Wireless Response System for multidisciplinary teaching and learning – Case studies

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Abstract - *This paper reports an investigation of a mobile learning technology used across sectors and internationally. The technology developed by the University of Huddersfield is the Wireless Response System – WRS. In order to evaluate WRS, learning activities were conducted in Economics, Engineering, Language and Law departments of European universities and Chinese University, including Huddersfield University in UK. The data collected from the studies evidence the success of the technology and its application. The university students were interested in using it, and we conclude that the WRS can assist classroom teachers with students of different disciplines and countries, especially in observing students' feedback, concentration and confidence.*

Keywords: Mobile Learning, Wireless Response System, Multidiscipline, Internet, pervasive computing, engagement, confidence

1 Introduction

Identifying an effective learning technology for multidisciplinary learning in a variety of settings is not an easy task pedagogically [1, 2]. Although PowerPoint is a popular medium used almost for almost every subject, Abdelrahman et al. have argued that using PowerPoint slides provides no feedback either from or to the students, and the lecture format of classroom delivery does not stimulate learning in the classroom [3]. Other tools, such as YouTube, have been introduced into the classroom, as discussed by Green et al [4]. However, these learning models are based on teacher dominant learning – TDL, not student centred learning – SCL. In order to improve SCL, Wakefield et al. brought mobile learning activities to the classroom using iPads [5], and concluded that the activity has been positively engaged with by students. Thus, mobile learning could be a trend for next generation classroom teaching, especially as the smartphone is becoming integral to the means of communication in universities and high schools for engaging with students [6, 7]. Using smartphone technology in the classroom is easily accepted by young generations [6]. Furthermore, smartphone technology can be applied by cross-disciplinary users [8].

It follows that mobile learning technology can help teachers to very quickly measure learning performance during the delivery of teaching. Both able students and "at-risk" students, i.e. students who may have difficulty passing the assessment, can benefit. Use mobile learning technology in the classroom may help teachers to provide support in time for the at-risk students.

2 Related Work

A Student Response System is part of a mobile learning scenario [9, 10]. The challenges of using response technology to enhance teaching and learning have been reported in the literature for decades [1, 2], mostly in higher education, especially in European and American colleges and universities [1, 2, 9,10,11]. For each report, the students are normally from a specific topic or subject, including accountancy, engineering, healthcare, medicine, computing, and hospitality. Anthony et al. reported that an SRS product called Socrative was used to measure student performance [12]. Suzanne et al. used SRS for a module targeting smoking cessation and commented that the SRS may not significantly improve the retention of students or their learning outcomes [13]. Brown et al. addressed the issues of resources for using SRS and concluded that the students were willing to use their own devices in the classroom [14]. Chui et al, compared the results from SRS feedback and traditional feedback and argued that there is no significant improvement in the examination outcomes for accounting students [15]. Nicolas et al. pointed out that the use of SRS may improve student engagement [6], and Grez et al. discussed how SRS is effective when providing feedback for students' oral presentations [16]. José et al. received positive opinions about using SRS in the classroom from engineering students, while noting that adopting the SRS in the classroom needs further study [17].

In general, although most of the above discussions argue about the advantages and disadvantages of using the SRS in classroom teaching, the contributions of SRS technology to

the higher education community have been acknowledged. This paper aims to use acquired evidence to analyze and discuss how this technology influences teaching and learning for multidisciplinary learning settings in higher education.

