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An Enjoyable Learning Experience in Personalising Learning Based on Knowledge Management: A Case Study

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ABSTRACT

Many attempts at personalisation have been made in education. They all collect learning data and analyse learning behaviours, and ultimately achieve personalised learning dynamically. However, further research is needed on the ways to effectively access and analyse information about learning within an enjoyable environment and with positive results when realising personalised learning. In order to solve this problem, we connect the time in class and after class with semantic knowledge and combine these elements with gamification and a better interaction experience. We explore whether this teaching method can offer students a better learning experience and positive learning outcomes. Our approach plays an obvious role in personalised learning. Our results indicate that a teaching method which connects the two parts of a class with gamification and a means of interaction in AR (augmented reality) produces novel and enjoyable feelings, stimulates students' enthusiasm and improves the learning effects when they do personalised learning.

Keywords: gamification, knowledge management, learning behaviour, personalised learning, student engagement

INTRODUCTION

With the explosion of Internet technologies and ubiquitous computing, personalisation has become widely used (Mejova, Borge-Holthoefer, & Weber, 2015). Whether it is reading the news or social networking, we have already achieved personalisation. Notably, some changes have occurred in education in order to realise personalised instruction. During the previous century, the University of Manchester Innovation Centre developed CAPA (the computer-assisted personalised approach) (Kashy et al., 1993), which allows teachers to create

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State of the literature

- With the explosion of Internet technologies and ubiquitous computing, some changes have occurred in education in order to realise personalised instruction.
- In the traditional model of classroom instruction, the in-class period lacks staff-student communication, class-student communication and immediate feedback. The out-of-class period cannot provide the students with personalised learning strategies according to their performance in class.
- Many applications of personalised learning do not fully provide the expected learning experience. They do not combine the in-class and out-of-class periods effectively in personalised instruction.

Contribution of this paper to the literature

- We apply the combination of gamification and AR based on semantic knowledge as a personalised learning approach in a real class.
- Students get immediate feedback through interaction with the teachers and other students in class. The out-of-class learning process in the online platform is also like a game to pass through, and it provides more choices to the students.
- It is easily achievable with augmented reality and appropriate to use in an in-classroom environment.

personalised exercises and to provide feedback. For instance, a flipped classroom (Herreid & Schiller, 2013) offers students a new type of classroom instruction which reverses the traditional educational arrangement and offers more opportunities for personalised expression. As we further advance into the twenty-first century, attempts in education to incorporate the Internet and electronic equipment are becoming more naturally applied and accepted. Open access education via the web has become popular, such as MOOCs (massive open online courses) and more targeted SPOCs (small private online courses) (Fox, 2013). Many online out-of-class learning platforms have also appeared, such as PeerWise (Denny, 2013). In addition, wearable devices present many possibilities for our educational reform. The real-time behavioural feedback study from human centred multimedia, Augsburg University, Germany proved that speakers wearing the Google Glass can effectively conduct presentations while observing the whole audience. The speaker can receive real-time feedback on audience members' expressions and actions, which demonstrated a positive effect on the speaker's performance (Damian, Tan, Baur, Sch, Ning, & Luyten, 2015). These attempts provide new ways to learn, collect learning data and analyse learning behaviours. Their aim is to finally realise personalised learning. However, these applications of personalised learning do not fully provide the expected learning experience (Fox, 2013).

After a period of investigation and a literature review, we assessed there are few methods that can effectively combine in-class and out-of-class periods. In the traditional model of classroom instruction, the in-class period lacks staff-student communication, class-student communication and immediate feedback. Teachers are unable to capture the learning state of students; thus, it is difficult to offer targeted instruction. Some educators have avoided such a problem by using a wearable device to assist with instruction. For instance, human centred multimedia, Augsburg University, Germany had a speaker wear the Google Glass to capture the actions of the audience in the real-time (Damian, 2015). The speaker made appropriate adjustments according to the feedback information: when the audience shook their heads, the system provided negative feedback. As such, the speaker could then adapt, e.g. by stopping to ask the students about the issue or by adjusting the rhythm of the lecture. Due to the difficulty of obtaining learning feedback from a class, online learning platforms become necessary. PeerWise successfully adds gamification into online out-of-class learning, increasing students' enthusiasm and achieving satisfactory effects. Yet, PeerWise does not provide the students with personalised learning strategies according to their performance in class. Also, some methods and equipment may be too expensive for some educational institutions or are not appropriate to use in an in-classroom environment. Even a flipped classroom will be more aim-oriented and efficient if a method combining the two class periods can be applied.

