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Investigating the Effects of Web-Based Instant Response System on Learning and Teaching in Pre-Service Teacher Courses

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Abstract: The purpose of this research focuses on the learning and teaching effectiveness by using web-based instant response system in courses for pre-service teachers. This study presents outcomes of research that examined students' experience using an instant response system, ZUVIO, in a couples of pre-service teacher courses at a university in northern Taiwan. We conducted semi-structured interviews with students to learn about the extent to which ZUVIO influence classroom dynamics, instruction quality and students' learning process and performance. Key findings revealed that ZUVIO enriched the quality of teaching and learning in the classroom, with the highest influence reported on all types of assessment, including live and formative assessment, ongoing assessment, and self-assessment, as well as improved learning experience in content delivery, interaction, engagement and motivation. Our findings also suggest that the use of web-based IRS in the classroom is likely to minimize distractions, thereby improving the quality of teaching and learning beyond what is provided in conventional classrooms. Other factors that contributed to students' enhanced learning included the creation and integration of appropriate content in ZUVIO, providing students with timely feedback, and game-play strategies.

Keywords: Instant Response System, ZUVIO, Motivation, Interaction.

1. Introduction

Technology is being increasingly integrated into teaching environments in view of enhancing students' engagement and motivation. In particular, instant response systems (IRSs) have been found to foster students' engagement, enhance classroom dynamics and improve overall students' learning experience. With the development of modern technologies, multimedia has been widely used in the teaching field, exerting a great influence on classroom teaching (Ding & Li, 2011; Neo & Neo, 2004). The learning styles have become more diverse to enhance both self-study and collaborative learning environment (Palloff & Pratt, 2005). Nowadays, learners become more active when they use digital devices in the classroom, and the classroom also becomes more interactive because of the online instructions (Gilakjani, Ismail & Ahmadi, 2011).

Therefore, this study aimed to explore the use of online IRS, ZUVIO, to examine students' learning experience and teaching quality. The study lasting for one semester (18 weeks) was conducted in a University located in northern Taiwan. Three courses were chosen as the sample.

To understand the effectiveness of online IRS in the pre-service teacher training courses, the following research questions were proposed:

1. Can instant response system, ZUVIO, improve students' learning experience?
2. Can ZUVIO promote the quality of instruction?

2. Literature Review

2.1 ZUVIO

ZUVIO is an online teaching and learning platform designed by Xue-Yue Technology in 2013. It aims to improve teaching quality, increase students' learning motivation, and use digital educational system (Yan, 2018). Figure 1 shows the interface of ZUVIO platform. The features of ZUVIO are summarized as follows (ZUVIO, 2013):

1. Course and account management system: Teachers can offer different courses each semester and manage the enrollment of each course.
2. Multimedia question system: Teachers can develop multiple choices, open-ended questions, or group questions. In addition, figures can be included in the questions. Moreover, teachers can decide whether the individual student or the group should answer the questions. Students, could use digital devices, like smartphones, tablets, or computers, to answer questions immediately.
3. Peer assessment system: Teachers can create groups and students can conduct peer assessment. Meanwhile, grading rubrics and weighting can be set in the system. Besides, teachers can choose whether the students have to give comments. During the peer assessment, the system will update scores and rankings among individuals or groups.
4. Grading system: Teachers can observe the dynamic answer process, and receive the detailed data and figures. Students, on the other hand, can read the previous answering records to review the course.

2.2 Instant Response Instruction

The terms instant response system, classroom response system, classroom communication system, wireless response system, and interactive response system are used interchangeably. The term refers to a software/hardware system that allows instructors to easily get instant feedback from their students, using remote control devices and a portable receiver. The most common use instructions are as follows:

1. Assessing student comprehension: Accurately assessing student comprehension of material in the classroom has always been a challenge for educators. Methods historically used by instructors have included calling on a broad range of students to answer questions, having the entire class answer questions through visible means, or using volunteers. Although these methods have merit in moving toward a more active classroom learning environment, they all fail to truly give the instructor an accurate picture of how well or how poorly all students have grasped recently taught concepts." (Czekanski & Roux, 2008).
2. Voting to engage students in knowledge construction: Typically, a lecturer may ask students to vote in order to engage them later in discussion. "We advocate a model of CRS-based teaching that we call "question-driven instruction." In this model, posing questions via CRS does more than augment traditional instruction: it forms the very core of the instructional dynamic. Our primary in-class goal is not to lecture or present information. Rather, we seek to help students explore, organize, integrate, and extend their knowledge. Students receive their primary exposure to new material from textbooks, multimedia, and other out-of-class resources." (Beatty et al., 2006).
3. Data gathering: Lecturers can ask to students to fill in short questionnaires or just a single multiple choice question in order to create real data to process in order to illustrate a method or a theory.

