluation contains whether the group participates in the class actively, listens to what the other groups’ have said and whether the group put forward reasonable suggestions etc. The purpose of teacher evaluation is to sum up knowledge and encourage students to cooperate with their classmates and learn actively and then cultivate students’ initiative and individual sense of responsibility, arouse students’ enthusiasm and interest of learning.

After-class instructional design.

Teacher activities.
Teachers need to sort out students’ materials after class, such as learning queries, common problems, works etc. On the basis of this, they should finish self-evaluation, reflect on the shortcomings in the teaching process and optimize teaching constantly.

Student activities.
After class, students need to summarize what they have learned in class and write their learning experiences of the part that they are interested in.

3 Instructional Design of Multimedia Courseware Design and Production Based on Flipped Classroom in Universities

In this paper, we take undergraduates of Lanzhou University whose major are educational technology as objects. We carry out the instructional design based on flipped classroom in the course of multimedia courseware design and manufacture as an example, take the use of trigger in PPT for example.

3.1 Teaching frontal analysis

Teaching content analysis.
The course of multimedia courseware design and manufacture is a professional development course, which devotes to improve the multimedia practical operation ability of students majored in educational technology. This course is of strong practice, and the operation steps are coherent. Besides, it is easy to learn, but difficult to go deep. Various commands need to cooperate with each other, which requires students to practice more. As a function in PPT, trigger is a way to control animation execution in the "custom animation" choice to realize functions of man-machine interface. It is often used in the production of interactive multimedia courseware, which helps expand the slide capacity, control the process, and increase the interest of the slide.
Teaching objectives analysis.

Knowledge and skill objective.
1. understand the concept, mark, principle and function of trigger.
2. speak the concept and function of trigger in their own language.
3. master the steps of making triggers in PPT.
4. induce problems that should be paid attention to in the process of making triggers.
5. complete the trigger cases in PPT independently.

Process and method objective.
1. make a thorough inquiry of triggers themselves.
2. participate in group discussions actively and communicate with others.

Emotion, attitude and value objective.
1. stimulate students’ interest in the course of learning.
2. build confidence in the design and manufacture of multimedia courseware.
3. cultivate imagination and creativity.
4. enjoy sharing their works, appreciate the works of others, and enhance the spirit of cooperation and inquiry.
5. enhance ability of self-learning and practical operation.

Analysis of learner characteristics.
The learners of this course are second-year students majored in educational technology in Lanzhou University. They are 21-23 years old. At this age, students enter concrete operational stage of Piaget’s theory, who are with strong understanding, independent thinking, comprehensive analysis, self-learning. Besides, they have their own learning methods. According to the teaching plan of educational technology, sophomores have already learned the leading course the University of the information technology infrastructure in the first year, which has certain theoretical basis and practical experience for learning PPT software. In other words, at this time, students have already had some professional basic theoretical knowledge, What’s more, compared with most of the other major students, they have more access to software operations which means they have less technical barriers during the process of their study.

Teaching environment analysis.

Network environment.
Lanzhou University campus network construction began in 1996, after years of improvement and development, Lanzhou University campus network has been built in a large scale and covered five school zones, such as the main campus, medical campus, Yuzhong campus etc. At present, the number of full network access computers has reached nearly 30000 units (including more than 17000 in students' apartments, more
than 9000 in staff offices, and more than 3000 in family district of teaching and administrative staff). Apart from this, the network has grown at an annual rate of 5% and now it has been built with full support for IPv4/IPv6. Based on access to CERNET and CNGI-CERNET2, it may realize IPv4/IPv6 universal access to campus network users and IPv4/IPv6 universal service of campus network information resources, which makes it a new teaching and research of information infrastructure in Lanzhou University. Above all, the network of Lanzhou University provides strong support and service for teachers and students.

**Computer room.**

There are forty computers for students and on computer for teachers. All of the computers are equipped with Windows XP operation system and Microsoft PowerPoint software. Besides, all of the computers can connect to the Internet, and more importantly, there is a temporary transfer in the computer room, which is convenient to share information, transfer files, and release tasks and submit homework for teachers and students. There are 10 computers in each longitudinal row in the computer room and the interval is about 1.1 meters. So it is easy to carry out collaborative and group learning.

### 3.2 Teaching activities design

**Instructional design of teaching activities before class.**

*Teaching activities.*

a.) **Write documents**

Teachers write learning manual, knowledge map, requirements of case manufacture, course questions and answers which builds scaffolding for students to learn and test learning performance. Also teachers provide students learning methods and frameworks, and guide students to learn the course of "use of trigger in PPT".

b.) **Make courseware**

Teachers make the courseware and write the corresponding notes to prepare for the video recording. Because the course of multimedia courseware design and manufacture is a practical course, when teachers are making courseware, they should pay attention to present more cases relatively, so that students can have a better understanding on it. At the same time, teachers need to collect the materials needed in the courseware for the students to apply in their own practice.

c.) **Record videos**

Teachers record a total of two videos of the content. The main content of the first lecture is the concept of trigger and the process of making a trigger. First, introduce the concept of trigger through asking "do you know what is trigger? which arouses students’ thinking and then describe the concept by the combination of graphic and text.
Combined with three cases of punishment game, audio switch controlling, video switch controlling, the concept of trigger is further explained. Next, take punishment game for example to demonstrate how to make triggers in PPT and summarize the whole process of it. Finally, a summary is made and bring questions to students to arouse their thinking further.

The second lecture is to explain the signs, principles and functions of trigger. It starts with looking back on the first lecture and then it shows what content they will learn in this part. Then the video demonstrate seven cases of how can triggers use in practical scenes, like literacy games, picture enlargement, guidance or tagging, linking questions, judgement questions, multiple choice questions and raising and dropping flag, which helps stimulate students’ interest in learning through these cases. Finally, according to the cases, there is a summary of the mark, principle, function of trigger.

d.) Share resources
Teachers share documents, videos and other materials with the help of network and mobile equipment.

*Student activities.*

a.) Obtain and save learning resources shared by teachers
Students obtain and save learning resources shared by teachers, such as learning manual, knowledge, micro lesson video, materials and so on.

b.) Learn and practice autonomously by resources provided
students read learning manuals first to know learning method and specific steps of this course. Under the guidance of knowledge, students learn with questions and practice autonomously by resources provided by teachers.

c.) Find problems in the process of practice and try to solve them
In the process of autonomous learning, students watch videos, surf the Internet, read books, communicate with students and try varieties of ways to solve problems. During this period, students sort out problems that they still can’t be solved.

d.) Review and summarize
Students review what they have learnt, sum up the knowledge point, fill in the blanks in the knowledge, answer questions raised at the end of the video and check the answers.

e.) Submit learning outcomes and problems
In order to urge the students to learn before class and test students’ learning effect, students need to submit their learning portfolios which at least include learning outcomes and problems these two parts. Learning outcomes include students’ learning cases, other teaching materials collected and an original cased of PPT triggers. Learning problems include questions they have met in the process of learning and problems they can’t solve.
In order to ensure that the students have watched the videos and brought questions into the classroom, each student needs to put forward at least one most valuable and meaningful topic that he personally believes is related to the course content. Making problem is a process of deepening understanding, and asking questions need to have a strong ability to use knowledge. On the one hand, it urges students to expand their study, improve their ability to use the curriculum, on the other hand, it encourages students to explore and think more. It is worth mentioning that a part of discussion topics of teacher's discussion in class come from this. It breaks through the traditional mode of students ask questions and teachers solve questions and it advocates students to answer questions about the solution, change from solve problems to raise issues and the develop the model of students' mutual teaching and mutual learning. When the student's topic is chosen by teacher, the student's pride and confidence will be promoted. In addition, in the course of classroom discussion, listening to the ideas of other students and teachers will bring fresh new ways of thinking, which helps to deepen the understanding and improve the ability to use it.

**Instructional design of teaching activities in class.**

a.) Provide topics for discussion, form a learning group

Teachers provide topics for discussion, part of which from teacher’s personal experience, and the other comes from students’ learning outcomes so as to increase their enthusiasm and self-confidence. We give the following topics for reference as follows: a. Where do you think the trigger can be used? Please give an example and draw a sketch map. b. What do you think should be paid attention to in the process of making triggers? c. What do you think of the role of PPT in college teaching? In view of questions raised by teachers, students form a temporary study group in class and conduct discussions within group and communicate between groups.

b.) Solve problems and interact with each other

During the discussion, teachers observe the performance of students and help them solve problems. There are three ways for teachers to solve problems: the first is individual tutoring, Teachers give one-on-one tutoring to problematic students, which increases the pertinence of problem solving and helps achieve individualized guidance of students and teach students in accordance with their aptitude. The second way is answer questions by group. Teachers participate in group discussion or observe the discussion of each group to know the common problems encountered by different groups, and guide the group to solve problems. The third one is answering common questions in class. Teachers put forward and solve problems according to individual tutoring and group answer questions in class, prompting students what they have ignored, so that students can get new insights in problem solving. After the discussion, students actively speak as representatives and participate in the exchange of issues.
c.) Arrange tasks and practice themselves

Teachers give students assignments can not only detect the students learning effect and push students to learn before class, but help students find problems in the process of complete the task. In the process of flipped classroom model instructional design, the assignment is to finish the case "picture magnifying effect". Students who finish first can help others, or under teachers' guidance, think how to improve cases of original trigger works submitted by individual.

d.) Show cases, exchange and evaluate outcomes

With the help of multimedia projection facilities, teachers show the original trigger works made before class to students, and encourage students to speak actively, to evaluate students' work, point out where is worth learning and what needs to be improved. On the basis of this, students put forward some opinions and suggestions, which make students learn from each other and to broaden their ideas. Finally, teachers systematically comb what they have learned and skills in class and lead students to evaluate their learning outcomes.

**Instructional design of teaching activities after class.**

*Teacher activities.*

1. collation: collecting students' works, learning problems, sorting out materials as cases and materials afterwards.
2. evaluation: teachers evaluate the students' learning effect before class, discussion in class, completion of tasks and self-evaluation of individual teaching level.
3. introspection: teachers reflect on the deficiencies in the process of instructional design based on flipped classroom and write teaching reflection.
4. Optimization: teachers sum up the common problems of students, launch discussion of specific topics and make the best answer.

In addition, teachers provide extended learning materials for students, which make them choose the part that they are interest in to expand learning.

*Student activities.*

At the end of the course, students sum up what they have learned and optimize their personal works and then hand it to teachers again. Except that, they can select the part that they are interested in to expand learning or answers questions provided by teachers.
Table 2. The flipped classroom instructional design of the application of triggers

<table>
<thead>
<tr>
<th></th>
<th>teacher activities</th>
<th>student activities</th>
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</thead>
<tbody>
<tr>
<td><strong>Before class</strong></td>
<td>write documents</td>
<td>1. obtain and save learning resources shared by teachers</td>
</tr>
<tr>
<td></td>
<td>Write learning manual, knowledge map, lecture of micro lesson video, answers and questions etc.</td>
<td>2. learn and practice autonomously by resources provided</td>
</tr>
<tr>
<td></td>
<td>make courseware</td>
<td>3. find problems in the process of practice and try to solve them</td>
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<tr>
<td></td>
<td>Make courseware of the course</td>
<td>4. review and summarizes</td>
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<tr>
<td></td>
<td>record video</td>
<td>5. submit learning outcomes and problems</td>
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<td></td>
<td>Record two videos.</td>
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<td></td>
<td>resource sharing</td>
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<td></td>
<td>Share documents, videos and other materials to students.</td>
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<tr>
<td><strong>In class</strong></td>
<td>provide topics for discussion</td>
<td>1. form a temporary study group</td>
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<td></td>
<td>One from teachers’ personal experience, and one from students' learning outcomes</td>
<td>2. discuss problems raised by teacher</td>
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<td></td>
<td>solve problems</td>
<td>3. seek individual tutors in group or teachers</td>
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<td></td>
<td>Individual tutoring; Answer questions by group; Answer common questions</td>
<td>4. complete the tasks arranged by teacher</td>
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<td></td>
<td>assign tasks</td>
<td>5. inductive knowledge point of fabrication skills and scenarios</td>
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<td></td>
<td>See who do fast</td>
<td>6. appreciate the case displayed by teacher</td>
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<td></td>
<td>exchange works</td>
<td>7. evaluate the learning results</td>
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<td></td>
<td>Sum up skills;</td>
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<td></td>
<td>Show works students do before class;</td>
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<td></td>
<td>Evaluate and discuss about works of students</td>
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<td></td>
<td>collect students' works, learning problems, sort out materials</td>
<td>1. write learning experience</td>
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<td><strong>After class</strong></td>
<td>collation</td>
<td>2. optimize and upload personal works</td>
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<td></td>
<td>Evaluation</td>
<td>3. choose to answer the teacher’s question</td>
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<td></td>
<td>Self-evaluation; student evaluation</td>
<td>4. expand learning by choosing what they are interested in</td>
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<tr>
<td></td>
<td>introspection</td>
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<td></td>
<td>Reflect questions and improve them</td>
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<td></td>
<td>Optimization</td>
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<td></td>
<td>Sum up common problems, launch discussion, provide extended learning materials</td>
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References

An Interactive E-book Approach to Improve Students’ Performances in Learning Classical Chinese Articles

Gwo-Jen HWANG *, Han-Yu SUNG, Wen-Shiou LIOU
Graduate Institute of Digital Learning and Education
National Taiwan University of Science and Technology Taipei, Taiwan
* gjhwang.academic@gmail.com

Abstract. Learning the ancient articles written in classical Chinese has been identified as being an important and challenging issue for the students in globe Chinese. The articles not only represent the literature in ancient China, but also contain the wisdom and philosophy of those ancient masters. However, in traditional instructions, it is difficult to express the spirit of this philosophy; therefore, many students have encountered great difficulties in learning the course. To cope with this problem, an interactive e-book system has been developed in this study to interpret the ancient articles in an interactive way. A quasi experiment was conducted to evaluate the performance of the proposed approach. The participants were 38 fifth graders from 2 classes in an elementary school located in northern Taiwan and they were divided into the experimental group and the control group. The experimental group used an interactive e-book learning mode to learn the articles in classical Chinese, while the control group used a conventional technology-enhanced teaching mode. The results showed that adopting the interactive e-book teaching mode can promote students’ learning achievement and motivation in the classical Chinese course.

Keywords: interactive e-book, learning motivation, classic Chinese, mobile learning

1 Introduction

The Analects of Confucius is one of the classical literature and aimed to cultivate students’ concepts of learning and morality as well as enhance their knowledge to Chinese culture and literature literacy (Chang, 1997; Pang, Esping, & Plucker, 2017). In the past decades, the Analects of Confucius has been appointed as a main topic in the Chinese curriculum in Taiwan and other global Chinese areas (Kim, 2004; Shan & Xiao, 2014). As the Analects of Confucius was written with ancient Chinese, it is difficult to those students who are unfamiliar with the ancient presentation style, which uses “dense” Chinese words to represent complex and deep meanings (Sung, Hwang, Lin, & Hong, 2017). In traditional instructions, most school teachers present the knowledge of the Analects of Confucius to students and ask them to have rote recitation and practices of the words, pronunciations, and meanings of those ancient Chinese
sentences. Such an instructional approach not only increases students’ cognitive load, but also affect their learning performance and interests.

In this study, an interactive e-book with narration, video, animation, and interactive practices is developed to promote students’ performances and interests in leaning the Analects of Confucius. Moreover, an experiment was conducted in an elementary school in northern Taiwan to evaluate the effectiveness of the proposed approach by answering the following questions:

(1) Can the interactive e-book improve the students’ achievements in learning the Analects of Confucius in comparisons with the traditional instruction?

(2) Can the interactive e-book improve the students’ motivations in learning the Analects of Confucius?

2 Relevant Studies

Confucius is a great scholar in ancient China. His philosophy not only shapes and represent the soul of China, but also affects the thoughts of scholars in the world (Sung, Hwang, Lin, & Hong, 2017; van Norden, 2002). The Analects of Confucius is a book recording the sayings of Confucius by his students and the scholars at the same era using classical Chinese. The education of the Analects of Confucius is considered to be a way of learning the philosophy of Confucius as well as the classical Chinese. It aims to equip students with the deep concepts of knowledge and learning as well as ability of reading and interpreting ancient Chinese. It is expected that the learners are able to have temperament in classical literature.

One of the challenges of learning the Analects of Confucius is that it was written in Classical Chinese, which is the most precious historical remaining from the ancestors and is also the most bountiful cultural heritage in China. The wordings in classical Chinese are concise and comprehensive and it is a written style in ancient China.

Although many daily language usages or idiom origins are from classical Chinese, as the increasing popularity of vernacular Chinese, the reading and education in classical Chinese decayed. Researchers in Global Chinese communities have summarized the difficulties teachers encounter in teaching the content in classical Chinese. For example, the characteristics of the traditional Chinese, such as shifting of reading styles, characteristics of a word, multi-pronunciations of a word, and multi-meanings of a word, usually make students feel frustrated at their first touch and hence resist learning. Moreover, when teaching the content in classical Chinese, teachers often repeat the texts in the books and ask student to mesmerize the content, which could be boring and hence could not arouse students learning motivation.