The main problem we need to solve is how to combine the in-class and out-of-class periods effectively in personalised instruction. We believe this approach should provide students with a pleasant learning experience, and it is easily achievable with augmented reality, so that personalised teaching and learning become more available. The collecting the data of students' learning behaviours and the offering of targeted tutoring are considered to be important. According to previous research, gamification is a suitable solution (Von Ahn & Dabbish, 2008). The experimental studies have shown that gamification is effective in increasing the engagement and enjoyability of students (Dondlinger, 2007). Moreover, augmented reality can be a wonderful assistant (Yuen, Yaoyuneyong, & Johnson, 2011). Because of the advantages of semantic technology in searching and expressing, we selected it to build the knowledge base as a way of combination (Alavi & Leidner, 2001; O'Leary, 1998).

We design a learning system based on semantic knowledge to realise personalised instruction. The approach combines the two periods of class using gamification and AR. In class, students use mobile phones and SmartBands. They shake, send a bullet screen (sending a message across the screen like bullets), receive a band buzz to interact with teachers and participate in the classroom environment and receive immediate feedback. Then, they use an online gamification study platform to complete exercises out of the class. We analyse the data of learning behaviour both in and out of class to provide intelligent recommendations for their personalised choices and self-cultivation. These two parts communicate and share data with each other through semantic knowledge. During the in-class period, in a traditional classroom, it is obvious that the lack of effective communication between teachers and students mainly stems from the shyness of most Chinese students. Because of the lack of interaction and real-time feedback between students and class, teacher cannot know students' learning state very well. As such, it is difficult to provide targeted tutorship for every student. Therefore, students' questions and problems cannot be raised and resolved. More and more students become confused and finally lose their interest in the class; some even feel disgusted with the class. In consideration of this situation, we design another system from the viewpoint of personalised for the in-class period. The personalised instruction is based on strategies that are popular and easy to achieve: bullet screen, shake and SmartBand. These personalised ways attract students to participate in the class actively, and they also enable a teacher to capture students' learning state and problems in real-time. Students can involve themselves in a discussion and raise their questions in a timely manner; meanwhile, the teacher gives the corresponding answers according to bullets and band buzz. It will change the traditional situation using the personalised system. Gamification is used to assist personalised learning by providing a game-like environment. In an out-of-class period, we have found that the students have some discontent with the exercises; however, the dislike of the exercises is caused by the lack of personalised choices and incentives. In real games, people explore the adventure areas by completing different tasks in the map. We consider the learning path as the exploration route in the game, and the learning procedure is just like having an adventurous experience. Students progress by choosing personalised exercises, and the exercises get more difficult as they learn. An individual report is provided to help them check their progress with learning. They feel fulfilled and are encouraged to have high participation when making progress. This design strategy, called the 'stage mode,' uses gamification mechanics including discovery, progression and infinite gameplay (Ryan & Deci, 2000). 'Stage mode' is similar to a computer game in that it follows steps to advance (Deterding, 2011). The final exam also encourages students to choose the task of different difficulty. This kind of goal management plays the same role as the final boss in games. The use of personalised learning with gamification may change the existing after-class learning.

In this paper, we apply the combination of gamification and AR based on semantic knowledge as a personalised learning approach in a real class. Students get immediate feedback through interaction with the teachers and other students in class. The out-of-class learning process in the online platform is also like a game to pass through, and it provides more choices to the students when they are working on the exercises. All the functions are based on analysing the data of their learning behaviours, learning routes and learning effects. Thereafter, students are offered the so-called stage mode learning experience, personalised exercises, teammate recommendations, individual feedback, role advice and final exam goal-management. Our approach plays an obvious role in personalised instruction. We present experimental evidence that our personalised learning with the combination of two periods of class has indeed improved learning experiences (student participation, exercise completion, satisfaction and joy of learning) and the effects of learning. Our work shows a way to realise high-efficiency personalised learning.

LITERATURE AND KNOWLEDGE BASE MODEL

Bullet Screen Class

Students send bullets and create online notes using smartphones during the class in Tsinghua University, China. The software enables the teacher to put the PPT (PowerPoint) into students' smartphones and decorate homework through WeChat. Students can then mark the current PPT page they do not fully understand and do the homework using their smartphones (Yu & Wang, 2016). In Kyoto University, Japanese students also send bullets in class. Students discuss the problem based on the content the teacher discussing in the form of bullets ('Class', 2016). The teacher can solve the problems immediately. Using the smart device in class alleviates the embarrassment that students may feel in regard to asking questions in a traditional classroom. It also eliminates the communication gap between students and teachers and allows for real-time question and answer. The results show that the smartphone has a positive impact on assisted education.

Computer-Assisted Personalised Approach

The CAPA system was developed to create individual assignments for students (Kashy et al., 1993). The system generates personalised homework and allows students to answer questions online, study together and receive immediate feedback. The problem they receive takes on the same form and covers the same principles. As such, the system encourages the students to cooperate with others. The students' reaction to the system is exciting, and the system can be regarded as an effective online learning tool.