3. Research Design

3.1 Participants

The participants, instruments, and procedure of the study are introduced in this section. Three pre-service teacher training core courses participated in this study lasting a semester for 18 weeks. In total, 206 Taiwanese college students are pre-service teachers from 3 core courses in the Department of

Education. Five students were randomly selected from each core courses, total 15 students were interviewed after final exam and provided qualitative comments regarding the use of IRS in the instant response learning experience and instruction quality analysis.

3.2 Instruments

In this study, for examining the learning achievement, the student's t-test was used to compare the two types classes' mid-term and final exam scores for 2 periods in the semester. In addition, for examining the quality of instruction, a five-point questionnaire (one being the lowest and five being the highest) was distributed to measure students' attitudes toward Instant Response Instruction by using ZUVIO. The questionnaire, the Course Satisfaction Survey, a survey evaluating courses as part of the Institutional Self-evaluation of the University, provides students with an opportunity to evaluate the course they took in the current semester. This Course Satisfaction Survey used in this study included 20 questions and covered four categories: motivation (items 1 to 5), interaction (items 6 to 10), learning outcomes (items 11 to 15), and assessment system (items 16 to 20), each question is counted from 0 to 5 points. The interview was designed with an open-ended question to collect qualitative data on the use of the IRS, the series of questions is: "What are the advantages and disadvantages of using the IRS in the classroom?" including 7 advantage questions and 5 disadvantage questions.

3.3 Procedure

Before midterm exam, the first-nine-week class of each course was designed as the control period/group, which was given the traditional teaching instructions. The other nine-week class was designed as the experimental one, which had to complete the IRS tasks assigned by the teacher and use assessment, voting, peer-review functions in ZUVIO. The same professor taught all 3 core courses, and the students in both classes were sophomores and juniors with no ZUVIO learning experience.

3.4 Data Collection

For examining the learning achievement, data was collected from students' midterm and final exam results, after mid-term exam and final exam in the semester. For analyzing the overall quality of instruction and learning experience, data was collected from Course Satisfaction Survey, in the end of university semester. And the semi-structured interviews were conducted in the end of university semester, focusing on students' personal learning experience, qualitative data was collected from interview to understand the strengths and weaknesses of using the IRS in the classroom.

4. Results and Discussions

4.1 Learning Achievement

According to the unified both students' midterm and final exam results in three courses for the semester, the experimental group and the control group differed significantly in the scores ($p = .000 < .05$) with regard to the use of instant response instruction strategy (please see the following Achievement T-Test Output Table).

Table 1

T-Test Output

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
MT_score	206	76.990	20.848	1.453
F_score	206	82.078	18.147	1.264

One-Sample Test				
	Test Value = 0			95% Confidence Interval

					of the Difference	
	t	df	Sig(2-tailed)	Mean Dif	Lower	Upper
MT_score	53.003	205	.000	76.990	74.126	79.854
F_score	64.915	205	.000	82.078	79.585	84.571

4.2 Overall Instant Response Instruction Quality and Learning Experience

The Course Satisfaction Survey provides students with an opportunity to evaluate the course, to show their learning experience or satisfaction in four categories: motivation, interaction, learning outcomes, and assessment system, each question is counted from 0 to 5 points. The descriptive statistics output is as following table, it shows students' high satisfactions on motivation, interaction, learning outcomes, and assessment system, the teaching effectiveness looks very well.

Table 2

Course Satisfaction Survey Descriptive Statistics Output

Semester	CourseID	Valid	Sample	Motivation	Interaction	Outcomes	Assessment	Total
1062	J024	77	83	23.0	22.8	22.9	22.8	91.5
1062	4942	59	61	23.0	22.9	22.9	23.0	91.8
1062	8184	59	62	22.9	22.9	23.0	22.8	91.6

4.3 Personal Learning Experience with IRS

The qualitative data was collected by using an open-ended question interview to collect personal learning experience qualitatively on the use of IRS, ZUVIO. Five students were randomly selected from each core courses, total 15 students were interviewed after final exam and provided qualitative comments regarding the use of IRS in the instant response learning experience and instruction quality analysis to understand the strengths and weaknesses of using the IRS in the classroom. In the students' responses to the qualitative questions on the advantages and disadvantages of using IRS in the classroom, they listed the following advantages:

1. the IRS enhances interactivity in the class, students were more involved, attentive, and participative;
2. students received better and more timely feedback by using IRS;
3. the IRS was fun to use in the class, and reduced the distract;
4. students can vote anonymously using the IRS;
5. the IRS is easy to use;
6. the use of the IRS adds technology components to the class;
7. the IRS promotes learning; and
8. the use of the IRS helps instructors to understand the students' level of understanding so that they can explain concepts to the students better.