The Analects of Confucius is a representative course in classical Chinese, which has been a part of standard curriculums in elementary and junior high schools in Taiwan and several global Chinese areas for decades. In order to promote students’ motivation and interests in learning classical Chinese, the researchers of this study attempted to embed the scenarios of the Analects of Confucius in interactive e-books using multimedia technologies with interactive interface designs. It was expected that through
the improvement of teaching method, the students’ learning performance as well as their motivation can be improved, and their cognitive load can be reduced.

3 Research methods

Two classes of fifth graders in an elementary school in New Taipei City were given the measurement. One class was the control group, adopting conventional technology-enhanced teaching method and using the Analects of Confucius learning system in Chinese course to learn the Analects of Confucius while the other group is the experimental group, adopting an interactive e-book learning mode and using the Analects of Confucius learning system in Chinese course to learn the Analects of Confucius. Before the experiment, two classes of students learned the Analects of Confucius first and had the pre-tests. Besides measuring students’ knowledge of the Analects of Confucius, questionnaires and open-ended questions were also given to understand students’ learning motivation before having the learning activity.

After the learning activity, learning achievement post-test was given based on the learning contents in class. Some post-questionnaires of learning motivation, technology acceptance, as well as cognitive load were used, and open-ended questions were given. Then analysis and discussion were processed to summarize the research conclusion and propose relevant opinions. Research structure, research design, and research measurement tools are explained in the following sections.

3.1 System structure

An interactive e-book development software, SimMagic, developed by HamaStar Technology, was used to develop and provide students an interactive learning environment. Figure 1 shows the system structure.
3.2 System interface and functions

At the beginning of the learning activity, pictures and texts are narrated to introduce the origin of the Analects of Confucius, as shown in Figure 2. Basic introduction of the authors of the Analects of Confucius was given to let students understand the first and last name as well as the hometown of Confucius, as shown in Figure 3. Then, concept-mapping was used to let students know the Chinese academic thinking of Confucianism, Taoism, Legalist, and Mohism at a glance and Confucius belongs to the Confucianism, as illustrated in Figure 4. Finally, Confucius’ spirit in education was introduced, as shown in Figure 5. Students were guided to learn the course contents gradually and let students have basic understanding of the Analects of Confucius. Those important contents were blocked by the sticker function so the students needed to touch and unveil the correct information to reinforce their memory to the course contents.

At the end of each section, there would be the summary of the section. Key words and important explanation would be marked in peach to let the testers review the learning contents and examine if they have clear understanding of those important concepts.
4 Experimental design

To examine the effects of learning achievement of those using an interactive e-book learning mode in the elementary school Chinese course, the experiments and relevant statistical analysis were conducted. This chapter introduces the experimental design and there are three sections, section 1 for the research participants, 2 for the learning contents, and 3 for the experimental procedure.

4.1 Research participants

The research participants were fifth graders of an elementary school in New Taipei City. Two classes were chosen, a total of 38 students participating the experiment. One is the experimental group and the other one is the control group. Two classes of students received a basic knowledge test of the Analects of Confucius to make sure that they have equivalent prior knowledge in Chinese courses. All students were instructed by the same teacher to minimize the factors caused by educators.

4.2 Learning contents

To let students have correct learning attitude and approaches, be inspired by Confucius’ thoughts and wisdom, understand the meaning in Book 1: Hsio R and Book 7: Shu R in the Analects of Confucius, the features of interactive e-books were used in the activity. Videos guided the students into the learning scenarios in learning the Analects of Confucius and tasks were designed to lead them to answer the questions to promote their learning results.

4.3 Experimental procedure

An interactive e-book learning and a conventional technology-enhanced learning mode were integrated into the Analects of Confucius in an elementary school Chinese course to let students understand the contents in Book 1: Hsio R and Book 7: Shu R. Through different learning modes, students’ learning motivation can be triggered and improve their learning results.

Figure 6 shows the experimental procedure of this study. Before the learning activity, two classes of students received the instruction of the Analects of Confucius, including the syntax and the meaning of classical Chinese. Then, the experiment was conducted. At the beginning of the experiment, the students were given the pre-test of the Analects of Confucius and pre-questionnaires of learning motivation and open-ended questions, and then the learning activity was conducted. In the learning activity, the learning contents were the same for two classes. The experimental group used an interactive e-book learning mode while the control group used a conventional technology-enhanced learning mode. After the learning activity, post-test of the Analects of Confucius and post-questionnaires of learning motivation, technology
acceptance, cognitive load, and open-ended questions were conducted to measure students’ learning results.

38 students

Basic instruction of the Analects of Confucius 30min

Pre-test and pre-questionnaires of learning (learning motivation and open-ended questions) 30min

The experimental group
Interactive e-book learning mode

The control group
Conventional technology-enhanced learning mode 50min

Post-test and post-questionnaires of learning (learning motivation, technology acceptance, cognitive load, and open-ended questions) 40min

Interview 15min

**Fig. 6.** Experiment procedure

### 5 Experimental design

The aim of this study is to adopt an interactive e-book mobile learning mode and investigate the effects of students’ learning achievement, learning motivation, cognitive load, and technology acceptance. This study assumed that compared to the conventional technology-enhanced learning mode, an interactive e-book learning mode can promote students’ learning achievement better. To examine the effects of this learning mode, a quasi-experiment was adopted and the participants were divided into the experimental group and the control group. The students in the experimental group used an interactive e-book mobile learning mode while those in the control group used a conventional technology-enhanced learning mode. The pre and post-tests of the Analects of Confucius learning achievement and pre and post-questionnaires of learning motivation, cognitive load, technology acceptance, and open-ended questions, as well as interviews were all used to analyze students’ changes in learning results before and after the learning activity.
5.1 Learning achievement

This section mainly explores the learning modes of the conventional technology-enhanced teaching and interactive e-book mobile learning on students’ learning achievement of the Analects of Confucius. The pre-test scores were the covariant and an analysis of covariance (ANCOVA) was conducted on the post-test scores. To meet the basic assumption of the analysis of covariance, a homogeneity of regression test on the scores of two groups was conducted. From the homogeneity test on pre-test, it was indicated that there is no violation of the assumption of homogeneity \((F = 0.97, p = 0.53 > 0.05)\), meaning that the covariant and the dependent variables are consistent. It can be known that the experimental group and the control group meet the basic assumption of the analysis of covariance, then the ANCOVA can be further conducted.

After the experiment, two groups of students had the Analects of Confucius learning achievement post-test to analyze the learning difference of using different learning modes in two groups. There are 25 items, with a perfect score of 100. The test was graded based on standard answers. There are two dimensions for the items, 13 items for the remember dimension and 4 points for each item, and 12 items for understand dimension and 4 points for each item. Table 1 shows the summary of ANCOVA. A significance was reached between the experimental group and the control group \((F = 4.45, p = 0.04 < 0.05)\), indicating that the interactive e-book mobile learning mode can significantly improve students’ learning achievement on the Analects of Confucius in Chinese courses.

Table 1. ANCOVA result of the learning achievement post-test in the experimental group and the control group

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>Adjusted mean</th>
<th>Std error</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>19</td>
<td>76.21</td>
<td>12.11</td>
<td>76.01</td>
<td>2.90</td>
<td>4.45*</td>
</tr>
<tr>
<td>Control</td>
<td>19</td>
<td>67.16</td>
<td>13.24</td>
<td>67.36</td>
<td>2.90</td>
<td></td>
</tr>
</tbody>
</table>

*p < .05

5.2 Learning motivation

This section mainly explores if the learning modes of the conventional technology-enhanced teaching and interactive e-book mobile learning bring a significance on students’ deep motive and surf motive in the learning motivation of the Analects of Confucius. The pre-test scores were the covariant and an analysis of covariance (ANCOVA) was conducted on the post-test scores.

To meet the basic assumption of the analysis of covariance, a homogeneity of regression test on the scores of two groups was conducted. In the deep motive dimension, the assumption of homogeneity of regression was not violated \((F = 0.60, p > 0.05)\), meaning that the covariant and the dependent variables are consistent. In the surface motive dimension, the assumption of homogeneity of regression was not violated \((F = 1.95, p > 0.05)\), meaning that the covariant and the dependent variables
are consistent. The above two examination meet the basic assumption of the analysis of covariance, then the ANCOVA can be further conducted.

In the deep motive dimension, the deep motive was the covariant and an analysis of covariance (ANCOVA) was conducted, as show in Table 2. Although the mean scores of the deep motive for the experimental group (M=4.02) is higher than that for the control group (M=3.88), no significance was found (F = 0.48, p > 0.05), meaning there is no significant difference on the deep motive in two groups. In the surface motive dimension, the surface motive was the covariant and an analysis of covariance (ANCOVA) was conducted, as show in Table 2. Although the mean scores of the surface motive for the experimental group (M=3.78) is lower than that for the control group (M=4.06), no significance was found (F = 2.32, p = 0.14 > 0.05), meaning there is no significant difference on the surface motive in two groups.

Table 2. ANCOVA result of deep and surface motive of two groups

<table>
<thead>
<tr>
<th>Learning motivation</th>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>Adjusted mean</th>
<th>Std error</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep motive</td>
<td>Experimental</td>
<td>19</td>
<td>3.85</td>
<td>0.72</td>
<td>4.02</td>
<td>0.14</td>
<td>0.48</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>19</td>
<td>4.05</td>
<td>0.72</td>
<td>3.88</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>Surface motive</td>
<td>Experimental</td>
<td>19</td>
<td>3.75</td>
<td>0.76</td>
<td>3.78</td>
<td>0.13</td>
<td>2.32</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>19</td>
<td>4.10</td>
<td>0.78</td>
<td>4.06</td>
<td>0.13</td>
<td></td>
</tr>
</tbody>
</table>

From the results above, no significance was found in the deep and surface motive. A paired t-test was further conducted on the experimental group, as shown in Table 5-7. The pre-test score for the deep motive in the experimental group is 3.33 and 3.85 for the post-test. A significance was reached (t = -2.94, p = 0.01), meaning that the deep motive was significantly improved. The pre-test score for the surface motive in the experimental group is 3.84 and 3.75 for the post-test. A significance was reached (t = 0.88, p = 0.39), meaning that the surface motive was not significantly improved.

Table 3. Summary of the paired t-test on the deep and surface motive for the experimental group

<table>
<thead>
<tr>
<th>Learning motivation</th>
<th>Self-efficacy</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep motive</td>
<td>Pre-test</td>
<td>19</td>
<td>3.33</td>
<td>0.82</td>
<td>-2.94**</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>19</td>
<td>3.85</td>
<td>0.72</td>
<td></td>
</tr>
<tr>
<td>Surface motive</td>
<td>Pre-test</td>
<td>19</td>
<td>3.84</td>
<td>0.70</td>
<td>0.88</td>
</tr>
<tr>
<td></td>
<td>Post-test</td>
<td>19</td>
<td>3.75</td>
<td>0.76</td>
<td></td>
</tr>
</tbody>
</table>

**p < 0.05
6 Conclusions and Discussion

Based on the research questions in Chapter 1 and the experimental results in Chapter 5, the conclusion of this study was drawn and suggestions were provided as a reference as following.

Research questions 1: What is the difference of using the conventional technology-enhanced learning mode and interactive e-book learning mode in learning the Analects of Confucius in learning achievement for the 5th graders at an elementary school?

From the analysis of the experimental result, it was found that a significance was reached in adopting the interactive e-book learning in learning achievement, meaning that after using the interactive e-book, the experimental group outperformed the control group. It is beneficial in promoting students’ learning achievement. The assumption of “The students using the interactive e-book learning mode outperformed the students using the conventional technology-enhanced learning mode in learning achievement” was supported. The remembering and understanding dimensions were further investigated. From the experimental result, it was found that under the interactive e-book learning environment, no significance was found on the remembering dimension but a significance was found on the understanding dimension. The result coincides with the understanding cognition process in the third stage of Grade 1-9 Curriculum Guidelines.

Research question 2: What is the difference of using the conventional technology-enhanced learning mode and interactive e-book learning mode in learning the Analects of Confucius in the deep/surface motive for the 5th graders at an elementary school?

The research results showed that no significance was found on the deep and surface motive in both the interactive e-book learning and the conventional technology-enhanced learning. The assumption of “The students using the interactive e-book learning mode outperformed the students using the conventional technology-enhanced learning mode in deep/surface motive” was not supported. The researchers suggested that the future research can be more diverse and proper learning strategies can be implemented. For instance, gaming mechanism or peer collaboration can be added in the e-book. The features of game can influence students’ active knowledge learning and promote students’ higher order thinking (Hogle, 1996). Through peers’ interactive learning at elementary school language learning, students can participate more actively, become an active learners, and gain more knowledge (Horner, 2000). However, the researchers further investigated the experimental group and it was found that their deep motive was significantly improved. Students’ learning promotion mainly came from their pursuit of knowledge and they had great learning goals. Earning high scores is a facilitating motive. Therefore, it can be deducted that the interactive e-book learning mode can trigger students’ inner interests and dep motives in Chinese course. When students believe that the learning is fun, they will put their greatest efforts to find
the suitable study method to understand the learning contents and hence gain deeper thoughts and apply to other courses.

References

An Exploration on the Regional Sharing Mechanism for High-quality Online Teaching Resources of Colleges and Universities in the Internet Era

Xiao-yan SU \(^1\), Cong-dong LI \(^2\), Ivan Ka-wai LAI \(^3\)

\(^{1,2}\) International Business School, Jinan University, Zhuhai, 519070, China
\(^3\) Faculty of International Tourism and Management, City University of Macau, Taipa, Macau

\(^{1,2}\) {tsuxyan, licd}@jnu.edu.cn, \(^3\) ivanlai@cityu.mo

Abstract. With the proposing of “Internet +” strategy, more and more high quality online teaching resources will be constantly developed and used at colleges and universities which are significant for solving the imbalance in high-quality teaching resources among universities. However, the lack of resource sharing mechanism seriously restricts the effectiveness of resource sharing. Based on analysis of the status quo of high quality online teaching resources sharing, this paper puts forward 5 types of resource sharing mechanism including coordination mechanism, motivation mechanism, investment mechanism, payment mechanism and evaluation mechanism to deal with this dilemma.

Keywords: Online teaching resources, Regional sharing mechanism, MOOC

1 Introduction

In recent years, higher education in China has transformed from elite education to mass education. During this process, the gross enrollment rate of college and university students continues to increase. But in the meanwhile, the contradiction between students' unlimited demand for higher education resources, especially high-quality teaching resources, and limited supply of high-quality teaching resources is becoming increasingly conspicuous. Affected by the development laws of high-quality resources and driven by the self-interest of colleges and universities, the distribution of high-quality teaching resources at colleges and universities is unbalanced and the flow of such resources is strictly limited. The shortage of high-quality teaching resources has been a long-term problem of higher education (Zhou, 2006). How to break down the barrier of interest and establish a regional sharing mechanism for high-quality teaching resources at colleges and universities has become one of the important problems that need to be solved in the reform and development of higher education at the present stage.
High-quality teaching resources of colleges and universities refer to excellent courses, top-quality teaching materials, famous teachers, teaching teams, famous majors, key laboratories, etc. with certain features or advantages accumulated by colleges and universities after many years. Driven by the rapid development of modern educational techniques, many colleges and universities have developed and accumulated a certain number of high-quality online teaching resources by their own teaching staff and brand advantages, which are digital, networked and visualized high-quality teaching resources including courseware, videos, pictures, audio materials, animations and other curriculum resources (Zhou, et al., 2013). Due to the scarcity and valuableness of high-quality online teaching resources, the above teaching resources have become objectives pursued by colleges and universities. As the strategic concept of “Internet +” is proposed, more and more online teaching resources will be further developed and utilized in the future. If government authorities as well as relevant colleges and universities help promote the regional sharing of high-quality online teaching resources, then on the one hand, the problem of insufficient supply of high-quality teaching resources of colleges and universities will be eased. And on the other hand, sustainable and Pareto development of high-quality online teaching resources will also be achieved. As a result, students will be able to enjoy the best teaching resources and various colleges and universities will achieve resource intensive development. Thus, it can be seen that the implementation of regional sharing of high-quality online teaching resources at colleges and universities is of a very important practical implication.

2 Exploration Course for the Regional Sharing of High-quality Online Teaching Resources of Colleges and Universities

So far, the exploration course for the regional sharing of high-quality online teaching resources of colleges and universities in mainland China can be divided into three stages:

The first stage started from the 1990s and mainly involved with large cities where many colleges and universities are located, such as Guangzhou, Beijing, Shanghai, Wuhan and so on. For example, Guangzhou Campus of Jinan University, together with other five universities in the Shipai district (including South China University of Technology, Guangdong University of Technology, South China Normal University, South China Agricultural University and Guangdong Polytechnic Normal University), developed the new pattern of innovative talents training via multi-university cooperation by making full use of various university advantages on the basis of “resource sharing, complementary advantages, division of responsibilities and mutual benefit”. From the academic year 1999 to 2002, 3,285 students from other five universities took elective courses in Jinan University, and 2,436 students of Jinan University took elective courses in other universities. On this basis, six universities in Shipai district further signed the "Agreement for Joint Course Selection among Six Universities in Shipai Area of Guangzhou" and "Cross-university Cooperative Teaching Agreement for Minoring a Second Major among Six Universities", which
provided system guarantee for the regional sharing of teaching resources. To provide convenience for students' selecting courses and minoring second majors in different universities, free traffic buses traveling to and fro between six universities were provided, which greatly promoted the regional sharing of teaching resources.