Fig. 1 WRS is designed for using multiple types of devices

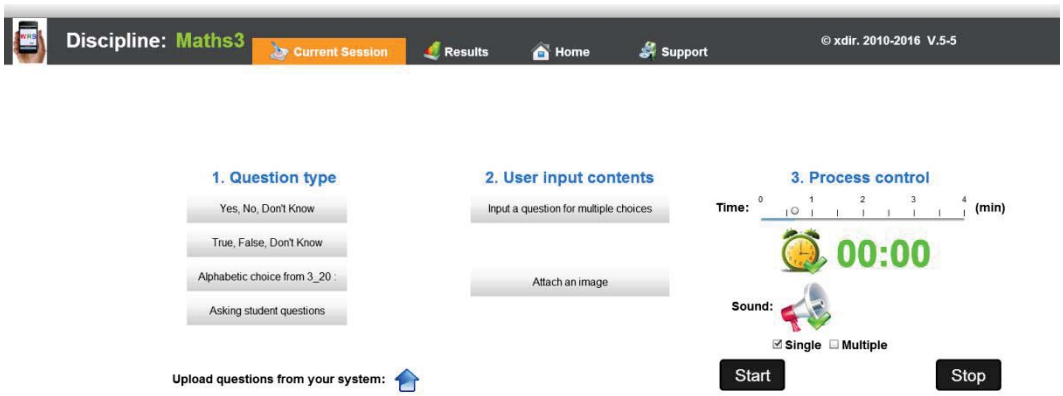

Fig. 2 WRS designed for teacher controlled interface

3 Methods and technologies

The approach is based on the concepts of activity based learning together with problem based and opinion based learning. In the former, questions are marked with the definite answers, especially for learning in natural science, such as mathematics; in the latter, the questions are used to observe the learners' views, and the degree of understanding, especially for learning in social science, such as debating, there may be more than one answer for the arguments.

The case study was the main method used in the investigation and carried out in universities internationally. The learners are from different subjects, such as economics, law, and engineering, and different universities and people were from UK and Europe, including Katowice, Poland, and Huddersfield, UK. Students were organized into groups with large size, middle size and small size.

The technology used here is called Wireless Response System, and was developed by the research group in University of Huddersfield with four EU sponsored grants since 2009. The system can be designed for PC, Mac or laptop by teachers, and multiple portable devices, such as tablets or smartphones, by learners (see Fig. 1). Meanwhile, the system is designed ubiquitously to be accessed anytime and anywhere as long as there is an Internet connection (see Fig. 2); and designed pervasively to be used for multiple disciplines (Fig. 1 illustrates how it has been used for teaching mathematics or

physics). The detailed theoretic and technical developments have been published since 2009 [6, 8, 9, 10, 18].

Fig. 2 shows the user interface for the teacher. The system is design on the basis of being fast and simple for users, the control actions are presented in one page, as follows.

1. The selection of question types, these could be multiple choice, text or predefined questions from the file storage.
2. User input could be text linked to the multiple choices, e.g. if the spelling for "Challenge" is correct, then select the question type: "Yes, No, Do not know" for the students to reply. Also, an image could be used as input content.
3. Process control, i.e. the control of a timer or audio that could be on or off, or a start button that could be paused then restarted, in order for teacher to give an explanation to the students who may need some clarifications, and stop button that is then used to end the session.

4 Case studies and Discussion

The results are acquired from different case studies in 1) three subjects, i.e. Economics, Law and Engineering computing in the universities. The cases are conducted and analyzed in three themes: a) Identify the true learning behavior; 2) Receive learners' opinions; 3) Observe the capability in problem solving.

4.1.1 Identify the true learning behaviour

Unlike traditional question types that only have two options: "Yes, No", or "True, False", in this system the question type is designed to have third option, i.e. "Do not know". That means if the students have not learned, they can select the choice of "Do not know" without guessing. Thus, this question type designed here is used to reveal a true learning behaviour. If the students only have the choice of "Yes, No", they have no choice but to guess, no matter they have learned or not, then the true learning is completely hidden. Guessing behaviour is a fault in learning activities. This fault is commonly embedded in most quiz systems, and has seldom been discussed. At a practical level, the teacher has no information about whether the learners have not learned from the classroom teaching. Thus, this design could be used to correct this fault.

A case has been demonstrated with 15 final year undergraduate students in Katowice University of Economics, Poland see Fig. 3. From this study, a true learning behaviour is identified, i.e. 13 students have selected the option of "*True*", while 2 students selected the option of "*Do Not Know*". These two students revealed that they do not know the knowledge relevant to the question but they did not guess the answer. With WRS, students can confidently say "*Do Not Know*", if they do not understand the lecture delivered. Meanwhile, this is also an immediate feedback from students to the teacher. Similar case studies in this question type were conducted in Shanghai Jiaotong University in which 18 European students were using WRS to learn Chinese language. The student learning behavior has been observed immediately in the classroom.