Flipped classroom

The flipped classroom was firstly based on recorded video. Nowadays, with the development of science and technology, the rise of intelligent devices has overturned class luxury, and the flipped classroom has obtained the attention of many people with the use of video and other forms (Thompson, 2011; Sparks, 2011). Questions are presented in the form of homework for the students to work on exercises during the class, and students can rely on smart devices in collaboration with other classmates to discuss and solve their own problems. An experiment conducted at Michigan High School that compared flipped and traditional classroom teaching showed that a flipped classroom results in better student performance (Williams, 2012). Other studies that highlighted the advantages of a flipped classroom were conducted by Troy Faulkner at Minnesota Byron High School (Fulton, 2012).

PeerWise

PeerWise (Denny, 2013) is an online repository of student-generated multiple-choice questions (MCQs). MCQs consist of one question which is attached to a class along with a set of answers. Only one of the answers is correct. In this system, badges have been used since 2013 to improve students' engagement. PeerWise is used in more than 1,000 universities, schools and technical institutes around the world.

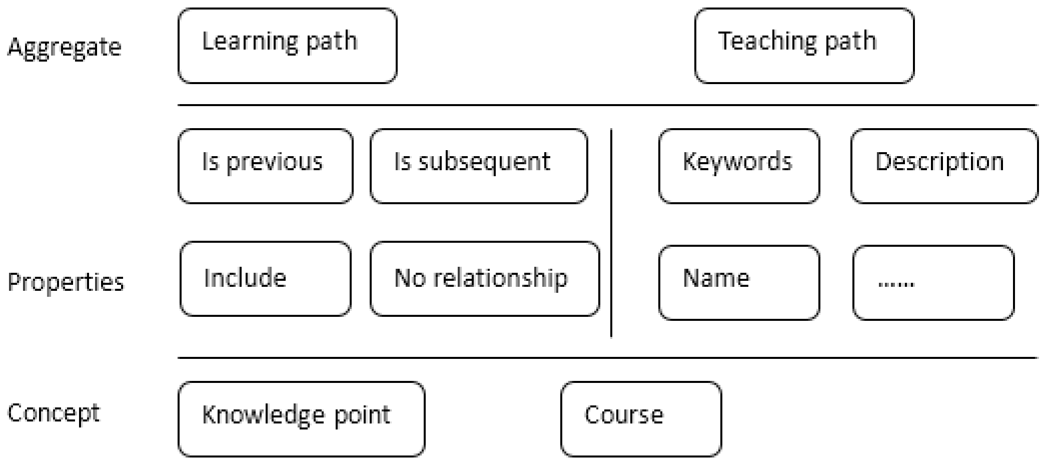

Figure 1. Ontology model of semantic knowledge base

Gamified Course

At the University of Cape Town, gamification elements are applied in courses. For example, instructors apply Steampunk theme in their courses (O'Donovan, Gain, & Marais, 2013). By using elements such as a storyline, puzzles, points, badges and a leaderboard, they hope to improve lecture attendance, content understanding, problem solving skills and general engagement. Unfortunately, some students declined to take part in the gamification.

The Proposed Knowledge Base Model

In our approach, we use semantic technology to build the knowledge base and store the knowledge points of the course. The in-class and out-of-class periods connect with each other through the knowledge point. Students shake their mobile or send a bullet screen when they are puzzled about what teachers are saying, and this routine will form the in-class learning behaviour. The online learning platform out of class will recommend the exercises and references according to the analysis results of their learning behaviour. For example, the platform recommends targeted exercises or learning materials to a student because he/she has shaken this knowledge point in class to express his/her non-understanding and then recommends the previous or subsequent knowledge point.

The semantic knowledge base ontology model has course and knowledge points related to two concepts. There are several kinds of relationships among the knowledge point concepts, such as 'is previous', 'is subsequent', 'include' and 'no relationship'. One of them will be chosen to be the relationship among the knowledge point entities. All the teaching behaviours and learning behaviours of each teacher and student will be recorded as a teaching path or learning path in the base. These two kinds of paths are the important data used to offer a personalised analysis. When we need to use the knowledge base, we can materialise it according to the course.