The second stage started from the beginning of this century and mainly involved with newly built higher education zones or university towns in various regions, which took "teaching association", "teaching community", etc. as main organizational forms. Colleges and universities within a certain region shared teaching resources in an organized way. Relying on the favorable geographic location, both the scale and depth of teaching resources sharing among universities in the university town surpassed the first stage. According to incomplete statistics, over 50 higher education zones or university towns were newly built throughout the country during this period, including those with a relatively large scale such as Guangzhou Higher Education Mega Center, Teaching Community in Beijing Xueyuan Road, Hangzhou Xiasha University Town, Shanghai Songjiang University Town, Chongqing College Town, etc. At the beginning of the Teaching Community in Beijing Xueyuan Road, only 3 public elective courses were offered to 500 students. At present, altogether 80 to 90 public elective courses are offered to about 12,000 students per year. For more than a decade, the "Teaching Community" has successfully set up more than 170 curriculums and offered 1,200 courses to over 100,000 students in such fields as literature, art, sports, medicine, natural science, social science, etc. The proportion of students' elective course credits account for 40% of all elective courses, and 8% of the total credits. Cross-university course selection not only optimizes students' knowledge structure and broadens their horizons, but also breaks the tradition of cultivating talents by a single college or university and creates the cooperation mode of multi-university talent training and sharing high-quality teaching resources.

The third stage witnesses the rapid development of modern online educational resources. By virtue of the development of modern educational information and multimedia technologies, some colleges and universities have invested and developed a number of online high-quality teaching resources. In 2003, the Ministry of Education launched the teaching quality and top-quality curriculum construction projects by implementing teaching reform in colleges and universities (Ministry of Education, 2003). The project requires that "teaching syllabuses, teaching plans, exercises, network coursewares, teaching videos, etc." related to top-quality curriculums of colleges and universities should be uploaded to the Internet for free access and sharing. The construction of national top-quality curriculums is required to "lay emphasis on network resources construction, cover all disciplines, promote network teaching and digital learning, and share high-quality teaching resources". The top-quality curriculum project has played a positive role in promoting the sharing of online teaching resources. With the vigorous development of online education, the Ministry of Education launched the establishment of a high-quality teaching resources sharing system in 2012. In addition, the Ministry of Education further specifies the key points of work in 2015 that it is necessary to "perfect the national education resources cloud service system, continue to push the development and application of high-quality digital educational resources, explore the application driven mechanism for online open
courses, and strengthen the construction, use and management of 'MOOC'.

Featuring abundant resources, a large amount of information, convenient and fast delivery, free from time and space constraints, etc., online teaching resources enable learners to study 7×24 at any time with the help of existing computer network and mobile communication technologies. Therefore, the current scope and degree of regional sharing of teaching resources will greatly surpass those in the traditional model.

The online teaching resources could create necessary conditions for the regional sharing of high-quality teaching resources by breaking time-space distance limits. However, due to objective factors such as varied teaching skills of different universities, constraints in inter-university sharing agreements, cross-university student management, etc. and subjective factors such as insufficient teachers' motivation, unbalanced income of universities, etc., the development of most high-quality online teaching resources remains slow in practice. Apart from sharing national top-quality curriculums and other teaching resources required to be open to the public for free, most high-quality teaching resources are still shared and used only on campus. According to statistics, 128,972 online teaching courses are offered by colleges and universities nationwide in 2009, but only about 5% of such courses are available for sharing. The degree of sharing inter-university high-quality online teaching resources is far lower than expected.

3 Status quo of High-quality Online Teaching Resources Sharing

The realization of regional sharing is able to break the traditional pattern of closed talents training at colleges and universities, achieve cooperation among various universities, innovate the talent training mode, enhance the reputation of teachers and universities and reach a win-win situation (among universities, teachers and students). However, in reality, the regional sharing of high-quality teaching resources in various regions does not achieve satisfactory results.

3.1 Status quo of the regional sharing of high-quality online teaching resources

(1) Number of resources is limited
At present, most teaching resources shared among colleges and universities are limited to curriculum resources. The sharing of other teaching resources such as books, reference materials, teachers, etc. are relatively infrequent. With respect to the sharing of courses, currently available courses cannot meet students' demands and most of them are offered in the traditional curriculum mode. New online teaching resources, such as micro-class, flipped classroom, MOOC and other forms, etc. are relatively rare. The following takes inter-university elective courses of 10 colleges and universities in Guangzhou Higher Education Mega Center as an example. In 2014 to 2015, 14 and 12 courses were offered respectively in the first and second semester, and less than 2
courses were offered on average in each semester. The extremely limited number of courses offered and students admissible were not enough to satisfy inter-university course selection demands of more than 30,000 students in the college town.

(2) Structure of resources is unreasonable
Seeing from courses offered by colleges and universities currently, cross-university elective courses are mainly limited to humanistic quality elective courses. Professional courses in urgent need by students are very limited, which are not enough to satisfy students' demands to improve their professional knowledge. According to statistics of the Teaching Community in Beijing Xueyuan Road, cross-university elective courses are mainly involved with art, fitness, leisure, etc., followed by literature and art courses (21%), and then sports (14%), computer (12%) and medicine (7%). Popular courses on economic management in urgent need by students are less than 7% in total courses. Seeing from the course setting of universities in Guangzhou Higher Education Mega Center from the academic year 2014 to 2015, over 90% of courses are general elective courses, and less than 8% are professional courses.

(3) Number of teachers is few
It can also be seen from the above course setting of universities in Guangzhou Higher Education Mega Center that about 10 to 15 teachers are assigned by 10 colleges and universities in each semester. Compared with the total number of over 4,000 teachers, very few teachers are involved in cross-university course selection, which is less than 0.3% of the total number. In addition, about one-third of teachers who participate in the sharing of curriculum resources are young teachers and the proportion of famous teachers is much lower.

(4) Sharing scope of resources is small
From the sharing scope of online teaching resources of existing universities, such resources are only available to students nearby these colleges and universities, not including students from distant colleges, universities and local communities. As a result, the influence scope of high-quality online resources is rather limited. Along with the development of modern information technology, how to improve the sharing degree and scope of high-quality online teaching resources under the background of modern educational technologies has become a practical problem that needs to be resolved immediately.

3.2 Cause Analysis
The fundamental cause of problems existing in the sharing of above-mentioned high-quality teaching resources at colleges and universities lies in unreasonable design of the regional sharing mechanism, which results in insufficient motivation to teachers and universities, lack of supervision and coordination and so on. To be specific:
(1) **The motivation mechanism is insufficient.**

The limited number of courses and teachers involved in online teaching resources sharing mainly results from insufficient motivation. Teachers and colleges are not motivated to offer cross-university courses. From the point of course-offering, the offering of cross-university elective courses will benefit other universities and students. Following the principle of "whoever benefits from such courses is responsible for payment", beneficiary universities and students should pay to universities and teachers who offer courses. But in fact, students' elective courses in some university towns are completely free of charge or collect very little charges, and teachers' class fees are still paid by the course-offering university. Some local governments subsidize the universities and teachers to participate in the sharing of resources. For example, the Department of Education of Zhejiang Province gives universities in Hangzhou Xiasha University Town offering inter-university elective courses with a subsidy of 30 Yuan/period for each course. However, the subsidy is not enough to cover teachers' period allowance, course management expenses and other expenditures. As a result, the universities and teachers are not motivated to participate in offering cross-university elective courses.

(2) **The investment mechanism design is unsatisfactory**

Both the real-time data updating of online teaching resources and timely offline interaction with students require the investment of appropriate human, financial and material resources. In addition, in the process of implementing regional sharing of online teaching resources, multiple subjects are needed to participate in the development, coordination and management of high-quality teaching resources. Therefore, stable and reliable investment mechanism design is necessary to ensure the continuous development of online high-quality teaching resources. Currently, the lack of human, financial and material investment in the development, design, maintenance and management of high-quality teaching resources and platforms greatly reduces the motivation of colleges or universities and teachers.

(3) **The payment mechanism design is unreasonable**

For universities or students who use high-quality online teaching resources, the payment of costs is a guarantee for the virtuous circle of development of high-quality teaching resources. At present, some universities in university towns or higher education zones implement different charging systems on cross-university course selection according to the nature of specific courses, among which quality education courses are free of charge, and professional courses are charged appropriately according to the nature of level, credit, subject and other characteristics of specific colleges or universities. However, with the increase in online teaching courses, there will be more and more students from outside the university or other areas. How to make payment reasonable? Shall the payment be made by means of tuition or certification fee? If the payment cannot be effectively settled among universities, will students be required to pay for cross-university elective courses apart from paying the tuition at their own
universities? If this form of payment is unreasonable or repeated, it is bound to affect students' enthusiasm to participate in cross-university elective courses.

(4) The evaluation mechanism is insufficient
The growth and development of high-quality courses cannot do without active feedback from students. However, as very limited cross-university elective courses are available for the students, no effective evaluation mechanism is set up to select the superior and eliminate the inferior online teaching resources to better meet students' demands.

(5) The coordination mechanism is deficient
Offering cross-university courses needs to coordinate between different universities, teachers, students and other subjects concerning time and place arrangements and many other issues, which has great difficulty in coordination. Lacking of an effective coordination mechanism may result in “conflict” courses and unsuccessful course offering. More importantly, if colleges or universities cannot solve mutual recognition of credit, cost settlement and other key issues, it will directly affect the regional sharing of high-quality online resources.

4 Designing the Regional Sharing Mechanism of High-quality Online Teaching Resources

More students, teachers, universities and other subjects can benefit from abundant high-quality online teaching resources only when such resources are used effectively. Therefore, it is very important to design a reasonable teaching resources sharing mechanism to achieve win-win cooperation among colleges and universities.

4.1 Coordination mechanism
Coordination mechanism refers to making coordinated arrangements about activities of the government, universities, teachers, teaching assistants, students and other subjects in the process of curriculum development, construction, use and maintenance, which requires various subjects to understand their respective divisions of work, duties clearly and cooperate with one another. Firstly, the education administrative department shall establish formal systems for mutual recognition of credit, tuition payment and settlement, certificate issuance, remuneration arrangement, teaching resources platform design among universities. In October 2014, the Department of Education of Guangdong Province issued the *Opinions on Credit System Management Implemented by Regular Institutions of Higher Education*, which clearly put forward that colleges and universities should set up the system for students' taking elective courses in other universities, and encourage students to take elective courses in other universities or based on the Internet learning platform. Elective courses taking in other universities can replace students' required courses or elective courses of their own university, which provides a system guarantee for the mutual recognition of credit. Secondly, all
university presidents shall set up a Coordinated Management Committee to regularly discuss the overall planning of online teaching resources, number of classes, structural design, teacher arrangements and other issues. The Coordinated Management Committee shall have a teaching affairs department to organize and arrange courses to be offered by various universities, and coordinate time and place issues related to teachers, students and courses. Thirdly, the teachers team is responsible for organizing and designing online resources, giving lessons, answering students' questions offline, and giving students the final performance evaluation. Fourthly, the teaching affairs department is responsible for coordinating the curriculum setting of teachers.

4.2 Motivation mechanism

Whether it is traditional teaching resources or online teaching resources, the motivation mechanism is key to promote the sharing of resources. For universities or teachers who offer resources, their knowledge should bring corresponding economic benefits. Qualification admittance, nature of course, number of students, qualification of teachers, curriculum evaluation and other indicators shall be established to correlate with the course remuneration system, so as to fully mobilize the enthusiasm of colleges or universities and teachers to participate in teaching resources sharing.

4.3 Investment mechanism

The local government and universities shall establish a stable investment mechanism for the development and use of online high-quality teaching resources, including personnel investment, fund investment and platform investment. Firstly, as for personnel investment, the construction, maintenance, updating and interaction of online teaching resources library require teachers and team members to invest a lot of time and effort. The sustainable development of high-quality online teaching resources cannot do without corresponding staff support. Secondly, as for fund investment, the government shall continue to increase information investment in colleges and universities to ensure the development of online teaching resources, truly realize full coverage of the campus wireless network and provide convenience for users of network teaching resources. In November 2014, the Ministry of Education and other five administrative departments jointly issued the Implementation Scheme for Building An Effective Mechanism Utilizing Information-based Means to Expand the Coverage of High-quality Educational Resources, which proposed that by the end of 2015, all types of schools at all levels should achieve full coverage of the "Internet", among which the broadband access ratio should be more than 50%, and the development and application of high-quality teaching resources are listed as primary tasks of educational informationization. The Ten-year Development Planning for Educational Informationization (2011-2020) proposed that governments at all levels should distribute educational informationization funds in the proportion of not less than 8% of educational appropriations. Thirdly, as for platform investment, not only legal and policy platforms supporting the regional sharing of online teaching resources should be set up, but also corresponding organizational platforms, management platforms,
settlement platforms, offline support and management platforms, etc. should be established.

4.4 Payment mechanism
At present, most online teaching resources platforms are open to the public free of charge by relying on government grants, college or university funds and corporate support. Such operation pattern cannot last long. With the development of online teaching resources and the rise of online education market, resource users, including colleges and universities, college students and social workers, must pay to course-offering colleges and universities to obtain online teaching resources. Whether such payment is settled by means of tuition fee or certification fee, such issues as the design of payment or settlement platform, the amount of payment, etc. need to be considered comprehensively.

4.5 Evaluation mechanism
As functions of the online teaching resources management platform continue to be enriched, its evaluation mechanism needs to be perfected as well. A reasonable evaluation mechanism, on the one hand, will give positive feedback to the resource supplier, so that the design of teaching resources can be better matched with users' demands and benefit both teachers and students. On the other hand, it can select the superior and eliminate the inferior online teaching resources, so as to improve the quality of online teaching resources. The evaluation of online teaching resources should consider basic features of network technology. Considering online teaching content, online teaching process and user interface interaction, etc., scientific and comprehensive evaluation indicators should be designed to avoid evaluation result deviations based on a single indicator.

Acknowledgments
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References
10. Website of Teaching Community in Beijing Xueyuan Road: http://www.xueyuanlu.cn/.
Integration of MOOCs with Flipped Classroom Teaching: An Empirical Study of Tourism English Course

Weiyuan Zhang¹, Qingsong Xie²,*

¹ Beijing Normal University, Beijing, P. R. China
² Chongqing Radio & TV University, Chongqing, P. R. China

¹ zhangweiyuan@bnu.edu.cn, ²,* pinasterxie@hotmail.com

Abstract. The purpose of this study was to explore the effectiveness of teaching mode which integrated MOOCs with flipped classroom in vocational courses. The methods of quasi experimental research, questionnaire survey and semi-structured interview were employed. 102 students in the vocational education college were selected and assigned randomly into experimental class and control class. It was found from this study that the students in experimental class made better academic achievements and were more satisfied with the course and teaching methods to some extent. Furthermore, there were statistically significant differences in the aspects of social interaction, cooperation, computer operation, and the use of the Internet, in which the students in experimental class rated much higher than those of the control class. The results suggest that the teaching mode of integrating MOOCs with flipped classroom is worthy of practice and popularization, but provision of teachers' on-job training are requested.

Keywords: MOOCs; flipped classroom; vocational education; teaching mode

1 Introduction

Recent advances in information and communication technology have unlocked entirely new directions for education research. Many teachers have been taking gradual but innovative steps to redesign their teaching methods and adding some technical elements in their teaching practice. Meanwhile, low efficiency of traditional classroom and change in pedagogical ideology have opened discussion and catalyzed changes in the physical classroom and delivery modes (Bishop & Verleger, 2013; Basal, 2015). As a result, blended learning, flipped classroom teaching, Open Education Resources (OERs) and Massive Open Online Courses (MOOCs) have been highly popularizing in educational institutions both in the world and China.

Since the early 2000s, blended learning, which integrated face-to-face classroom learning with technology-mediated online learning, has emerged and become a prevalent pedagogical practice (Ginns & Ellis 2007). Some researchers reported that
students in blended learning setting had a better learning performance as compared to traditional setting and e-learning setting (Tomlinson & Whittaker, 2013; Thai, et al., 2017).

Flipped learning represents a newly-emerging form of blended learning, in which students individually watch online lectures prior to actual class and then get engaged in classroom learning activities interacting with peers and instructors (Lee et al., 2017). Flipped classroom teaching mode allocates more class time for active learning and leverages accessibility to advanced technologies to support a blended learning approach (Min et al, 2014). In the flipped classroom, teachers employ asynchronous video lectures and practical problems as homework, and organize active, group-based problem solving activities in the classroom. It represents a unique combination of learning theories once thought to be incompatible - active, problem-based learning activities founded upon a constructivist approach and instructional lectures derived from direct instruction methods founded upon behaviorist principles (Bishop & Verleger, 2013). Some researches stated that the flipped classroom teaching mode enhanced students’ learning performance, self-efficacy beliefs, intrinsic motivation, and perceived flexibility in their studies (Tomlinson & Whittaker, 2013; Prokhorets et al., 2015; O'Flaherty & Phillips, 2015; Amresh et al., 2015; Yoshida, 2016; Song et al., 2017).