Interactivity is one of the most highly cited benefits of the IRS. Students highlighted that the use of the IRS increased their involvement in the class, helped to promote more class participation, allowed them to get immediate feedback, and enabled them to assess their understanding relative to those of the other students. Anonymity is one of the advantages provided by the IRS. With the IRS, every student has the chance to answer every question without being embarrassed if his or her answer is wrong. The anonymity feature of the IRS increases students' willingness to participate in the class. Fun is another benefit of using the IRS system. As the students stated, "the IRS complements the lectures," "introduces activities during the lectures," and "makes the lectures more interesting." The IRS uses BYOD idea as remote control; therefore, the IRS is fairly easy to use and operate. Also, since the design of the courses were technology-integrated, students realized the benefit of using advanced technology, such as the IRS in the class. Students also believed that with the help of the IRS, the instructor was able to explain course materials better. Overall, they felt that the use of the IRS in the class promoted interactivity and learning.

On the other hand, the main disadvantages of the IRS that were identified by the students are as follows:

1. sometimes the IRS do not function properly due to an unstable internet connection;
2. question types are limited to multiple choice questions and true/false questions;
3. some students do not take voting seriously; and
4. voting using IRS takes up class time.

The above identified disadvantages are concerned with technology, instructional design, and students' attitudes. First, the IRS is a new technology and has room for technological improvement and advancement. For example, when wireless network is unstable, students' responses sometimes could not be detected and received through the internet. The cloud database was not able to receive more than one concurrent response. Second, the IRS can only capture quantitative data, thus limiting the responses to multiple-choice or true–false questions. Third, since using the wireless handheld device, the smart phone or the tablet, was fun to the students, some of them did not take it seriously—by clicking multiple times on purpose, by clicking on answers that were obviously incorrect, or by clicking on answers that were out of the range/choices given. Students also raised concerns relating to instructional design. For example, the following questions should be considered when designing instruction. How much class time should be allocated to voting? What types of questions are appropriate for use with the IRS? And will the use of the IRS disrupt the pace and flow of the class?

5. Conclusions and Implications

The advantages and disadvantages identified by the students not only provide a more comprehensive picture and understanding of using the ZUVIO in the classroom, but also provide additional information that is useful to educators planning to implement the IRS. These qualitative comments highlight a number of pedagogical and curriculum issues that are valuable to educators.

1. Interactivity has long been considered one of main pedagogical issues in the classroom, especially for large classes and technology-related courses. The results of this study suggest that the IRS is an effective way to improve interactivity in the classroom. The students' comments also indicate that interactivity promotes learning.
2. The success of using the IRS in the classroom also suggests that technology components should be part of the curriculum design for classes related to technology. For example, adoption of a state-of-art technology can improve students' interests and motivation in learning the course materials. In this study, the IRS was successfully utilized in 3 designed classes, which is a technically oriented course.
3. Technology should be working. Not only must the technology be easy to use, it must also be useful and working properly. A technology that is not working properly can create frustrations and disrupt the learning process. For example, the internet connection should be checked before the class to ensure that it's on and stable.
4. Instructors need to integrate the IRS seamlessly into the curriculum design. Although the IRS is an effective way for enhancing classroom interactivity, it may disrupt the pace and flow of the lecture if it is not implemented with care. Instructors need to design the questions carefully to complement the lectures. When designing the instruction, instructors also need to consider when to introduce the questions, what questions to ask, and how much class time to allocate. Instructors should also be flexible to adjust the pace of lecturing based on the students' responses gathered using the IRS.

Besides, the implementation of Instant Response Instruction by ZUVIO in courses had effective and positive feedback from the Taiwanese college students. According to the results of the questionnaire, students' learning motivation has been enhanced. Moreover, they were willing to apply what they have learned interactively. The student-centered approach guided the students to be more active in the classroom, and the designed curriculum also created an interactive learning atmosphere. In addition, with the use of ZUVIO online peer assessment platform, students could work with others on the Internet. Based on the results of the questionnaire, students could listen to their team members' ideas and try to reach a consensus. They paid more attention to the group presentation because they can grade their classmates.

This study has several implications.

1. Using IRS helps students' learning skills and collaborative skills.

2. Multiple-grading methods increase students' involvement in the class. Students feel positive when they can grade their peers.
3. Combing ZUVIO's peer assessment system with the group presentation creates an interactive classroom.

The limitations of the study were that only three courses participated in this study. The results would be more valid if there were more participants. Besides, if the study lasted longer, students' learning motivation and learning behavior could be observed more clearly. In the future, more teaching approaches could be implemented with multimedia to create interactive and student-centered classrooms.

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