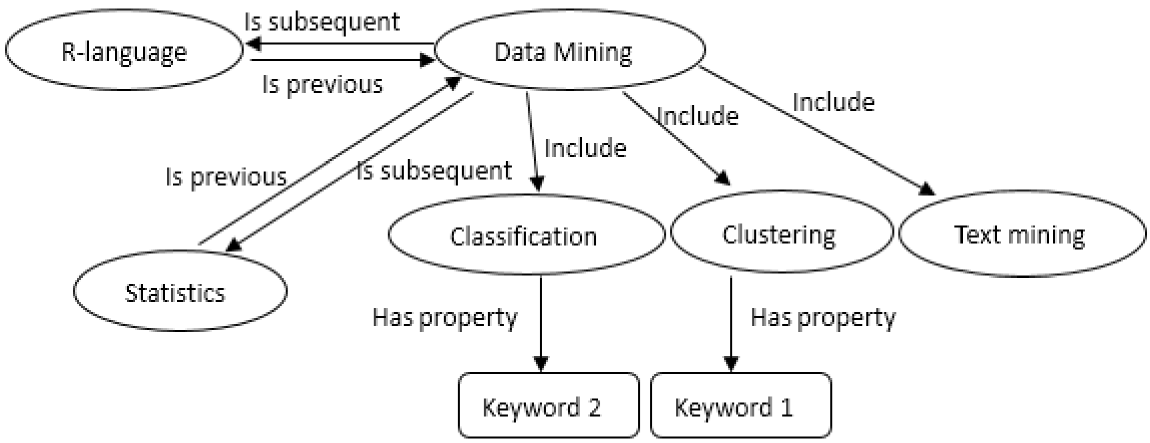

Figure 2. Example of a semantic knowledge base

METHODOLOGY

The design of an in-class system

In order to assist personalised learning using AR, the teacher's system (SmartBand) and the students' system (use of smartphones) provide different operation and feedback modes:

a) Students' system:

(1) Bullet screen: Students express their ideas and problems in the form of sending bullets to the teacher's screen according to their own learning state.

(2) Shaking: Students shake their smartphones during the class to notify the teacher that they did not hear or fully understand what the teacher is saying. They can shake one time in one PPT page.

(3) Knowledge point: The system will extract important knowledge points from the current page of the teacher's PPT and display them on the students' smartphones. Students can then quickly understand important knowledge to be gained from the current page of the PPT.

b) Teacher's system:

(1) Record: The system will record bullet and shake requests from students, which contain the following fields: student ID, bullet content, sending time and related PPT page.

(2) Feedback: During the class, if students do not understand what the teacher is saying in one page of the PPT, they shake their smartphones to alert the teacher. When the number of the students who shake their smartphones reaches a certain amount, the SmartBands will buzz to catch the teacher's attention.

Figure 3. Interface of students` system and teacher`s screen with bullets

Based on an example, the specific process of the personalised classroom using AR can be described as taking a designed subject, an in-class system, teachers and students as the background. During the class, students need to log into the in-class system using their smartphones to clearly visualise the knowledge points of the PPT from the interface of the students' system (**Figure 3**). Based on these knowledge points, students can send bullets freely, and the bullets will be shown on the teacher's screen (**Figure 3**). At the same time, teacher will find students' interests and doubts by analysing the bullets' content and the situation that prompted the shaking. Notably, the bullets also can attract other students, promoting discussions among students as well as making the class lively. The bullets with effective content can enlighten the confused students. When a teacher's PPT page reaches an established threshold (e.g. 35%) in terms of the number of students who shook their smartphones, the teacher's bracelets will vibrate and he/she will stop to answer the questions or even adjust their teaching rhythm accordingly.

During the class, several categories of data will be collected for the out-of-class period analysis which will give each student the most suitable exercises and recommend learning lines through a combination of gamification and sematic knowledge. In doing so, the shaking record or request will be used to enhance students' understanding of content, allow students to explore their own points of interest or to let students cultivating their own interests in class, i.e. do personalised real education.

The design with gamification and knowledge management

The combination of personalised learning and gamification was applied as a learning platform for the out of class period, which has two significant gamified personalised learning features:

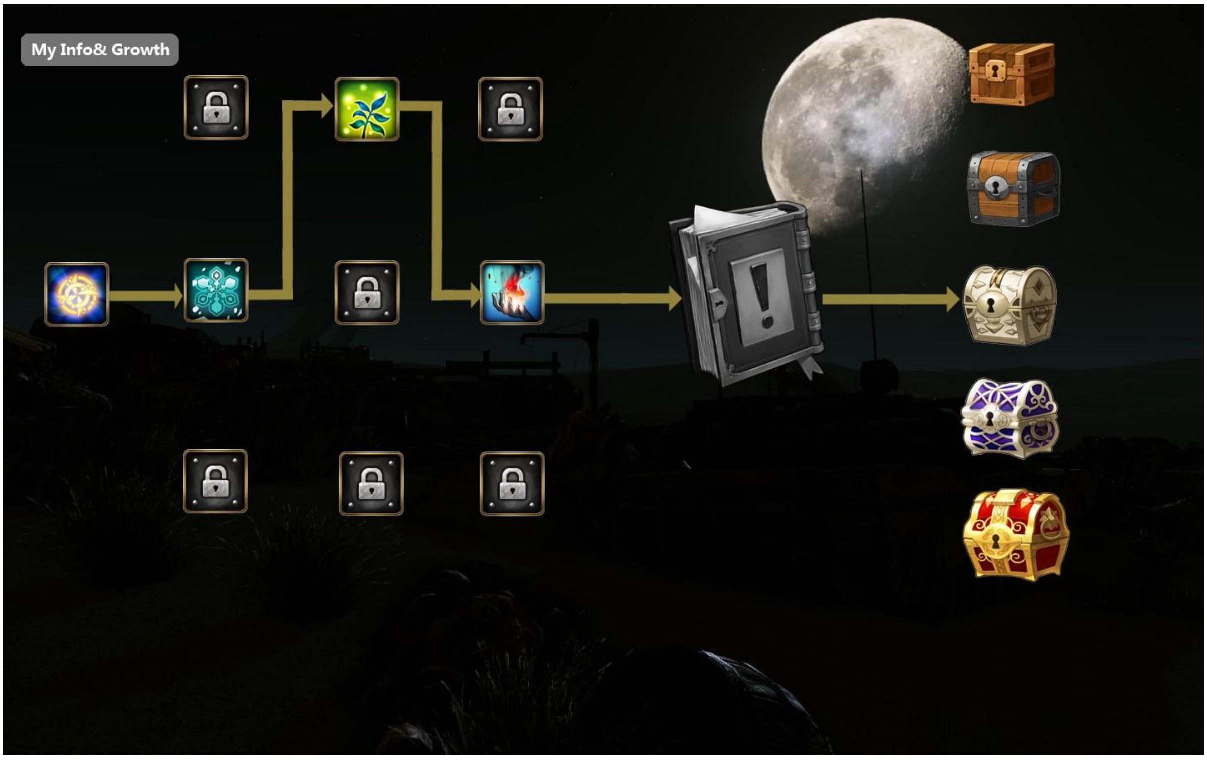

Figure 4. Interface of gamification platform

a) Gamifying personalised learning is like going on an adventurous journey. There are free personalised choices of task pools and the final exam level. Cooperating with others to finish the final task is like facing a boss in a game.

b) Personalising the learning process by offering exercises with knowledge/skill weight, degree of difficulty and individual feedback.

In our platform, students choose a mission, name a task pool and every week they have to accept and finish at least one exercise in the pool. Thereafter, we give them a personal report, and they need to cooperate with others to finish the final task. The interface of the platform is shown in **Figure 4**.

Students are advised to complete the basic exercise so that we can assess their basic level in the beginning of the course. There are several task pools to choose from every week. Each task pool has a particular emphasis on skill points. For example, one task pool may focus on any aspect of design, management or programming. Students choose the one they are interested in without any constraints. The platform recommends the exercises according to their behaviour in the class. If they shook for the knowledge point they did not understand, the platform gives prior recommendations and then recommends exercises of the subsequent knowledge point.

Figure 5. Different knowledge/skill weight and degree of difficulty of each exercise

The student can continue when he/she finishes one of the exercises that week. Every week is a stage. The following content is covered in foggy shadows to create a mysterious atmosphere, as shown in **Figure 5**. It is applied to encourage students to explore and discover.

Every exercise is personalised in the pool with its knowledge point, knowledge/skill weight and degree of difficulty as shown in **Figure 5**. It shows one possibility of the proportion. The platform then recommends exercises in the task pool based on its property and on the progress of students. The platform provides them with a chance to keep doing exercises in the pool and increases the level of difficulty when they are successful.

All the choices made by students will be recorded as a learning path as shown in **Figure 1**. This path is designed like the exploration route in game. Different choices may lead to a different future. The path not only records the choices but also the quality of the exercises, how quickly the students complete them as well as other aspects. This procedure is just like playing an invented game. Discovery, progression and infinite gameplay attract the students to this learning procedure. They explore the unknown knowledge map by doing exercises.

Figure 6. Learning report

After four weeks of doing exercises, we analysed the learning path of every student and the completion of tasks. The platform provides each student with an individual 'learning report'. As shown in **Figure 6**, the report can help students figure out their own learning progress and effects in detail. It lists the personalised information of the students: the potential of each student, career suggestions, exercise completion, partner recommendation and so on. This helps them to make the proper plan for their study and garner individual feedback. Thereafter, we recommend proper teammates who bring complementary skills to them. For example, if Bob is identified as a programmer, designers and product managers of a similar skill level will be recommended. Additionally, during the fifth week and before the final exam, we gave students who failed to complete the exercises the opportunity to redo them at an appropriate time so that their routes were not incomplete. They could make up the exercises they missed.

The final exam is designed as a boss stage. It comes after teammates recommend it. This examination is different from the traditional one. We used to offer a unified outline and examination paper and only give students a score after grading the papers. In games, players face the final round at this time, so the students are encouraged to choose final tasks of a different difficulty. The scores of the final tasks range from 60 to 100, and by reaching every multiple of 10, it will step up to a new level. **Figure 4** shows the five treasure chests, which represent the five final tasks. After reading the content, each team accepts the final task they think is suitable for them. Goal management helps students to challenge themselves. It is just like they team up with proper classmates and take on the missions together in a game.