Since 2001, the Open Education Resources (OERs) movement with Creative Commons philosophy of freely sharing information and the pervasiveness of the Internet have created many new opportunities for teaching and learning (Martin, 2012). Beyond OERs, the year 2012 saw a new model of delivery of higher education over the Internet, called MOOCs, from world’s prestigious universities, which created a kind of revolution and people in hordes enrolled in these courses. The MOOCs have been increasing worldwide and have brought a revolution in education (Muñoz-Merino, et al., 2016). At the same time, it has also caused lots of doubts and questions because of low completion rates, unclear business model and no reaching to all people (Warugaba, et al., 2016; Belawati, 2014)

In order to raise the completion rates of MOOCs, researches in Rwanda conducted a research on “flipped” MOOC, which incorporated in-class sessions to facilitate participant completion. The results were positive with a completion rate of 52.6%, which was well above the general MOOC completion rate of less than 10% (Warugaba, Naughton, Hedtgauthier, et al., 2016). Some other researchers also found that students performed better with the introduction of the MOOCs to flip the classroom rather than with the traditional approach. The factors of this improvement of learning was the use of a more active learning methodology in the face-to-face lessons, a better attention to the diversity and better student focus (Muñoz-Merino, et al., 2016).

In recent years in mainland China, the development of blended learning, flipped classroom, OERs/ MOOCs have accelerated innovation and reform of teaching and learning modes. Ma, Kong & Zeng (2016) found that 85 papers in blended learning research were published in seven CSSCI (Chinese SSCI) journals in the field of distance education and educational technology during 2005-2015. He & Ma (2017) reported that 80 papers in MOOC research were appeared in the same seven CSSCI journals during 20015-2016.
Tian (2015) reviewed a large-scale study on the use of flipped MOOC teaching mode in 100 primary and secondary schools in mainland China and found that the results were very encouraging for students, but heavy workload and role-change difficulties for teachers.

With the rapid development of MOOC movement since 2013, many education and business stakeholders have got involved in MOOC development and practice in mainland China. In 2015, there were 96 MOOC platforms in mainland China while only 32 MOOC platforms outside of mainland China (Zheng, Chen & Lin, 2016, pp.8-32). Thousands of MOOC courses were developed and opened to the public, but the number of users were much lower as expected. Although MOOC movement continues, the issues have been addressed concerning high expenditures, low completion rates, lack of learning support, lack of interaction, lack of learner’s readiness, and lack of quality assurance in mainland China (Zheng, Chen & Lin, 2016, p.14-15).

Therefore, it is an urgent issue to explore how to use MOOCs widely and effectively. Although many researches have been done in blended learning, flipped classroom, and flipped MOOC, limited research has been done on integration of MOOCs with flipped classroom teaching mode in vocational courses in mainland China. This study aims to carry out a quasi-experimental research on the effectiveness of tourism English course, which employs the new teaching mode of integration of MOOCs with the flipped classroom, in a tertiary vocational college in the southwest of China. It is hoped that the results of this study can contribute to the literature in this area and be referred by educators in vocational education colleges in the application of innovative teaching methods in the digital era.

2  Research Questions

The three questions in this study will be explored as follows:

1. Could the teaching mode of flipped classroom with integration of MOOCs improve students’ academic achievements in the tourism English course?
2. Could the teaching mode of flipped classroom with integration of MOOCs enhance students’ vocational accomplishment in the tourism English course?
3. What are the students’ perceptions after attending the tourism English course which employed the flipped classroom teaching mode?

3  Research Design and Methods

3.1  Sample

The sample was selected from the students in the second year of study at Chongqing Technology and Business Institute, which was attached to Chongqing Open University, located in southwest of China. The cluster sampling technique was employed and all 102 students enrolled in the course of tourism English were chosen for this study. The
students were in the age range of 18 to 23, with most of whom were 20 (47.5%) and 21 (38.4%). The duration of this study was from August to November 2017.

The tourism English course lasted 12 weeks and consisted of ten topics, including going through check-in formalities, going through customs, meeting on arrival, check-in and checkout, talking about itinerary, sightseeing, shopping, food and recreation, handling complaints, and farewell. Apart from the 1st week of course introduction and the last week of course review, the students studied 1.5 hours in class and 1.5 hours outside of class for each of the ten topics per week.

3.2 Methods

The methods of quasi experimental research, questionnaire survey, and semi-structured interview were employed in this study.

3.3 Research Design.

The quasi experimental research design.
The sampled students were randomly assigned into two classes and the details of the quasi experimental research design was summarized in Table 1.

<table>
<thead>
<tr>
<th></th>
<th>No. of Students</th>
<th>Instrument for Pretest</th>
<th>Experimental treatment</th>
<th>Instrument for Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental class</td>
<td>48</td>
<td>The Standardized Competency Test for Tour Guide</td>
<td>Flipped classroom (integration of MOOCs with classroom learning)</td>
<td>The Standardized Competency Test for Tour Guide</td>
</tr>
<tr>
<td>Control class</td>
<td>54</td>
<td>Test for Tour Guide</td>
<td>Traditional teaching mode</td>
<td>Test for Tour Guide</td>
</tr>
</tbody>
</table>

The Standardized Competency Test for Tour Guide, developed and revised by the teacher of this course, was used as an instrument of pre-test and post-test. It was also confirmed by the teacher that this test was unknown by all students.

<table>
<thead>
<tr>
<th>Test</th>
<th>Experimental Class</th>
<th>Control Class</th>
<th>P-value (T-Test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>listening</td>
<td>45.64</td>
<td>43.67</td>
<td>43.67</td>
</tr>
<tr>
<td>Speaking</td>
<td>39.44</td>
<td>38.34</td>
<td>38.34</td>
</tr>
<tr>
<td>Reading</td>
<td>48.96</td>
<td>51.48</td>
<td>51.48</td>
</tr>
<tr>
<td>Writing</td>
<td>44.58</td>
<td>45.37</td>
<td>45.37</td>
</tr>
<tr>
<td>translating</td>
<td>36.70</td>
<td>44.24</td>
<td>44.24</td>
</tr>
<tr>
<td>Average score</td>
<td>43.06</td>
<td>44.62</td>
<td>44.62</td>
</tr>
</tbody>
</table>

M (Mean), SD (Standard Deviation), P-value (statistical significance)

** at the level of 0.05
The pre-test on the Standardized Competency Test for Tour Guide was carried out before the start of the semester for all the students both in the experimental and control classes. The five sub-tests concerning listening, speaking, reading, writing and translating ability were conducted in the classroom. The results were presented in Table 2.

Table 2 shows that, from the average score, the students in control class is a little bit higher than those of experimental class, but no statistically significant differences are found. There are no statistically significant differences in the levels of listening, speaking, reading and writing between the two classes. However, there is a statistically significant difference in translation at the level of 0.05 and the students in the control class is higher than those of the experimental class.

**Questionnaire Survey.**
The two questionnaires in Chinese version were designed and developed by the authors for the students in experimental group and control group respectively. The 4-part 17-item questionnaire, including background information, learning satisfaction, enhancement of vocational accomplishment, and overall evaluation, were the same for all students. For the experimental class, one more part with 3-items was added for understanding the students’ perceptions on using flipped classroom teaching mode in this course.

The contents of the questionnaire were validated by eight expert professionals from two conventional universities, two vocational education colleges, and one open university. The revision was made based on the assessors’ comments.

**Semi-structured Interview.**
The interview guide was designed and developed in order to understand students’ learning experiences of flipped classroom in the experimental class. The validation of the interview guide was also made by the same eight expert professionals, mentioned in the questionnaire survey. Sixteen of 48 students (30%) in the experimental class were randomly selected, based on students’ registration numbers, for the interview.

### 3.4 Design of flipped classroom teaching

The teaching of the control class and the experimental class was planned in using two different modes. In this study, we arranged the same learning objectives, the same lecturer, the same teaching contents, the same examination papers, the same testing personnel. The lecturer, with over five years’ teaching experiences in this course, taught both of the classes.

The experimental class applied the flipped classroom and the lecture videos were provided through e-learning and m-learning platforms. One was the MOOC platform, which was called “ChongQing Xuetang”, designed and modified on the basis of Moodle platform (see figure 1). The students could watch videos and do the interaction with peers on the MOOC platform before classes.
The WeChat public m-learning platform was also introduced for the students in the experimental class and all the lecture videos of this course were presented (see figure 2). The students all had smart phones and they could watch lecture videos anytime and anywhere before classes.

The design of flipped classroom teaching mode of the course in the experimental class, compared with traditional teaching mode in the control class, was presented in Table 3. It can be seen from Table 3 that, for each of topics, the students in the experimental class could have 60 minutes for discussion, practice and exercise while the students in control class only have 20 minutes for practice without discussion and exercise sessions in class.
Table 3. The design of the flipped classroom in comparison with traditional classroom teaching mode

<table>
<thead>
<tr>
<th>Minutes</th>
<th>Flipped classroom teaching mode (experimental class)</th>
<th>Traditional classroom teaching mode (control class)</th>
</tr>
</thead>
<tbody>
<tr>
<td>outside of class</td>
<td>watching MOOC video lectures and interacting with peers, which is relevant to next class</td>
<td>practicing what they have learned and doing exercises based on the requirement of the last class</td>
</tr>
<tr>
<td>90</td>
<td>before class</td>
<td>after class</td>
</tr>
<tr>
<td>10</td>
<td>review of MOOC video lectures on new lesson</td>
<td>review of last lesson</td>
</tr>
<tr>
<td>40</td>
<td>discussion practice</td>
<td>lecture</td>
</tr>
<tr>
<td>20</td>
<td>exercises</td>
<td>group practice</td>
</tr>
<tr>
<td>10</td>
<td>teacher’s evaluation and summary</td>
<td>teacher’s evaluation and summary</td>
</tr>
<tr>
<td>10</td>
<td>consolidation and homework assignment</td>
<td>consolidation and homework assignment</td>
</tr>
</tbody>
</table>

3.5 Statistical Consideration

The statistical package, SPSS version 24.0, was used. For statistical analysis, we have looked into the frequency, mean (M) and standard deviation (SD) of the data and conducted T-test for measuring statistically differences between the experimental and control classes.

4 Results

According to the valid data collected in the classroom from 102 students, the research outcomes of this study in the experimental class and control class can be classified into five parts: (1) academic achievements, (2) course satisfaction, (3) improvement of vocational accomplishment, (4) overall evaluation of the course, (5) perceptions of flipped classroom with the integration of MOOCs in the experimental class.

4.1 Comparison of the Academic Achievements

In order to measure the students’ academic achievements, a post-test was given to the students after the completion of the course in conjunction with the pre-test in both the experimental and the control class. The same test on the Standardized Competency Test for Tour Guide with five aspects of language competencies were used. The results in the two classes can be seen in Table 4.

Table 4 shows that, in the post-test, the average score in the experimental class is a little bit higher than that of the control class, but no statistically significant differences in all sub-tests, including listening, speaking, reading, writing and translation, are found between the experimental and the control class. As we know, in the pre-test, the average
score in the control class was a little bit higher than that of the experimental class. However, it can be seen from Table 4 that the students in the experimental class have achieved higher than that of the control class in academic achievements in the post-test although there are no statistically significant differences.

<table>
<thead>
<tr>
<th>Table 4. Comparison of the Academic Achievements between the two classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-test</td>
</tr>
<tr>
<td>listening</td>
</tr>
<tr>
<td>Speaking</td>
</tr>
<tr>
<td>Reading</td>
</tr>
<tr>
<td>Writing</td>
</tr>
<tr>
<td>translating</td>
</tr>
<tr>
<td>Average score</td>
</tr>
</tbody>
</table>

M (Mean), SD (Standard Deviation), P-value (statistical significance)

### 4.2 Comparison of the course satisfaction

With the purpose of understanding the students’ level of satisfaction on this course between the experimental class and the control class, eight indicators were used for evaluation. All students in the experimental and control class were asked to rate each of the eight items according to a 5-point Likert scale: strongly satisfied (point 5), satisfied (point 4), neutral (point 3), dissatisfied (point 2), and strongly dissatisfied (point 1). The formula of average score calculation was adopted from the assessment method of student learning experience survey developed by School of Professional and Continuing Education at the University of Hong Kong (Zhang & Cheng, 2012). The T-test was conducted to measure the differences of the two classes and the results are presented in Table 5.

<table>
<thead>
<tr>
<th>Table 5. Comparison of the course satisfaction between the two classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicators</td>
</tr>
<tr>
<td>---------------------------</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Teacher’s knowledge</td>
</tr>
<tr>
<td>Teaching methods</td>
</tr>
<tr>
<td>Teacher’s teaching level</td>
</tr>
<tr>
<td>Interactive learning</td>
</tr>
<tr>
<td>environment</td>
</tr>
<tr>
<td>Course quality</td>
</tr>
</tbody>
</table>

M (Mean), SD (Standard Deviation), P-value (statistical significance)

* at the level of 0.05
** at the level of 0.01
Table 5 reveals that the level of student satisfaction in the experimental class in all eight indicators is higher than that of the students in the control class. Moreover, there is a statistically significant difference in teaching methods at the level of 0.05 and a highly significant difference at the level of 0.01 in interactive learning environment between the two classes. This may be explained by the implementation of flipped classroom with more cooperative and interactive learning activities in class for the experimental class students.

4.3 Comparison of vocational accomplishment

In order to understand whether the students’ vocational accomplishment has been enhanced from this course, six aspects, including social interaction, cooperation, problem-solving, computing operation, logical thinking, and use of the Internet, were designed. All the students in the experimental and control classes were asked to do an evaluation and each of the items was rated on 5-point Likert scale: highly improved (point 5); improved (point 4); neutral (point 3); not improved (point 2); not improved at all (point 1). The formula of average score calculation was also adopted from assessment method of student learning experience survey developed by School of Professional and Continuing Education at the University of Hong Kong (Zhang & Cheng, 2012). The T-test was conducted to measure the differences of the two classes and the results are presented in Table 6.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Experimental Class</th>
<th>Control Class</th>
<th>P-Value (T-test)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Score M SD</td>
<td>Score M SD</td>
<td></td>
</tr>
<tr>
<td>Social interaction</td>
<td>76.19 3.55 0.909</td>
<td>66.98 3.18 0.872</td>
<td>0.048*</td>
</tr>
<tr>
<td>Cooperation</td>
<td>75.60 3.52 0.869</td>
<td>66.35 3.15 0.789</td>
<td>0.033*</td>
</tr>
<tr>
<td>Problem-solving</td>
<td>75.60 3.52 0.869</td>
<td>70.19 3.31 0.841</td>
<td>0.226</td>
</tr>
<tr>
<td>Computing operation</td>
<td>74.40 3.48 1.047</td>
<td>62.75 3.01 0.946</td>
<td>0.027*</td>
</tr>
<tr>
<td>Logical thinking</td>
<td>75.00 3.5 0.911</td>
<td>70.28 3.31 0.761</td>
<td>0.274</td>
</tr>
<tr>
<td>Use of the internet</td>
<td>82.14 3.79 0.944</td>
<td>72.17 3.39 0.847</td>
<td>0.033*</td>
</tr>
</tbody>
</table>

M (Mean), SD (Standard Deviation), P-value (statistical significance)
* at the level of 0.05

It can be seen from Table 6 that the scores of all the six indicators in the experimental class are higher than those in the control class. In addition, there are statistically significant differences in the social interaction, cooperation, computer operation, and use of the Internet between the two classes. The reasons may be explained that the experimental class students accomplished their learning tasks in groups in class and used MOOC platform/WeChat public platform frequently before class as requested.
4.4 Comparison of the overall evaluation on the course

This part reports on the students’ overall evaluation on the course, including the course effectiveness, the teaching effectiveness, and teacher’s support service effectiveness. The 5-point Likert scale was used from strongly agree (point 5), agree (point 4), neutral (point 3), disagree (point 2) and strongly disagree (point 1). Again, the formula of score calculation was used from School of Professional and Continuing Education at the University of Hong Kong (Zhang & Cheng, 2012). The T-test was conducted to measure the differences of the two group and the results were presented in Table 7.

<table>
<thead>
<tr>
<th>Overall feedback</th>
<th>Experimental Class</th>
<th>Control Class</th>
<th>P-Value (T-test)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Score</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>All things considered, the course has been effective in helping me learn</td>
<td>83.33</td>
<td>3.83</td>
<td>0.486</td>
</tr>
<tr>
<td>All things considered, the teaching has been effective in helping me learn</td>
<td>81.55</td>
<td>3.76</td>
<td>0.885</td>
</tr>
<tr>
<td>All things considered, the teacher’s support services has been effective in helping me learn</td>
<td>90.48</td>
<td>4.12</td>
<td>0.661</td>
</tr>
</tbody>
</table>

Table 7. Comparison of the overall evaluation on the course between the two classes

M (Mean), SD (Standard Deviation), P (statistical significance)

Table 7 summarized that the students in the experimental class rated course effectiveness, teaching effectiveness and teachers’ support service effectiveness higher than those in the control group. Moreover, there is a statistically significant difference in teacher’s support services between the two classes. This may be explained that the teacher had more interaction with students in class using flipped classroom teaching mode than in the control class.