Fig. 3 WRS used in a session for economic students in Poland

4.1.2 Receive learners' opinions

Receiving responders' opinions is very common practice in social science. In this study, learners responded their views to a specific question for which there was no definite answer, i.e. opinion based learning. The question has been designed with three options, A, B, and C. Eight people joined the session with two groups. Each group had one responder. Responders were from different European countries, e.g. the Ukrainian National Law University, and the Moldova State University. A question about PhD study in human rights law was written by Stuart Toddington, a professor in Human Rights Law [19], and it was found that 50% of the responders agreed with the option of A, 25% agreed with the option of B or C, respectively, see Fig. 4. These views could be a reference in future PhD course design for human rights law.

Fig. 4 WRS used in a session of Human Rights Law

4.1.3 Observe the capability in problem solving

This study was carried out for first year engineering students who were learning computer programming. The purpose was to observe the learning efficiency and effectiveness when delivering a lecture. It was found that fewer than 38% answered the question correctly at the first session of WRS, as shown in Fig. 5. After a discussion with the students for a few minutes, about 78% responded correctly in the second session of WRS, see Fig. 6. Their understanding was improved by more than 50%, although this group of students has no previous experience in programming, but it seems that using WRS technology made most students engaged well in such a difficult subject.

From the observation of trials on these three subjects, the students engaged with the learning actively, no matter whether they were first year engineering students, final year economic undergraduate students, or at postgraduate level in law. For example, they confidently expressed their true understanding, and did not guess the answer (Fig. 3). They sent different views about their thinking (Fig. 4), and improved their comprehension for more than 50% with such a difficult subject after using the technology (Fig. s 5 and 6).

Furthermore, the cost is one of barriers to use SRS historically, because commercial SRS products require users to purchase a set of software and hardware [26, 27]. Finance investment is always a serious topic in any educational institute. In this study, students can use their own devices, e.g. phones, laptops or PCs to play with WRS as long as the Internet is connected. Thus, the cost is not an issue at all.

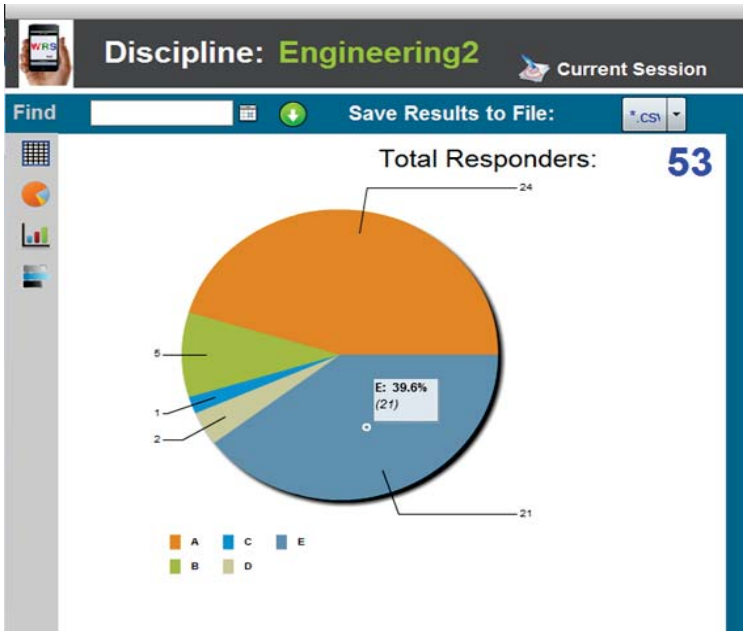

Fig. 5 WRS used for Engineering students

4. Conclusion

In the light of the above evidence, it is concluded that from this pilot study: 1) WRS has been successfully used in Economics, Law and Engineering sectors in the UK and abroad, and 2) WRS has been successfully used in both adults and children learning settings. The main achievements are as follows.

- Response technology can be an effective tool used in classroom learning. The students' understanding can be observed immediately during the teaching.
- Learning effectiveness has been observed as WRS can provide feedback to the teachers straightaway during class teaching. Meanwhile, any necessary additional support can be provided in time to the cohort who may not have fully understand the material delivered during the lesson.
- The students' engagement in the learning is improved as most students are interested in the discussion and activities, and receive rapid feedback, engendering better concentration and increased confidence

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