The experimental procedure

An experiment was carried out in the course 'Web Design', a large-scale class (N=221, 83 females and 137 males) in our university, China. The experiment lasted for about 7 weeks.

This course has been taught in our University for many years by the same teacher with the same teaching syllabus. Every semester there are more than 200 students who volunteer to join the optional class.

In the fifth week, we added the in-class part to our course. We prepared a lesson about computer science with 6 PPT pages and created a questionnaire after the class. The questionnaire was a means to assess who logged into the in-class system. Its purpose was to investigate students' suggestions in regard to comparing the traditional classroom to the personalised classroom. After the experiment, we obtained students' bullets, the shaking data and the results of the questionnaire.

The course was ended with the final exam, followed by a questionnaire. The questionnaire was given to the students who chose to use the platform after the final exam. This surveyed the learning effect, the evaluation of the platform and collected comments and suggestions. We also did a brief interview with the student who chose this course for two

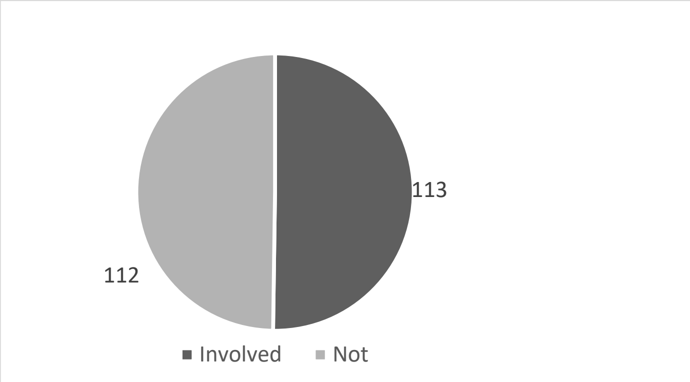

Figure 7. Comparison of students who was involved and not involved

Table 1. Data from students using the in-class system

	Bullets		Shaking	
	Sum	**%**	**Count**	**%**
Page 1	35	5.67	32	28.31
Page 2	84	13.61	30	26.55
Page 3	117	18.96	22	19.47
Page 4	157	25.45	46	40.71
Page 5	101	16.37	5	4.42
Page 6	123	19.94	18	15.93

semesters and the instructor. During the experiment, we collected data from the learning path (including every chosen exercise, finishing quality, efficiency, etc.) and the final grade.

RESULTS

Figure 7 shows the proportion of the involvement of students. Half (113 of 221) of the students took part in the in-class system. We collected 770 data in total, including 617 bullets and 153 shaking count. The average of each student send 5.4 bullets in a lesson. Then we analysed the 617 bullets and got 400 useful bullets which related to the knowledge points. We also systemised the data of the PPT page, bullets and shaking count as illustrated in **Table 1** and Figure 8. In the table and figure, it can easily be observed that students are the most active in the middle class when the class beginning and ending their activity is not high. This situation had two possible reasons: students listen to the teacher carefully; students need others to discuss using bullets. Additionally, SmartBands prompt the teacher only one time in the class; in this PPT page, the number of bullets is also the highest. It indicates that students had more problems and more discussions with other students in this page. When students had a problem, they discussed it using the form of bullets. We also found the most unuseful bullets appear in the PPT which has the least number of shaking. Most students understood the content of this page; therefore, they talked about other things to participate in the class.

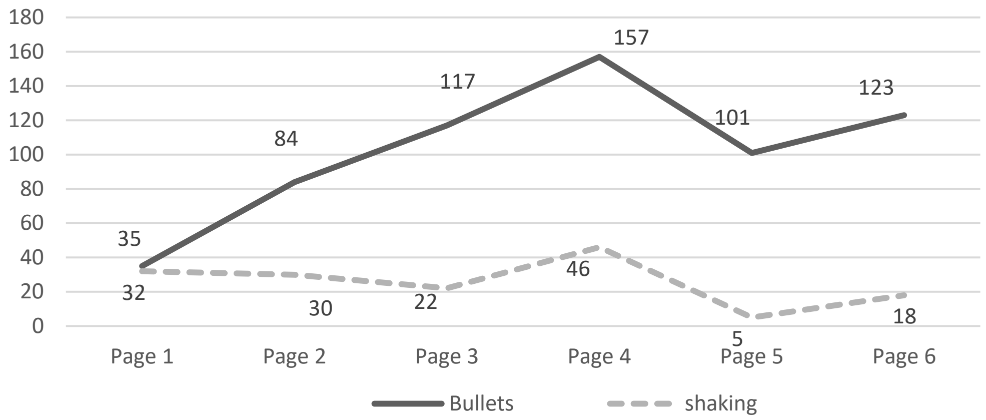

Figure 8. Data from students using the in-class system

Table 2. Completion of exercises every week

	Finish at least 1 exercise		Average of exercises doing	Choose more than 1 pool		Average online time
	Frequency	%		Frequency	%	
1st week	127	57.46	4.96	-	-	36361.4697s
2nd week	182	82.35	3.53	11	7.69	31427.8409s
3rd week	167	75.57	3.83	15	8.98	27465.3146s
4th week	123	55.66	3.35	11	8.94	23624.5271s