4.5 Students’ perceptions of Flipped classroom learning

In order to understand students’ perceptions of the flipped classroom teaching mode with integration of MOOCs, all the students in the experimental class accepted a further survey. Three questions were asked, including preference, satisfaction and adaption to other courses, regarding the use of the flipped classroom integrated with MOOCs.

It was found from the survey results that 77.3% of the students rated most preferred/preferred in using flipped classroom teaching mode while 22.7% of the students rated Neutral. 79.5% of the students rated most satisfied/satisfied in using flipped classroom teaching mode while 20.5% of the students rated Neutral. 63.6% of the students expected the other courses to apply the flipped classroom teaching mode while 36.4% of the students rated neutral.
Sixteen students out of 48 in experimental class were randomly selected for semi-structured interview with the purpose of understanding their experiences of flipped learning. The following are some of the most typical comments made by the students of this course:

“It is the first time that I have taken a course integrated MOOCs with flipped classroom. It is new and fresh, which is much different with other traditional courses. I like this new design and arrangement”.

“I like the MOOC platform, which I could not only watch lecture video, but also communicate with my classmates for questions on the learning content”.

“Through the Wechat public platform, we can study and review the course anywhere and anytime. In our class, the teacher can have more time to help us in learning in class. For a vocational education college student, this kind of support service is precious and rare”.

“I think that lots of courses should adopt this new teaching mode, especially those courses which have lots text materials. Some teachers usually just read the textbook in class, which is so boring. It is a great waste of time. Actually, we can read and study by ourselves. We are not wood. We are young and active in a digital era”.

“The teaching materials are rich, especially with lots of tailor-made lecture videos, which provide the opportunity for us to watch again and again outside of classes. Online and offline study make us study freely, and we will not be tired in class and outside of class as some of other courses”.

“I am concerned about the exam scores of using this new teaching method at the beginning. However, as a result, we learned more and got high exam scores, which I am very satisfied”.

“This teaching mode requires lots of autonomy. The students must be highly self-controlled and regulated, which is a challenge for our college students to learn”.

From the interview results, the students in the experimental class are very positive about the flipped classroom teaching mode in this course. We can see, in a digital era, students would like to taste cooperative and interactive learning environments in class using information and communication technology.

4.6 The challenge of integration of MOOCs with flipped classroom teaching for teachers

The application of flipped classroom teaching mode with integration of MOOCs could be beneficial for students. However, from teacher’s perception of this course, this new teaching mode increased workload heavily. Teachers have to spend much more time on preparing videos, re-designing courses, doing mentoring, solving problems, answering questions in and after class. Teachers also need to learn new teaching theories, new teaching methods, and new technologies. Therefore, flipped classroom teaching mode won’t be widely used effectively without provision of on-job teaching training for teachers.
5 Discussion

The extensive use and effectiveness of MOOCs are essential issues for MOOC’s healthy and sustainable development. The MOOCs are generally composed of learning objectives, lecture videos, quizzes, and discussion forum among students by themselves. This study indicated that the use of online learning resources of MOOCs in flipped classroom teaching is a feasible way to enhance teaching and learning effectiveness in vocational education colleges.

The objectives of vocational education colleges is to cultivate the students’ passions for learning, harvest necessary job skills, and enhance their opportunity of employability. As the traditional classroom teaching mode spends most of the time on giving lectures in class, the development of students’ vocational accomplishment is minimum. The students feel tired on passively taking lectures for a long time by teachers in class. When using flipped classroom teaching mode, students could have most of the class time to join in the group discussion, group drills, and group exercises under the support of the teachers both in and out of the class.

This study showed that, apart from the improvement of students’ academic achievements to some extent, this new teaching mode could motivate students’ learning interests and enhance students’ vocational accomplishment substantially, which is very important for the students in vocational education colleges.

In addition, using MOOCs as learning resources in flipped classroom teaching, the online contents of MOOCs could be well shared and used by teachers in their subjects without additional charge. The students could watch lecture videos more than one time based on their individual learning needs and pace outside of the class time.

Moreover, most of the students in vocational education colleges in mainland China were born in late 1990. This generation is generally marked by an increased use and familiarity with digital technologies. Technologies have even been a part of these young people’s daily life. This study revealed that integration of e-learning and m-learning MOOC contents with flipped classroom teaching is widely welcomed and appreciated by these young adults in vocational education colleges.

Limitation of the study.
This study is only based on one vocational course with small sample in the southwest of China. The more sample courses in different subjects and vaster experiments in vocational education colleges are required to further analyse and evaluate the effectiveness of the flipped classroom teaching mode with integration of MOOCs in order to make generalization in the fast-changing Internet plus era in China.

6 Conclusion

This paper employed the methods of empirical study and explored the effectiveness of vocational courses by integration of MOOCs with flipped classroom teaching. It is found that this innovative teaching mode could improve students’ academic
achievements, enhance students’ vocational accomplishment, motivate students’ learning interest, which was welcomed and appreciated by vocational college students. However, teachers have to spend more time and master relevant knowledge and skills to ensure this teaching mode to be put into practice successfully.

Acknowledgement

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References


The Effectiveness of MOOC for Teacher Professional Development: Requirement, Design and Implement

Shufang LUO
X-Learning Center of Graduate School of Education,
Peking University, Beijing, 100871, China
luoshufang@pku.edu.cn

Abstract. Teacher professional development (TPD) is always a big issue in educational field. With the rapid changes in education such as educational reforms, new curriculum standards, emerging technologies and new teaching or learning model, there is a great demand for teachers to update their own knowledge, skills, and practices through continuous professional development. Based on the characteristics of massive open online courses (MOOC) such as large-scale, easy to access and support of collaboration, we tried to think about the potential of MOOC for teachers' professional development and offered kinds of courses for teachers on the MOOC platform. This paper explored the effectiveness of MOOC for teacher professional development. In particular, we would conduct the analysis of the course requirements, course design, course implement through the pre-course questionnaire, post-course questionnaire, discussion forums and interviews of the course designers, course managers and learners. This strategy of analysis has sought to review the data from the following five perspectives: learner compliance with the design; achievement of design goals; achievement of learner goals; measurement against established criteria; measurement against emerging learner-defined criteria. Finally, we would discuss why and how MOOCs can promote a better teacher professional development. First, using MOOC for teacher professional development can bring several “efficiency” benefits. Second, the outcome of using MOOC for professional development is the “quality” issue.
An Application of NFC Technology on Class Attendance Systems

Sasivimon SUKAPHAT, Wachirawit CHAIPUVAPHAT, Suphisra KETSUTHI, Sathinee PAISOPA, Sirinoot TEANRUNGROJ

Department of Computer Science, Faculty of Science, Srinakharinwirot University
Bangkok, Thailand, 10110
{sasivimon, sc551010321, sc551011022, sc551011020, sirinoot}@g.swu.ac.th

Abstract. Currently, the class attendance checking process of Computer Science program, Srinakharinwirot University still performs manually by calling student’s name one by one. This process is impractical and such a waste of time especially in a large class. Therefore, we aim to present an alternative way for the class attendance checking by applying the wireless technology in smartphone, NFC, to help the lecturers manage their class at ease. The proposed system consisted of two modules: the NFC module and the web module. The NFC module performs on the mobile site which transfers the student’s personal data from the student’s smartphone to the lecturer’s smartphone by tapping both phones to each other. The web module performs on the server site which contains the class attendance database. Moreover, the web module also provides class attendance application which will be used for some students who do not have NFC supported in their smartphones. All class attendant information can be represented on the web application. The proposed system will help the lecturers to reduce their time spending in class attendance process and this system can be in the other faculties.

Keywords: e-learning; quality assurance, student engagement, student satisfaction, Android platform, class attendance system, NFC

1 Introduction

Class attendance checking is the one of Srinakharinwirot University regulation which aims to cultivate students to be a punctual person. In addition, students who attend class on time will get more chances to learn all contents according to the course syllabus. However, the class attendance checking method in Srinakharinwirot University still uses a roll call method which is inconvenient and such a waste of time, especially in big classrooms. It should be better if we can find a technology that helps class attendance checking process more conveniently and more efficiently.

Recently, NFC (Near Field Communication) technology are built in most smartphones for serving demands of usage wireless communication in anywhere and
According to Igoe (2014), Faulkner (2013) and Ortiz (2008), NFC emerged from RFID (radio-frequency identification) technology that establishes a communication between two electronic devices within a short distance (up to 10 centimeters) which can be setup faster and easier than Bluetooth. As NFC enables two electronic devices to transfer small data to each other in the simplest way, it can be used as a contactless smart card for storing personal information. The NFC contactless smart card can be used in various purposes such as tickets to access transportation gates or an employee card to give someone contact information or even used in attendance system.

As mentioned above, we interested in applying the NFC technology in a smartphone for checking the student’s class attendance in Department of Computer Science, Faculty of Science, Srinakharinwirot University. Because most students have their own smartphones which support NFC technology, it is easy for them to use their smartphones for checking the class attendance without purchasing anything else.

2 Related Works

NFC has been announced since 2004 which aims to provide a set of wireless communication in a very short range. Compared with Bluetooth, NFC consumes less power, easier and faster to set up the connections between mobile devices. With the capability of secure data exchanging, NFC has been used in many authentication systems which are described as below:

According to Keene, J. (2012), Samsung introduced a NFC-based employee ID card system, which allows workers at its Suwon offices to check in work using their smartphones. Rather than having to carry an ID card everywhere and more likely to forget or lose it, Samsung workers at Suwon has been able to touch their smartphones to a barrier to enter the building. Samsung said that this method will be cost-saving, since their employees will not have to spend money on replacing the lost cards.

In 2013, Bangkok Mass Transit System (BTS) cooperated with Advanced Info Service Co. Ltd, one of Thailand mobile operator, announced to use a smartphone embedded with NFC to enter or exit through an automatic gate. Customer have to purchase a special SIM card to use with NFC technology-enable handset. Then, they can use their electronic wallet for accessing the transportation gates.

In order to enhance the e-learning system, Bucicoiu and Tapus (2013) proposed a location-based authentication method using NFC which determines the location of the students for keeping track of their activity. This application also uses a photo in order to ensure double authentication. All these features will ensure the student is attending the class and the teacher made note of it in an easier manner. Moreover, Wei et al. (2017), also proposed an interactive learning system embedded with NFC attendance system that helps instructors to conduct their class in a more interactive way.

As mentioned above, NFC technology has been used in many applications that require the identification process. By storing personal data in user smartphone, we can transfer those data via NFC tag to the NFC reader device to identify the user. Therefore, we decide to apply NFC technology in Android platform for using in class attendance system. The essential student’s information is stored in their smartphone. When
students attend to their class, they have to tap their smartphone to the NFC reader device for keeping their record of their class attendance. The proposed system will help the class checking process faster and easier and can report the student’s class attendance information in many ways.

3 Implementation

With the benefits of NFC, we have developed SWU class attendance system to enhance the school’s class checking method. This system consisted of two modules which are the NFC module and the Web module. The overall of SWU class attendance system architecture is represented in Fig1.

![Fig. 1. SWU Class Attendance System Architecture.](image)

3.1 NFC Module

First of all, the students have to install SWU class attendance application in their smartphones. After logging into our application (Fig. 2 (a)), the students must proceed the registration process to our application by submitting their personal information such as ID, name and their class on the registration screen (Fig. 2 (b)). An example screen of user information including their class information is shown in the screen (Fig. 2 (c)). When the students attend in the class, they have to tap their smartphone to the NFC receiver device. For preliminary experiment we use the instructor’s smartphone as
NFC receiver device. The application will display the successful class attendance checking status as shown in Fig 2 (d).

In the instructor application, after logging into our application (Fig. 3 (a)), the instructors are able to view their course list and the student names in the roster files of their courses as shown in Fig. 3 (b) and Fig 3 (c) respectively. The instructor smartphone is used as an NFC receiver device in this experiment. After a successful class attendance checking process of each student, the instructor screen will display a successful notification as shown in Fig 3 (d).

In addition, the students’ smartphones will be turned on vibrate mode automatically after tapping student smartphone to a NFC receiver device. In order to change mobile mode, we have to call AudioManager class to access to android’s volume and ringer mode controller. The example code of this process is shown in Fig. 4
3.2 Web Module

The web module was used to prepare the course’s information for each instructor. First of all, the instructor course’s list and the roster file for each course are imported from Srinakharinwirot registration system to the SWU class attendance system (Fig. 5). Instructors are able to update their roster file such as adding a new student or deleting one that withdrawn from their course, updating the class schedule and also managing the class attendance record of each student manually. The instructors are able the check each student’s class attendance status and all of class attendance information can be reported as shown in Fig.6 and Fig.7 respectively.

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Fig. 4. The example code to implement the AudioManager class for changing student mobile mode automatically.

Fig. 5. The instructor course’s list screen.

Fig. 6. The student’s class attendance record screen.
Experiments Conducted and Discussion

The preliminary experiments were conducted through the second semester of 2016 academic year which performed by 5 subjects of Computer Science Department. The number students who attended our experiment are 78 persons that consists of 10 to 24 persons per course. The roster files of these courses were already prepared in our application. The students must login to the SWU class attendance system before entering their class room. When students entered the class room, they had to tap their smartphone to the instructor smartphone. Each NFC checking process performed less than 1 second with the data transferring rate 421 Kbps. All transferred data which sent from student smartphone to the instructor smartphone are correct and complete and will be further kept in the database server. In order to ensure that smartphone will not interrupt the student while studying, it will be turned in vibrate mode automatically. In case of students who use non-NFC smartphone, the instructor can record their class attendance by using the Web module. Both NFC module and Web module are performed correctly in every function.

In order to evaluate the user’s satisfaction, we prepared an e-survey which consists of five categories which are: the performance, the accuracy, the ability to reduce the time for checking class attendance, the simplicity of the system and the necessity to use this system. The results from 28 testers are shown in Table.1.

![Fig. 7. The example report of class attendance from one course.](image-url)
Table 1. The system satisfactory survey results.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of responses</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Response %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>18</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>85.71</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>19</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>89.29</td>
<td></td>
</tr>
<tr>
<td>Time reducing</td>
<td>18</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>85.71</td>
<td></td>
</tr>
<tr>
<td>Simplicity</td>
<td>19</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>89.29</td>
<td></td>
</tr>
<tr>
<td>Necessity</td>
<td>25</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>92.86</td>
<td></td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>88.57</strong></td>
<td></td>
</tr>
</tbody>
</table>

5 Conclusion

This paper presents a prototype class attendance checking application by applying NFC technology in Android smartphone. We develop an application which consists of two main modules: NFC module and web module. The students are able use their smartphone for checking their class attendance by tapping their smartphone to the instructor smartphone. The instructors are able to manage their class information, the student information and also print the report of class attendance information. Our application is able to transfer data with a good speed (421 Kbps). The overall functions are able to perform correctly and completely. In addition, the system satisfactory survey results shown that the average satisfaction is 88.57%.

References

Detecting Emotions in Students’ Generated Content: An Evaluation of EmoTect System

Emmanuel Awuni KOLOG
School of Computing, University of Eastern Finland, Joensuu, P. O. Box 111, FI-80101, Finland
emmanuk@uef.fi

Abstract. In this paper, an e-counselling system for automatic detection of emotion in text is evaluated by comparing with two of text classifiers implemented in WEKA machine learning software. A support vector machine classifier was used for the development of the e-counselling system, hence we compared the performance of the e-counselling system’s classifier with the WEKA’s Multinomial naïve-Bayes and J48 decision tree classifiers. While this paper is geared towards ascertaining the efficacy of the various classifiers for classifying emotions in learners’ generated text content, this paper also aims to ascertain the performance of the e-counselling system for complementing decision making concerning students in counselling delivery. In building the system, an annotated students’ life story corpus was developed and used for the experiment. Therefore, 85% of the total instances of the life stories was used as training data while the remaining 15% was used as test data with sample instances of real-time data from students’ textual submission through the e-counselling system. The results of the experiment show that the SVM, implemented in our proposed e-counselling system, is superior over the MNB and J48 classifiers.

Keywords: emotion detection, text classification, counselling, decision making
machine learning, students

1 Introduction

Emotions are a conscious experience which can be described as the state of feeling that result in physical and psychological changes. In the arena of counselling, emotion is regarded as one aspect of human behaviour that plays an important role in decision making processes (Jain & Kulkarni, 2014). Counsellors are thus expected to devise strategies for understanding the emotional behaviours of their clients. It is well-known that counsellors often rely on the emotional cues of their clients to understand their emotional behaviours (UNESCO, 2002). From this perspective, research has shown that counsellors’ own emotions can, in some cases, influence their decision while adjudicating and deciding the emotional state of their clients (Kolog & Montero, 2017; Lerner et al., 2015).
Although, emotions of students can be expressed in different ways, such as body movement and text, Witten et al. (2014) believe that people express much of their emotions in text when they are given the opportunity to write. This considerably underpins the relevance of recognising emotions in text for decision making. In this view, school counsellors are able to assess the academic performance of their students by linking their change in academic performance to their emotional changes, in order to aid decision making concerning students. Being able to track the emotions of students in text, counsellors and school administrators will be able to prevent suicide, anti-social behaviour, among others as these can be triggered by emotions.

Expression of emotions in text constitutes a semantic component of human communications, which has the tendency to influence one’s decision. Research has shown that a person’s state of emotion could influence his or her concentration (Kolakowska et al., 2014), task solving (Jung et al., 2014) and decision making skills (Kolog et al., 2016; Lerner et al., 2015). The computational tracking of emotions in text is eminent as it helps to minimise the human discrepancies on decision making process or other related processes. This is particularly important in counselling delivery where emotions are a core component of a communication between counsellors and their clients. Given the influence of emotions on our daily activities, text-based automatic detection of emotions has long been a subject of interest for researchers, especially in the fields of natural language processing, affective computing and human computer interaction. Extracting emotions in text is useful as it represents a conduit for understanding the behaviour of humans (Sebe et al., 2005).

Given the impact of educational advocacy groups towards campaigning on equal and universal accessibility of education, students’ populations have increased exponentially over time (Roser & Ortiz-Opina et al., 2017). Therefore, manually tracking and taking decisions of large number of students regarding their emotional behaviour from their textual submissions has become difficult and as well a costly process (Gandomi & Haider, 2015; Mohammed, 2015). In this era of digital revolution, it is not surprising that people, especially counsellors, are often reluctant to read large volume of students’ textual submissions regarding counselling delivery (Kolog et al., 2016; Igbokwe et al., 2012). These difficulties highlight the need for computational tracking of emotions and this is useful for ensuring efficiency, consistency and effectiveness in text-based emotion analysis.

Despite the fact that emotions can be expressed in text, there is no doubt that text-based media cannot mediate body language and tone of voices fully (Hrastinski, 2006). This represents one of the limitations associated with text-based emotion detection. In the educational setting, nowadays, students prefer to seek counselling anonymously through text (King et al., 2006; Kolog, 2017a). It is therefore worth noting that students who prefer anonymous counselling do so because of the lack of trust they have in their counsellors (Kolog et al., 2015b; Glasheen et al., 2013; Inman et al., 2006).

In this paper, an e-counselling system—hereafter-called EmoTect1— for detection of emotions in text is evaluated. The system was developed using a machine learning support vector machine (SVM). Coupled with the EmoTect’s SVM classifier, WEKA’s

1 Nlp4counselling.com
Multinomial Naïve-Bayes (MNB) and J48 decision tree classifiers are evaluated and their performances compared. WEKA is commonly used machine learning software developed by the University of Waikato\(^2\). While this paper is geared towards ascertaining the performance of the various classifiers in recognising emotions of students in their life stories and real-time textual submissions, this paper aims to ascertain the performance of the EmoTect classifier for complementing decision making in counseling delivery.

2 Background

Some related works on emotion detection are presented in this section. This takes due cognisance to studies that have used NLP and machine learning techniques. In addition, the text classifiers that were used in this experiment are defined in this section.

2.1 Related works

Crowston et al. (2010) investigated the performance of human-developed natural language processing rules to those inferred with machine learning (ML) technique for coding qualitative data. The study investigated which among the techniques is effective for researchers when coding qualitative data. During the experiment, Crowston et al. (2010) used messages from human discourse platforms, such as chats and blogposts. First, Crowston et al. (2010) employed two PhD students to manually code the data with predefined themes. Reliability kappa score of 80% after the manual coding was obtained, which prompted the researchers to use the data for training their machine learning classifier. Unlike our approach in this study, 75% of the total data was used for training a ML classifier while the remaining 25% was used for testing of the classifier. On the other hand, the researchers developed and applied human-developed NLP rules to detect and classify the data according to the themes. The results suggest that NLP with ML can be effective in qualitative coding of data than that of the Human-developed rules. Crowston et al. (2010) therefore recommended for researchers to code qualitative data with ML techniques instead of manually coding of qualitative data, especially when the data is very large.

A proposed approach for detecting emotions in text was proposed by Obdal & Wang (2014). Obdal & Wang (2014) contextualised their approach for detecting emotions in Chinese language. Their proposed model is based on a supervised machine learning technique. The proposed model is a segment-based fine grained emotion detection. The model applies to the hierarchical structure of sentence, such as dependency relationship. In their model, the emotion label of each dependency sub-tree of a subjective sentence or short text is represented by a hidden variable. The values of the hidden variables are then calculated based on the interactions between variables whose nodes have head-modifier relation in the dependency tree. Obdal & Wang (2014) evaluated their model with datasets from news content, fairly tales, and blogposts. The researchers compared

\(^2\) http://www.cs.waikato.ac.nz/ml/weka/
the results from their experiment to some existing approaches. According to the Obdal & Wang (2014), the experimental results from their proposed segment-based model demonstrated some levels of effectiveness.

Suttles & Ide (2013) have experimented the classification of emotions in tweets. The researchers adopted Plutchik’s eight basic emotion categories but reformulated the emotion categories into four bi-polar emotions which is based on the Plutchik’s wheel of emotions (Plutchik, 1980). The rationale for the bi-polar approach was to allow the researchers to treat a multi-class problem of emotions as a binary problem. During the pre-processing of their tweets, the researchers considered and labelled the ‘emoticons’ and ‘emoji’s’ in the tweets with the emotion categories. This is because the researchers believe that ‘emoticons’ and ‘emojis’ carry information, which are useful and could significantly contribute to the results of their experiment. Part of the tweets they collected were used as training data while the other part was used as testing data. After experimenting, Suttles & Ide (2013) found that their approach can be used to determine reliable text classifiers.

Balabantaray et al. (2012) explored how a machine learning technique could be used to detect emotions in microblogging sites. This is because the researchers believed that microblogging sites are user-generated sites that contain much emotions and attitudinal contents. In this light, the authors performed emotion detection experiments on a collected twitter. Supervised machine learning technique was used. The collected tweets were manually annotated by five trained annotators according to some predefined emotion categories. The authors were more concerned with the annotation process. Therefore, they found the annotators to have agreed strongly for identifying instances of happiness and anger in the text corpus (tweets). Upon using a multi-class SVM classifier to classify emotions in the tweets, the study found 73.4% accuracy.

2.2 Supervised learning text classifiers

Text classifiers, in supervised learning, are algorithms that perform the classification task when unseen data is fed into them, and this is based on a training data. There are several machine learning classifiers that have been used widely. Research has shown that the most efficient classifiers for text classification are the support vector machine (SVM), Naïve-Bayes, decision tree and Neural networks. It is for this reason that support vector machine, multinomial Naïve-Bayes and J48 decision tree classifiers are used in this study.

Support vector machine is a supervised machine learning algorithm that can be used for both classification and regression problems. The algorithm is discriminative in a sense that it is defined by constructing a hyperplane or a set of hyperplane in a high dimensional space (Hashem & Mabrouk, 2014). The hyperplane in the higher-dimensional space is defined as the set of points whose dot products with a vector in that space are constant. When training data is presented to SVM, a model is built which consists of data points chosen from input data space and their class labels. SVM outputs optimal hyperplane which classifies unseen or unclassified data after a model is build. SVM is more effective if more training data are used as training data.
Multinomial Naïve-Bayes (MNB) is a simple probabilistic classifier that is based on Bayes theorem with strong and naïve independence assumptions. A MNB is a widely used classifier for text classification problems, such as emotion detection, email spam detection, personal email sorting, document categorization, sexually explicit content detection, language detection and sentiment detection (Vasilis, 2015).

J48 decision tree classifier is an extension of Iterative Dichotomiser 3 (ID3). ID3 was invented by Ross Quinlan in 1986, the classifier is used to generate decision tree in dataset (Quinlan, 1986). In WEKA, J48 classifier is an open source implementation of the C4.5 algorithms. The C4.5 algorithm is a predictive model that uses decision tree to go from observations about an item- represented in the branches- to conclusions about the item's target value -represented in the leaves (Kaur & Chhabra 2014). By using J48 classifier, a “decision tree is built from the training data using the property of the information gain or entropy to build and divides nodes of the decision tree in a manner that best represents the training data and the feature set” (Hsu et al., 2003).

3 Overview of EmoTect Implementation

As stated earlier in this work, EmoTect is a web-based machine learning classification system that has been developed purposely to complement the work of counsellors. The overview of the EmoTect implementation is elaborated in this section. Also, the section presents the role of EmoTect in counselling delivery. Figure 1 is the process diagram of EmoTect in counselling delivery. The figure is elaborated in the subsequent sections.

![Image](image.png)

**Fig. 1.** Process diagram for EmoTect in counselling delivery

3.1 EmoTect development

The EmoTect system was developed by considering Peffers et al. (2006) design science research (DSR) framework (see Kolog, 2017a). With this, selected counsellors were intermittently involved in the development of the EmoTect system, particularly in the aspect of the requirement elicitation and the evaluation phases. The various stages of the Peffers et al. (2006) framework were broadly categorised into three parts that work
in iteration and sequential. These parts are the *requirement elicitation, implementation* and *evaluation* (Kolog, 2017a). The EmoTect system was built from implementing a support vector machine learning classifier called *sequential minimum optimisation* (SMO). Much of the developmental process of the EmoTect is covered in Kolog (2017a).

**Contact counsellor**

![Contact counsellor form](image)

**Fig. 2.** Contact counsellor process from users’ page to the project’s page

Figure 2 depicts the context view of EmoTect showing the various processes involved in the data processing. The EmoTect system has two components: *contact counsellor* and *emotion detection*. The “**contact counsellor**” component is the presentation layer that provides opportunity for students to contact their counsellors by text. The textual content of the students’ submission is then passed onto the *emotion detection* component for the automatic classification of emotions according to the predefined emotion categories (Plutchik’s basic emotions). The result after classifying the emotion is presented in a visual form (see Figure 4). The “**contact counsellor**” form
shown as part of Figure 2 is expected to appear on users’ webpage for students to contact their counsellors. To do this, a user is expected to visit our webpage, register, create a database in the system and then generate a JavaScript code to embed in their webpage. This will then appear as a widget form on the users’ page. It is from here that the students’ submissions are sent to the emotion detection part for processing and visualisation.

A developed life story corpus, which is a collection of students’ emotional antecedents were collected, annotated and used to train the SVM classifier in this study. Ethically, permission was sought from the students and the school management through informed consent form before the life stories were collected. Also, counsellors were assured of the data protection and those who were unwilling to share the stories were allowed to opt out.

Plutchik’s (1980) eight basic emotions were used as the emotion categories for the EmoTect classification. This is because Plutchik’s basic emotions were confirmed in our previous study, as we conducted a focus group discussion with selected counsellors to understand the basic emotions they often extract from students during counselling. (Kolog, 2017a). Plutchik’s basic emotions are anger, disgust, sadness, anticipation, surprise, trust, fear and joy.

Figure 3 illustrates a visualisation interface of emotion classification. EmoTect classification undergoes two phases: training and prediction phases (see Figure 4). In addition to the collected life stories (LSC), real-time data (RTD) was collected from the system after it had been been used by students for counselling. The combined data (LSC and RTD) were labelled with the Plutchik’s emotions by selected counsellors. The stories were developed into a corpus—life story corpus- which was used in the training of the classifier. To note is that the classifier is freely available for research purpose. Before training the classifier, the stories were pre-processed at different stages, from tokenizing the text, applying Part-of-speech tagging and lemmatising the data for feature extraction before feeding into the SVM classifier. Feature words were then fed into the classifier to create a model for prediction of unseen data.
Fig. 3. Emotion detection interface

Fig. 4. EmoTect’s classification process

The second phase is the prediction. The prediction phase starts from the sources of the input text, such as the “contact counsellor” form and email sources. This is the stage where users get to interact with the system. Just like the training phase, the input data goes through the same pre-processing stages to extract feature words. The feature words are then fed into the classifier model that was created after the training. The classifier model then predicts the unseen text from users. Detailed work regarding the implementation of EmoTect is presented in Kolog (2017).

3.2 The role of EmoTect in counselling

Given the advance in technology, counselling is no longer limited to face-to-face communication, where students have to meet counsellors in person. Existing ICT tools have shifted the paradigm; students can now receive counselling online. Diverse technologies are available to assist counselling delivery. For instance, artificial intelligence technologies have considerably revolutionised counselling delivery where intelligent and expert systems are able to provide counselling to students without the human intervention. Often, students who are geographically isolated and urgently needing counselling can turn to online media platforms for such services. As explained in Section 3.1, the emotion detection component of EmoTect is hosted on our webpage while the “contact counsellor” widget form is meant to appear on the webpages of the users.

Apart from the input from the “contact counsellor” form, external sources such as email can be copied and paste into the system for prediction (see Figure 3). Also, as seen in Figure3, text files can be uploaded directly into the system. The textual content of students’ submission is then passed on to the emotion detection part for the automatic
classification of emotions. The extracted emotions from students’ textual submissions are stored for future reference. The intent of implementing this component is to give counsellors, and perhaps school administrators, the opportunity to monitor the emotional changes of their students over a selectable period as illustrated in Figure 5. Counsellors can use the emotional records of students to match with the performance of their students, thereby making decisions regarding any academic changes or flaws. The essence of the emotion keywords is to give counsellors a reason to be critical in their decision-making process regarding students’ emotional development. For instance, keywords like kill, suicide, worry and die are likely to trigger a suspicion that makes it worthwhile to take a second look at students’ submissions.

Counsellors, on knowing the mood or emotional states of their students, are able to make general decisions of the students. For instance, if the state of anger shown in the visualisation graph in Figure 5 is high, counsellors can take a step to organise symposia on anger management or any related topics for their students. Although, EmoTect was developed based on data collected from schools in Ghana, it can be used anywhere on the globe for the purpose of complementing decision making during counselling.

![Emotional changes over a selectable period](image)

**Fig. 5.** Emotional changes over a selectable period

4 Experimental setup

As part of evaluating EmoTect in this study, this section presents the experimental part of this paper. It reflects on the collection of the text corpus and the annotation strategies used. Also, the classification process is outlined in this section as well.

4.1 Corpus and annotation

Life stories of students were collected through questionnaires (Kolog, 2014). Students were asked to write about their life stories subjectively. Life story of students, in this study, is defined as students’ emotional antecedents that influence their academic development. With this definition, students were made to understand the kinds of stories needed for this study. Lugmayr et al. (2016) believe that students are able to express themselves better when they are given opportunity to write about their life
In addition to the collected life stories (LSC), the system was allowed for use by the counsellors for a period of time. During the contextual evaluation of the system (see Kolog, 2017a), selected counsellors were allowed to use for a period. After that, sample real-time data (RTD) during the real use of the system was used as part of the total dataset used for the experiment.

The data was first pre-processed for easy annotation. The rationale for the pre-processing was to make the data more suitable for the counsellors to annotate with the emotions categories (Plutchik emotions). In the end, the data were then given out to three selected school counsellors, who have a lot of experience in counselling, to annotate with the emotions. Before the annotation, the annotators were given training on how the annotation exercise should be carried out. After the annotation exercise, the disagreements in the annotated instances of the stories were re-evaluated by the researchers in collaboration with all the three counsellors. Some of the disagreements were later on agreed on consensus. The rationale of this approach was to get a good agreement score for training the classifiers. In the end, a kappa score of 70.5% was obtained, which is a suitable score for training the classifier (Landis & Kouch, 1977).

### 4.2 Classification

To use WEKA for the classification task, the data had to be converted into Attribute-Relation File Format (ARFF). ARFF file is an ASCII text file that describes a list of instances sharing a set of attributes. ARFF files were developed by the machine learning group at the department of Computer science of the University of Waikato, meant to be used with WEKA machine learning software. Classification algorithms in WEKA can be applied directly to either a dataset or call to a project.

Supervised machine learning technique was used for the classification process in this paper. Just like EmoTect implementation, 15% representing 330 instances (documents) of the total instances of the life story corpus (2, 200) was used as the test data. Additionally, 120 instances of a real-time data were collected from the EmoTect system after it had been used for a period of time with students. Table 1 shows the various instances data that was used in the experiment. Besides EmoTect, as described in Section 3, the training data, which is the remaining 85% of the total data, was used to train the various classifiers implemented in WEKA- MNB and J48.

<table>
<thead>
<tr>
<th>Dataset</th>
<th># Test instances</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSC</td>
<td>330</td>
</tr>
<tr>
<td>RTD</td>
<td>120</td>
</tr>
<tr>
<td>LSC + RTD</td>
<td>450</td>
</tr>
</tbody>
</table>

Table 1. Test data according to the life stories (LSC) and the real-time data (RTD)

---

5 Results and discussion

Coarse-grained evaluation measure was used to determine the performance of the EmoTect’s support vector machine, WEKA’s Multinomial Naïve-Bayes and J48 decision tree classifiers for detecting emotions in the learner generated data (i.e. LSC + RTD). By this approach, this researcher computed for the precision, recall and f-measure of each of the individual emotion categories, and as well the overall weighted average. The proportion of the labelled instances of the gold standard (test data) that were identified and extracted by the classifiers is referred to as the recall. The fraction of the automatically extracted data that is found to be labelled correctly as the gold standard by the classifiers is termed precision. The F-measure, also termed F-score, is the harmonic mean (average) of the recall and precision measures.