In the questionnaires of the in-class system, 90% of the students (102 of 113) thought the system was more helpful and preferred it over the traditional classroom. However, three students said the bullets affected their lectures. The teacher was satisfied with the system. He stated that SmartBand is a great aid for the lecture and that the bullets can let him know the students' learning state in real-time.

We analysed the engagement and learning effects of students using the platform. As shown in **Figure 9**, the completion rate rises linearly, but it also shows the number of finished exercises declined and decreased with time. **Table 2** shows the completion of every week. The average of the exercises completed every week is over half of the number of exercises in every task pool (5 exercises for each pool). Every week, there were some students who chose more than one task pool (2nd week 11p, 7.69% of 182p; 3rd week 15p, 8.98% of 167p; 4th week 11p, 8.94% of 123p). The average amount of times the platform was used is shown in **Table 2**. It decreased with time. Regarding the participants, around half (95p, about 42.99%) completed all four weeks of exercises. In the fifth week, students were allowed to make up exercises. A total of 47 students chose to make up their 88 missing exercises. These make their routes more complete.

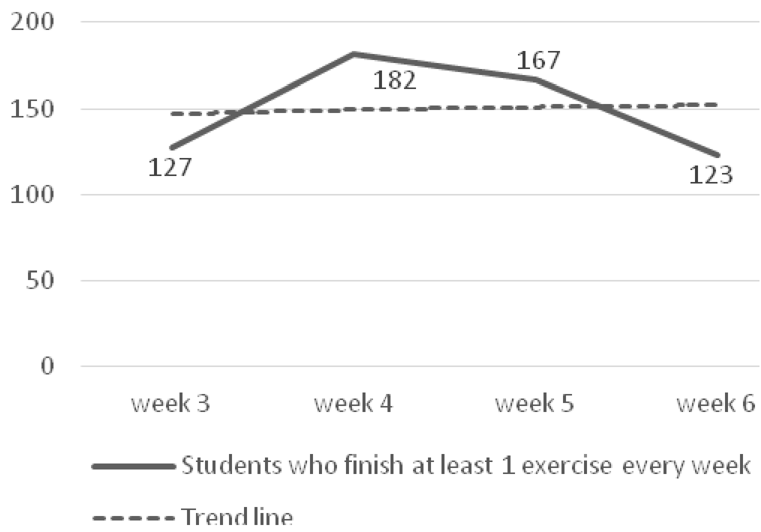

Figure 9. Completion of exercises every week

Table 3. Score of the final exam

	Average score	Standard deviation	Score over 80	
			Frequency	%
2015 fall semester	79.09	10.7863465	124	56.11

In the final exam, we observed that 124 students (56.11% of the students) attained a score of over 80 as shown in **Table 3**. We regard the number of students whose scores are over 80 as an excellent rate. The average score of the final exam was 79.09, which is very close to the excellent score.

In the questionnaires, 88.17% of the students were satisfied with the platform, and the others chose neutral options. Nine students pointed out that some improvements were still needed in the user interface and gamification design. Only one student expressed his dislike of the platform. In interviews following the final exam, a student who chose the course twice announced that he felt more comfortable and enjoyed this kind of personalised learning. Instructors also said that for students to keep abreast of knowledge to grasp the situation, very simple tips must be given to better help them refocus lectures, without the need for full monitoring of each student's learning status.

DISCUSSION

Our results have shown that using gamification and AR provided by the SmartBand to combine the two parts of class in personalised learning causes favourable changes in teachers' instruction, student participation, exercise completion, satisfaction, perceptions of learning and, consequently, better final grades. Our approach plays an obvious role in personalised learning, and the results are positive in general.

During the in-class period, students were active and joined our class interaction. Over half of the students took part in and sent bullet messages. In the out-of-class part, exercise completion achieved positive results and rose linearly. Also, it was discovered that the approach works well for the final exam. The excellent rate of the final exam is over 50%. We can clearly see that the satisfaction of the students is generally high after analysing the questionnaire and the interview. The combination can create a better experience for students and improve the effect of learning. The acceptance of personalised learning in this environment is high. In the interview with the teacher who taught the web design course, he said, 'It provides me with more information about students' learning state [and] helps me to adjust teaching contents. Then I can know more clearly about what they want and give them targeted tutoring.'