In Table 2, WEKA’s Multinomial Naïve-Bayes (MNB) classifier performed poorly for classifying anger and disgust when taking into account the score of the f-measure. However, the MNB classifier performed well beyond the acceptable threshold (>70%) in the remaining individual emotion categories. Thus, joy and surprise yielded the highest f-measure of 80%. The implication is that the harmonic mean of the recall and precision for the MNB is 80%. Overall, only 70% of the proportion of the human labelled test data-gold standard- was actually identified by the WEKA’s MNB classifier while 69% of the identified emotions categories were correctly predicted by the classifier as the gold standard. This implies a low performance of the WEKA’s MNB classifier for classifying emotions in the students’ generated data which was used in this study.

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Emotion</th>
<th>Precision (%)</th>
<th>Recall (%)</th>
<th>F-measure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LSC + RTD</td>
<td>Anger</td>
<td>54</td>
<td>69</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>Anticipation</td>
<td>67</td>
<td>65</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Disgust</td>
<td>58</td>
<td>50</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Fear</td>
<td>75</td>
<td>76</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>Joy</td>
<td>86</td>
<td>74</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Sadness</td>
<td>79</td>
<td>71</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Surprise</td>
<td>70</td>
<td>90</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Trust</td>
<td>68</td>
<td>78</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Weighted Avg.</td>
<td>69</td>
<td>70</td>
<td>65</td>
</tr>
</tbody>
</table>

In Table 3, WEKA’S J48 decision tree performed averagely for predicting fear, anticipation, and disgust (50% < J48 < 60%) when considering the f-measure score. The remaining emotion categories that yielded a score above the 70% are satisfactory in terms of the predictions against the gold standard. From Table 3, the overall performance of the J48 decision tree classifier is 63% recall, 66% precision and 66% f-measure. In this light, the overall performance of the J48 decision tree is slightly below the acceptable threshold and the performance is considered mediocre. This implies that 63% of the test data was correctly identified as the labelled data from the gold standard while 66% of the identified data was correct as the gold standard.
Table 3. Evaluation results of WEKA’s J48 decision tree

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Emotion</th>
<th>Precision (%)</th>
<th>Recall (%)</th>
<th>F-measure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Anger</td>
<td>62</td>
<td>77</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Anticipation</td>
<td>58</td>
<td>60</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Disgust</td>
<td>55</td>
<td>50</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>Fear</td>
<td>63</td>
<td>55</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>Joy</td>
<td>72</td>
<td>68</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Sadness</td>
<td>71</td>
<td>82</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Surprise</td>
<td>80</td>
<td>63</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>Trust</td>
<td>70</td>
<td>54</td>
<td>62</td>
</tr>
<tr>
<td>Weighted Avg.</td>
<td>66</td>
<td>63</td>
<td>66</td>
<td></td>
</tr>
</tbody>
</table>

From Table 4, the performance of the EmoTect’s SVM with respect to the individual’s emotion categories was also ascertained. Except for the trust and joy categories whose f-measure scores were slightly below the threshold of the 70%, the rest of the emotion categories were satisfactorily predicted, of which their f-measures are more than the threshold of the 70%. However, the overall performance of the EmoTect’s SVM yielded 75% precision, 70% recall and 73% f-measure. This implies that, the performance of the EmoTect’s SVM classifier was superior over the WEKA’s MNB and the J48 decision tree. What this means is that 70% of the test data was correctly identified as the gold standard data while 75% of the identified data (compared with the test data) was correct when comparing with the gold standard data. The harmonic mean (average) of the recall and precision is 73%. It is therefore clear that EmoTect, our proposed system, produced the best performance in terms of the detection of emotions in the learners generated content as against the MNB and the J48 decision tree implemented in WEKA.

Table 4. Evaluation results from the SVM implemented in EmoTect

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Emotion</th>
<th>Precision (%)</th>
<th>Recall (%)</th>
<th>F-measure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Anger</td>
<td>79</td>
<td>67</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Anticipation</td>
<td>80</td>
<td>65</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Disgust</td>
<td>70</td>
<td>72</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>Fear</td>
<td>80</td>
<td>70</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Joy</td>
<td>67</td>
<td>68</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>Sadness</td>
<td>74</td>
<td>72</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Surprise</td>
<td>80</td>
<td>71</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>Trust</td>
<td>66</td>
<td>73</td>
<td>69</td>
</tr>
<tr>
<td>Weighted Avg.</td>
<td>75</td>
<td>70</td>
<td>73</td>
<td></td>
</tr>
</tbody>
</table>

As reported in the earlier paragraphs in this section, the performance of each of the classifiers varied but slightly. By comparing the classifiers, the overall performance of the EmoTect’s SVM was found to be superior over the WEKA’s J48 and the MNB classifiers. For having established the performance of the various classifiers in terms of the detection of emotions in text, there is the need to look into what might have accounted for these performances. One of the key areas to look at is the data which was used in the experiment. The life stories were collected from students in three senior
high schools of Ghana where English language is not the native language. Based on this, some challenges associated with the use of emotion words to describe or fit into a particular situation was observed. Although, the British English is the official language of instruction in schools, students, at that level of their studies struggled to use appropriate emotions words to describe situations. For instance, if student could write “I wil kel masef” instead of “I will kill myself”, it became difficult for the annotators to figure out what the student meant. In the same vein, EmoTect algorithm picks the features as it is and trains the classifier with it. This, we assume might have contributed to the performance of the various classifiers.

In addition, some of the students understood their life stories as life challenges, so we deduced that most of the extracted features were negative rather than positive. From close observation, this researcher believes that to achieve higher accuracy, more emotionally-charged data is required. For this reason, this researcher will collect more data to train the system as it is still being used by school counsellors. Despite the aforementioned challenges in the data content, we conclude that a natural language processing with machine learning techniques can be an effective tool for tracking emotions in text if implement efficiently.

In counselling, emotion is thought to represent useful linguistic information that contributes to human communication. As revealed, the performance of the EmoTect system, comparing with WEKA classifiers and with human way of analysing emotions in text, is suitable for tracking emotions in text thereby complementing the work of school counsellors in understanding the emotional behaviours of their students. These findings are consistent with our previous study where the EmoTect system was evaluated with end-users in their settings (Kolog et al., 2017). From that study, counsellors were enthused about the capabilities and the aesthetic view of the EmoTect system and further recommended for improvement. Subsequently and before this study, the system was afterwards improved in terms of the efficacy of the output.

6 Conclusion

In this paper, we have demonstrated how a supervised machine learning technique could be used to classify emotions in students’ textual submissions for counselling. This was investigated through our e-counselling system for emotion detection in text. The demonstration was conducted through an experiment where the EmoTect’s classifier (SVM) was compared with WEKA’s Multinomial naïve-Bayes and J48 decision tree classifiers. Since EmoTect is a system to complement the work of counsellors in their decision making of students, the rationale of this study is to determine the efficacy and the performance of the EmoTect classification algorithm. Overall, EmoTect’s SVM performed slightly better than the WEKA’s J48 and MNB classifiers in terms of the classification of emotions in students’ generated content. This researcher further looked into the reason that might have accounted for the performance of the classifier. Based on the findings, this researcher concludes that more emotionally charged students’ life stories are required to increase the quantity of the training data, in order to improve its accuracy of the emotion detection component of the e-counselling system- EmoTect.
References


The Acceptance of Using Open-Source Learning Platform (Moodle) for Learning in Hong Kong’s Higher Education

Ching-Hong LUK¹, Kwan-Keung NG², Wai-Ming LAM³

¹³ School of Business and Hospitality Management, Caritas Institute of Higher Education, Tseung Kwan O, New Territories, Hong Kong, China
² University of Sunderland in Hong Kong, Hong Kong, China

¹ eluk@cihe.edu.hk, ² steven.ng@sunderland.edu.hk
³ plam@cihe.edu.hk

Abstract. Using online learning platforms for teaching and learning is common in this generation and development is driving innovation. The advances of information technology have significantly changed ways of teaching and learning in higher education. Online learning platforms take many forms depending on a particular application. In addition to Blackboard, Moodle is one of the most popular online learning platforms nowadays worldwide. Moodle is a learning platform designed to provide educators, administrators and learners with a single robust, secure and integrated system to create personalized learning environments. In addition, the acceptance of the students to the online learning platform will affect the higher education information and the construction of modernization of education in a certain extent. A number of studies have indicated that the successful pedagogical use of technology depends on students’ attitudes and acceptance towards technology. Therefore, the prediction of students’ attitude and acceptance towards online learning platform is crucial for the teaching and learning quality in education. This study is to investigate the acceptance of using online learning platform, i.e. Moodle by using the augmented version of TAM model (A-TAM) to investigate their behavioral intention and use behavior of Moodle for their learning, as Moodle is one of the most common online learning platform in Hong Kong and there are a significant proportion of Institutes adopting Moodle in Hong Kong higher education. In other words, this study investigates how perceived usefulness, perceived ease of use, attitude towards behavior and subjective norm affect behavioral intention so as to actual behavior of using Moodle in Hong Kong higher education.

Keywords: A-TAM; online learning platform; open-source; learning management system; Moodle; higher education
1 Introduction

Information technology (IT) in education is still a main concern. There is a number of studies in the information technology adoption and acceptance by using Unified Theory of Acceptance and Use of Technology (UTAUT) or Technology Acceptance Model (TAM) models (Escobar-Rodriguez & Monge-Lozano, 2012; Cornell, Eining, & Hu, 2011; Dasgupta, Granger, & McGarry, 2002). IT is being incorporated into teaching and learning process, not only through the availability of online courses, but also to support and assist student learning (Martin & Serrano, 2009; Romero, Ventura, & Garcia, 2008). The development of e-learning is getting rapid since most of the higher education institutions are using web-based instruction system for teaching their online courses. Advances in technology have facilitated new forms of information processing and created new structures, which will not only complement universities, but also transform them. Therefore, virtual classrooms become very common when new technologies are included in the University context. This is currently bringing together the possibilities of teaching-learning based upon a communication system using computers (Ciudad, 2010).

E-learning platforms have transformed the ways teachers and students learn (Fillion, Limayem, Laferriere, & Mantha, 2007). This change has made it possible for students to manage their learning process, while the role of the teacher is orchestrating and guiding students their education (Ciudad, 2010). Therefore, nowadays, university teachers have to modify the subjects and methodology involved in teaching and learning. Students must actively collaborate in learning, participating and collaborating with their teachers (Clausen, 2005; Reichert & Tauch, 2003). In recent years, e-learning platforms are becoming common and a number of these e-learning platforms exist. Some require paying for access to the software, while in others this is not required. One of the most frequently used e-learning platforms is the Moodle platform, as it offers a wide range of services, such as chat, forums, questionnaires, etc. it is easy to use and simple for teachers to change or increase its contents. Students can gradually connect to the information as the course progresses (Bergeren et al., 2005; Rice, 2006).

Since a number of studies used UTAUT and TAM models to investigate the acceptance of using technology in various fields, including higher education, this study is going to use augmented version of TAM (A-TAM) model, which eliminates the limitations of TAM to measure the social and other control factors affecting the students’ acceptance of using technology in higher education. The continuous evolution of TAM leads to the inclusion of additional constructs related to the social influence (Venkatesh & Davis, 2000). A-TAM gives a higher priority to the social factors, e.g. social norm especially in IT (Compeau and Higgins, 1991; Mathieson, 1991; Moore and Benbasat, 1991). In this study, the result shows that the seven hypotheses are supported. In other words, perceived usefulness, perceived ease of use, attitude towards behavior and subjective norm affect behavioral intention so as to actual behavior of using Moodle in Hong Kong higher education.
2 Literature Review

2.1 Benefits of Open Source Learning Management System (LMS)

A Learning Management System (LMS) is a software package enabling the management and delivery of learning content and resources to students. Most LMS systems are using web-based platform to facilitate access to learning content and administration at anytime and anywhere. Most of the LMS applications allow student registration, the delivery and tracking of e-learning courses and content. They may also allow the management of instructor-led training classes. In addition, the LMS allows learner self-service, facilitating self-enrolment, and access to courses. Generally, LMS can be categorized into two categories, namely Open Source LMS and proprietary LMS. OSS refers to software that is developed, tested or improved through public collaboration and distributed with the idea that it must be shared with others, ensuring open future collaboration (Feller & Fitzgerald, 2000). The advantage of OSS is that it is free and can be adapted and extended to meet one’s own needs. The advantage to educational institutes is that what they can obtain by applying OSS is to profile e-learning according to a clear vision of the educational methods one plans to apply.

Open Source has emerged a powerful new way to generate knowledge and economic value. It is available to anyone at usually little or no cost. It also offers users the choice to probe, modify, learn from and customize the software, harnessing the power of many small contributions from a large network of individuals, to suit their needs. Other benefits of Open Source LMS are affordable software for individuals, enterprise and government, universal access through mass software rollout without costly licensing implication, ability to customize software to local languages and cultures, lowered barriers to entry for software businesses and participation in global network of software development (Machado & Thompson, 2005). All these explain the reason why there is an increasing number of institutes using Open Source LMS in their programmes.

2.2 The use of learning management systems (LMS) in learning environments

In recent years, we have witnessed the growing introduction of LMSs in all levels of schooling. Students entering universities nowadays will already have their own laptop computer with an Internet connection, and a growing number will have used an LMS in school. Despite the increase in LMS adoption in schools and universities, concern has been expressed to whether LMSs are being used as effective learning tools or merely as electronic document repositories (Badge, Cann & Scott, 2005; Hall, 2006). Successful implementations of LMSs depend, not only on providing training and support for instructors, but also on the level of student active engagement and student and instructor satisfaction with the LMS used (Hall, 2006). The user perspective is therefore crucial to examine the implementation of LMSs and to evaluate their success.

Francis and Raftery (2005) distinguish among three e-learning modes of engagement, which correspond to growing levels of complexity and depth in LMS usage. The first mode is labelled as baseline course administration and learner support as well as illustrates situations where an LMS is used only to distribute course information and
carry out course administration and most learning activities occur in traditional classroom settings. The second mode is blended learning leading to significant enhancements to learning and teaching processes. This particular mode entails combining face-to-face interaction with a more widespread use of features such as communication tools, promoting interaction between tutor and students or among students; collaboration tools that assist students in the development of group work and otherwise allow for the sharing of learning resources; assessment tools, including the submission of graded assignments, the completion of quiz tests and the provision of feedback on work submitted; and finally, the inclusion of learning content that allows each student to independently further their learning at their own pace and specific interest. The third mode corresponds to a fully-fledged online course or module where most learning will take place using the LMS, with extensive use of the tools described above and only marginal face-to-face interaction.

2.3 Moodle

Moodle is a course management system, also known as a Learning Management System (LMS). It is a free web application that educators can use to create effective online sites. It allows very large deployments and a large number of students. Many institutions use it as their platform to conduct fully online courses, while some use it simply to augment face-to-face courses, which is known as blended learning. Many Moodle users use the many activity modules, such as forums, databases and so on to build richly collaborative communities of learning around their subject matter, while others prefer to use it as a way to deliver content to students and access learning using assignments or quizzes (Moodle, 2017).

3 Methodology:

This study used augmented version of TAM (A-TAM) model (Taylor & Todd, 1995) to investigate the relationships between the constructs of perceived usefulness, perceived ease of use, attitude towards behaviour, subjective norm, behaviour intention and actual behaviour in higher education context. The construct of perceived behavioural control was not adopted in this study as Sawang et al. (2014) suggested a non-significant effect of perceived behavioural control on intention. In addition, this construct was mainly adopted in the Theory of Planned Behaviour (TPB) (Ajzen, 1991). Meanwhile, this construct was defined as “the perceived ease or difficulty of performing the behaviour and assumed to reflect past experience as well as anticipated impediments and obstacles” (Doll & Ajzen, 1992), which was already included in the construct of “perceived ease of use” in our A-TAM model. Therefore, A-TAM model is a hybrid model of TAM and TPB (Taylor & Todd, 1995).

There are SEVEN research hypotheses which are listed as follows (as shown in Figure 1):

H1: Students’ PEU has a significant influence on students’ PU for using Moodle.
H2: Students’ PU has a significant influence on students’ ATB for using Moodle.
H3: Students’ PEU has a significant influence on students’ ATB for using Moodle.
H4: Students’ PU has a significant influence on students’ BI for using Moodle.
H5: Students’ ATB has a significant influence on students’ BI for using Moodle.
H6: Students’ SN has a significant influence on students’ BI for using Moodle.
H7: Students’ BI has a significant influence on students’ AB for using Moodle.

Fig. 1. Research model on the acceptance of using open-source learning platform (Moodle) for learning in Hong Kong’s Higher Education

A 5-point Likert-type scale was used in the questionnaires; total 132 questionnaires were collected from Caritas Institute of Higher Education and Caritas Bianchi College of Careers, and 4 questionnaires were unusable due to incomplete responses; as a result, there were 129 valid data input via Partial Least Squares regression (PLS) software.