Nevertheless, our results are not entirely positive. Some students pointed out the bullets influenced them while learning in the class. Passion and participation in the gamification part still decline over time. Our out-of-class platform is optional. Gamification strategies that keeps students' long-term attention still need to be explored. However, humans' attention naturally declines over time. Although we have not solved this problem as of yet, we are interested in exploring this issue further.

It is worth considering adding gamification and AR to personalised learning. Our approach and the course in this case are a weak coupling, which means the approach does not tightly match with the course, and it is convenient to transplant to other courses. All the knowledge points and exercises are supplied by the knowledge base and question bank based on the base, which can be rewritten in various courses. Where to use the out-of-class platform entirely depends on the students. This kind of design offers a possible way to introduce personalised learning into the classroom.

CONCLUSION

A better learning experience and positive outcomes are goals of personalised learning. In this article, we have explored whether combining two periods of class with a semantic knowledge base and using gamification and AR in personalization can offer students a better way to achieve personalised instruction. Gamification brings novel and enjoyable feelings and offers a talented interactive platform in personalised learning. AR brings immediate feedback and convenient interaction. Despite a downtrend in the number of accepted and completed exercises in the out-of-class period, we have achieved most of our expectations. Also, because of the weak coupling between the approach and the course, it can be a feasible and portable option for multiple courses.

In the classroom, we need more fun, more interaction, and more technologies to realise personalised learning and to cater to students. In the future, more interaction methods will be integrated, and more attractive gamification designs are also desirable. We anticipate that through the new design of a gamified platform, we can obtain more data about learning behaviours.

REFERENCES

Alavi, M., & Leidner, D. E. (2001). Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS quarterly*, 107-136.

Clive, Thompson (2011), How Khan Academy is Changing the Rules of Education.

Damian, I., Tan, C. S., Baur, T., Sch&#, Ning, J., & Luyten, K., et al. (2015). Augmenting Social Interactions: Realtime Behavioural Feedback using Social Signal Processing Techniques. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (pp. 565-574). ACM.

Denny, P. (2013). The effect of virtual achievements on student engagement. *In Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 763-772). ACM.

Deterding, S. (2011). Meaningful play: Getting gamification right. *Google Tech Talk*.

Dondlinger, M. J. (2007). Educational video game design: A review of the literature. *Journal of applied educational technology*, *4*(1), 21-31.

Fox, A. (2013). From moocs to spocs. *Communications of the ACM*, *56*(12), 38-40.

Fulton, K. (2012). The flipped classroom: transforming education at byron high school. *T H E Journal, 39*.

Herreid, C. F., & Schiller, N. A. (2013). Case studies and the flipped classroom. Journal of College Science Teaching, 42(5), 62-66.

Kashy, E., Sherrill, B. M., Tsai, Y., Thaler, D., Weinshank, D., Engelmann, M., & Morrissey, D. J. (1993). CAPA-An integrated computer-assisted personalized assignment system. *American Journal of Physics*, *61*(12), 1124-1130.

Kyoto University, Japan (2016). Class with Bullets. Retrived from http://news.missevan.com/news/article?newsid=39579.

Mejova, Y., Borge-Holthoefer, J., & Weber, I. (2015). Bridges into the Unknown: Personalizing Connections to Little-known Countries. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (pp. 2633-2642). ACM.

O'Donovan, S., Gain, J., & Marais, P. (2013). A case study in the gamification of a university-level games development course. In *Proceedings of the South African Institute for Computer Scientists and Information Technologists Conference* (pp. 242-251). ACM.

O'Leary, D. E. (1998). Using ai in knowledge management: knowledge bases and ontologies. *IEEE Intelligent Systems, 13*(13), 34-39.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist*, *55*(1), 68.

Sparks, S. D. (2011). Schools "flip" for lesson model promoted by khan academy. *Education Week, 31*, 2.

Von Ahn, L., & Dabbish, L. (2008). Designing games with a purpose. *Communications of the ACM*, *51*(8), 58-67.

Williams, C. (2012). Flipped class method gaining ground. *District Administration*.

Yuen, S., Yaoyuneyong, G., & Johnson, E. (2011). Augmented reality: An overview and five directions for AR in education. *Journal of Educational Technology Development and Exchange*, *4*(1), 119-140.

Yu, X., & Wang, S. (2016). Blending Learning in Tsinghua University. Retrived from http://yuketang.com.cn/domains/57074b361ea493005dc73383/park/qing_hua_da_xue_hun_he_shi_jiao_xue_gong_zuo_fang_yu_ke_tang_chuan_shou_wan_zhuan_ke_tang_xin_miao_zhao.

http://iserjournals.com/journals/eurasia