4 Research Findings

In these 129 valid responses, the gender percentage is quite even, i.e. 64 are male students and 65 are female; besides, 68 are local students and 61 are non-local students. Besides, Perceived Usefulness (PU), Perceived Ease of Use (PEU), Attitude Towards Behaviour (ATB), Subjective Norm (SN), Behavioural Intention (BI), and Actual Behaviour (AB) have received quite similar mean scores from 3.52 to 3.69; however, in the questions of SN2 “Other students think that it is good to use Moodle” and AB2 “I actively participated and interact with others in Moodle in the last semester” have received the lowest mean scores 3.46 and 3.44 respectively among these questions as shown in Table 1.
Regarding the reliability and validity test results are shown in Table 2, the score of AVE (Average Variance Extracted) and Cronbach’s Alpha are higher than 0.5 and 0.7 respectively in both analyses; therefore, the captioned results indicate the construction of the questionnaires and responses are reliable and acceptable as shown in Table 2.

Regarding the correlation analysis, the correlation values among these six constructs are reported in Table 3:

### Table 1. Summary of students’ responses on using Moodle (Mean and Standard Deviation [S.D.])

<table>
<thead>
<tr>
<th></th>
<th>PU</th>
<th>PU1</th>
<th>PU2</th>
<th>PU3</th>
<th>PU4</th>
<th>ATB</th>
<th>ATB1</th>
<th>ATB2</th>
<th>SN</th>
<th>SN1</th>
<th>SN2</th>
<th>SN3</th>
<th>SN4</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEAN</td>
<td>3.64</td>
<td>3.71</td>
<td>3.58</td>
<td>3.70</td>
<td>3.62</td>
<td>3.57</td>
<td>3.59</td>
<td>3.59</td>
<td>3.72</td>
<td>3.47</td>
<td>3.56</td>
<td>3.49</td>
<td>3.46</td>
</tr>
<tr>
<td>S.D.</td>
<td>0.97</td>
<td>0.96</td>
<td>1.01</td>
<td>0.96</td>
<td>0.95</td>
<td>0.98</td>
<td>1.01</td>
<td>0.96</td>
<td>1.04</td>
<td>1.02</td>
<td>0.95</td>
<td>0.98</td>
<td>0.93</td>
</tr>
</tbody>
</table>

### Table 2. Cornbach’s Alpha and the AVE (Average Variance Extracted) analysis of using Moodle

|       | AVE | Compo- | R Square | Cronbach’s | Commu- | Redun- |
|-------|-----|site Reli-|         | Alpha      | nality  | dancy  |
| PU    | 0.825767 | 0.959507 | 0.712273 | 0.947274 | 0.825767 | 0.586222 |
| PEU   | 0.759112 | 0.940259 | 0.920357 | 0.759112 |          |        |
| ATB   | 0.826240 | 0.934465 | 0.894633 | 0.894633 | 0.826240 | 0.227841 |
| SN    | 0.754257 | 0.924664 | 0.891307 | 0.754257 |          |        |
| BI    | 0.861392 | 0.949088 | 0.891947 | 0.861392 | 0.861947 | 0.166840 |
| AB    | 0.795550 | 0.921094 | 0.740538 | 0.795550 | 0.795550 | 0.582950 |

### Table 3. Latent Variable Correlations analysis of students’ behaviour intention for using Moodle

<table>
<thead>
<tr>
<th></th>
<th>PU</th>
<th>PEU</th>
<th>ATB</th>
<th>SN</th>
<th>BI</th>
<th>AB</th>
</tr>
</thead>
<tbody>
<tr>
<td>PU</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEU</td>
<td>0.843963</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATB</td>
<td>0.814911</td>
<td>0.900129</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SN</td>
<td>0.830488</td>
<td>0.862679</td>
<td>0.851388</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>0.798817</td>
<td>0.860816</td>
<td>0.851761</td>
<td>0.864648</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>AB</td>
<td>0.825764</td>
<td>0.879601</td>
<td>0.880938</td>
<td>0.861783</td>
<td>0.860545</td>
<td>1</td>
</tr>
</tbody>
</table>

Regarding the coefficients to all six constructs, i.e. PU, PEU, ATB, SN to Behavioural Intention (BI) and BI to Actual Behaviour (AB), are all over 0.7, please refer to the Partial Least Squares Structural Equation Modelling (PLS-SEM) as shown in Figure 2:
Fig. 2. PLS-SEM Path analysis of the acceptance of using open-source learning platform (Moodle) for learning in Hong Kong’s Higher Education.

Furthermore, a bootstrapping analysis via SmartPLS programme from 129 responses to 5000 samples has been run in order to assess the significance of the path coefficients among these six constructs are listed in Table 4:

Table 4. Research Test Results of students’ behaviour intention for using Moodle (Beta Value & T-Statistics)

<table>
<thead>
<tr>
<th>FACTOR ➔ BI (Behavioural Intention)</th>
<th>Beta Value</th>
<th>T-Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: Perceived Ease of Use (PEU) ➔ Perceived Usefulness (PU)</td>
<td>0.844</td>
<td>22.784870</td>
</tr>
<tr>
<td>H2: Perceived Usefulness (PU) ➔ Attitude Towards Behaviour (ATB)</td>
<td>0.192</td>
<td>2.374385</td>
</tr>
<tr>
<td>H3: Perceived Ease of Use (PEU) ➔ Attitude Towards Behaviour (ATB)</td>
<td>0.738</td>
<td>9.663791</td>
</tr>
<tr>
<td>H4: Perceived Usefulness (PU) ➔ Behavioural Intention (BI)</td>
<td>0.132</td>
<td>1.345661</td>
</tr>
<tr>
<td>H5: Attitude Towards Behaviour (ATB) ➔ Behavioural Intention (BI)</td>
<td>0.368</td>
<td>3.490206</td>
</tr>
<tr>
<td>H6: Subjective Norm (SN) ➔ Behavioural Intention (BI)</td>
<td>0.441</td>
<td>4.556960</td>
</tr>
<tr>
<td>H7: Behavioural Intention (BI) ➔ Actual Behaviour (AB)</td>
<td>0.861</td>
<td>32.473308</td>
</tr>
</tbody>
</table>

According to the Beta Value and T-Statistics listed on the above table, seven hypotheses are supported by the research results of both analyses. Perceived Ease of Use (PEU) has a strong influence on Perceived Usefulness (PU) on Moodle, Perceived East of Use...
(PEU) also has strong impact on Attitude Towards Behaviour (ATB); besides, Attitude Towards Behaviour (ATB) and Subjective Norm (SN) have demonstrated significant influences on college students’ Behavioural Intention (BI) toward using Moodle. As a result, Behavioural Intention (BI) also demonstrates a strong influence on students’ Actual Behaviour (AB) as well.

5 Limitation and Further Research

Since this is a preliminary research on finding students’ behavioural intention and actual behaviour on using Moodle for their studies, the sample size is limited. In addition, most of the respondents are studying in business and hospitality management and come from two institutes. It is recommended that further research would be conducted in a wider based, and respondents should be invited from other schools / departments, and other higher education institutes as well. Moreover, researchers also recommend that other open source learning platforms should also be investigated which platform would mostly influence students’ learning behavioural intention.

6 Conclusion:

This study is to investigate the acceptance of using online learning platform, i.e. Moodle by using the augmented version of TAM model (A-TAM) to investigate their behavioural intention and using behaviour of Moodle. The result shows that all six constructs, namely Perceived Usefulness (PU), Perceived Ease of Use (PEU), Attitude Towards Behaviour (ATB), Subjective Norm (SN), Behavioural Intention (BI), and Actual Behaviour (AB) received similar above average mean scores from 3.52 to 3.69. In addition, the analyses show that PEU has a significant influence on PU and ATB; PU has a significant influence on ATB and BI; ATB has a significant influence on BI; SN has a significant influence on BI; and finally, BI has a significant influence on AB.

In other words, Perceived Usefulness, Perceived Ease of Use, Attitude Towards Behaviour and Subjective Norm affect Behavioural Intention so as to Actual Behaviour of using Moodle in Hong Kong higher education.

However, in order to improve the generalization of the study, future study should be extended to students in other disciplines and various types of open source learning platforms can be examined.

References:


Online eLearning System for Music Jamming

Joseph FONG¹, Kenneth WONG²,*

¹Caritas Institute of Higher Education, Hong Kong
²International Hybrid Learning Society, Hong Kong,

¹jfong@cihe.edu.hk, ²wting_wong@hotmail.com

Abstract. Nowadays, with Internet people listening to music by using YouTube becomes everyday life. Moreover, various websites offer music tutorial sessions to teach people play music. For example, there are video for musicians show others how to play musical instruments for songs. Nevertheless, after people have learnt the techniques to play music, there is not yet an easy way for them to practice what they learnt by jamming music with each other. As a result, they cannot evaluate their learning knowledge and skill. This paper aims to offer a method for music players jam music through Internet and mobile App with each other in order to improve their musical skill. Our approach is to use an online music mixer to mix multiple players music record together on the Internet. For example, user A records a music session A playing drum, and user B records another music session B playing guitar. Then user C can use an online music mixer to mix session A and session B together into a new session C. This session C is the result of jamming session A and session B together to become a complete song of by itself. The result is like user A and user B jamming music together on the Internet. Also, other people can learn music by listening sessions A, B and C to appreciate each component of the song played by different musical instruments. The benefit is that people can learn music by jamming songs together on the Internet even though they are physically in different locations.

Keywords: eLearning, music jamming, online music mixer, App, Internet

1 Introduction

In the old days, jamming music is done by a group of people playing different musical instruments with the singer together in the same room at the same time. In reality, it is not easy for a group of people to confirm a date and time which everyone is available for jamming music. With the advancement of technology, there are researches solving this problem by making use of the Internet. MIT Technology Review (2007) claims that new music software could make online jams nearly as good as rehearsals in the same studio. For example, Skype is a very popular solution for a group of people to talk and see each other on PCs or smart phones. However, the main purpose of such solution is not target for music jamming with the requirement of extraordinary importance for voice and video quality. As a result, research for a methodology to promote music
jamming for eLearning is necessary. A methodology of applying video streaming technology and relevant equipment is desired for solving the problem of lack of music jamming live for eLearning in the market.

Scott Witmer (2009) has pointed out that there are several products on the market which allow music players to record parts of the song and send them via the Internet to other music players for collaboration. However, this situation is not ideal for jamming music live because a player must wait for another player to complete the song.

Al-Sakib Khan Pathan et al. (2016) includes multimedia streaming such as online mixer which deals with multimedia streaming in networks of the future, from basics to more in-depth information for the experts. The text includes coverage of Internet architectures and protocols, embedded systems and sensor networks, web services, Cloud technologies, and next-generation wireless networking.

Julie A. DeCesare (2014) said that streaming video is not simply an accommodation to distance learners; rather, it’s an expectation for the curriculum, and a valuable tool for teaching critical thinking skills, analysis, and the use of primary sources.

Zhu Ce (2010) has mentioned that eLearning has been a precursor in using video streaming over the Internet. Also, he claimed that video streaming is an effective way of teaching, provided certain conditions are met. We expect a music player in location A can see another music player in the screen and jam music with the singer in location B. This can be achieved through video streaming technology.

Soundtrap (2017) offers that students can collaborate and communicate with each other inside Soundtrap. Teachers can now give remote lessons through Soundtrap’s virtual learning environment. This opens up exciting possibilities for project based learning and collaborations between schools around the world in real time.

YOU.DJ - MIX MUSIC ONLINE (2017) is the best online DJ software to remix SoundCloud music and YouTube videos for FREE!

In general, music players can jam music together by using a music mixer. Each player records a session of music into a sound track, and the mixer mixes them together into a song. The main technique is to align the sound tracks together correctly. The music mix can help align sound tracks together during recording. That is, after the first player records the first sound track, the second player listen to the sound track and can decide when to record his/her own sound track in the song, and which can be done by the mixer automatically.

If we want to computerize a music mixer, we need to solve the time alignment problems of various sound tracks played by different music players. For example, Figure 1 shows the start of the recordings and the start of a song of three sound tracks which are to be mixed into a song. The first sound track lays out the start of sound track and the start of a song. However, the first, second and the third sound tracks are not in time alignment. As a result, we need to delete the silent part of the first, second and the third sound tracks, and then use an online mixer to mix these three sound tracks into the start of record for a complete song.
2 Experiments

We have done feasibility study of two experiments for online music jamming. The first case is called WeSing for music players sing and play the same song together in WeSing (2017). Fig. 2 shows a system overview of WeSing for live broadcasting of band performance. The system contains a live band, JVC Cam, a singer in the same location. The JVC Cam must be shooting at the Live Band and Singer at the same time. One important component of the JVC Cam is the relay server which provides 2 functions: (1) Store the recorded video (2) Generate a webpage to contain the video. But the relay server need not in the same location of JVC Cam. It must connect to the internet. The JVC Cam is connecting to the relay server through 4G network. When the singer is practicing with the live band, the JVC Cam must be shooting at the Live Band and Singer together simultaneously. Then, the JVC Cam will transmit the recorded video to the relay server within 1 minute through 4G network, provided that one video is only recorded 1 song. Once the relay server receives the video, it will generate the webpage automatically at once. Certainly, the webpage contains an URL and the video. Since the relay server configures the public static IP address, anyone can access the webpage and watch the video immediately. In fact, the JVC Cam provides the Streaming Server solution. Our eLearning system applies Streaming Server solution in which the JVC Cam’s (GY-HM200) built-in HD streaming engine with Wi-Fi and 4G LTE connectivity allows live HD transmission directly from the camera to the viewers. HD streaming engine allow users to deliver live HD to content delivery networks such as USTREAM AND YouTube. The Relay Server (Innotek IT-MOS2480 Media On-Demand Streamer) is a high-performance and reliable audio and video streaming
server. It is optimized with ultra-performance of CPU processing power, network interface and storage sub-system for simultaneously streaming H.264 contents to multiple mobile and desktop screens.

Fig. 2. An experiment of WeSing for guitarist and singer jam music through the Internet

Fig. 3 shows a system overview WeJam(2017) for a live music jam performance via a 2-sided video conferencing system. One side is a guitarist in a band room. There must be one computer connecting to the Internet with the webcam in the band room. The computer must install a video conferencing software, such as Skype. Another side is another guitarist with a mobile phone. Both guitarists must use the same video conferencing apps in his/her mobile phone. The webcam first captures the image and music of the first guitarist, then it sends to the second guitarist on the other side of skype, the video conferencing software. On another side, the second guitarist is playing in front of the skype of a mobile phone. The mobile phone will also capture guitar playing music with Skype and send to the first guitarist on another side through the 4G network. As a result, both guitarists can jam music together online on the Internet.

Fig. 3. An experiment of WeJam for guitarists jam music through the Internet

These two experiments show that while it is feasible for two music players jam music together online on the Internet. In the first case of Fig. 2, one player sings a song, along with another player playing guitar for him in the same song. In the second case of Fig.
3, two players play guitars with each other in the same song. Nevertheless, both cases suffer certain time delay in the process. Our conclusion is that if users can accept the time delay in online music jamming on the Internet, then our feasibility study is successful.

3 System Architecture

In this paper, we offer an offline solution of jamming music together. The idea is for music players record their own part of music in the same song, and then apply an online music mixer mix their recorded sound tracks together to complete a song.

The architecture of the online mixing is an Android Apps which allows user to open an account and upload sound tracks as shown in Fig. 4. The system contains several buttons such as Home for overview, Musician for user account and Public sharing for uploading and mixing sound tracks together into a song.

Fig. 4. An App for user to upload and mix sound tracks

Fig. 5 shows the screen layouts for the users to mix two uploaded sound tracks by specifying the start position and the length of each sound track. User can then delete leading spaces of a sound track to align it with another sound track before mixing.
Fig. 6 shows that after the online mixing, the user can view the complete song with all components. The user can also view a component of a song alone, for example, the drumming or the guitar of the song. In this way, the user can jam music with other users, and can also learn the playing of a particular musical instrument such as drum and guitar. Furthermore, the user can change the tempo of the song so that it is easier for a music learner to follow both the melody and the rhythm of the song.

The benefit of online mixer system helps the music learner to play music by:

1. Listen to a component of a song from the online mixer App.
2. Imitate it by recording the learner’s own playing of the same component into a sound track
3. Mix the learner’s played component of the song along with the rest component sound track of the song.
4. Compare the resultant mixed sound track with the original song sound track to learn the difference for improvement.

A prototype of the online mixed system has been implemented for feasibility study in thejammers.net (2017). The result is positive.
Fig. 6. Components of a song for user to select for jamming music after mixing sound tracks

4 Conclusion

Since our eLearning system combines component sound tracks into a song by jamming them with mixing together, we can provide a platform for music player to practice their music performance skill more easily and conveniently.

The benefits are:

- Music players can jam music with each in different locations.
- Our eLearning system can help musician rehearsal their practice by playing each component of the song and then mix them together into a song even though they are physically in different locations.

Our future plan is as follows:

- Develop an easy method to upload all recorded video to social media website, such as Facebook, YouTube, etc. to share our eLearning system to the public.
- Develop this system to suit the needs for other musical cooperation in the future.
• Improve music player’s learning productivity with our online mixer eLearning system.
• Enhance the music mixer into an online music mixer and iPhone platform.

References

8. WeSing (2017) https://www.youtube.com/watch?v=sEHKTyLF1IA
9. WeJam(2017) https://youtu.be/ONvi52n3JRo
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