Student participation in lectures using mobile phones

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***Abstract**: Electronic classroom response systems (ECRSs) are a way of increasing interactivity and student participation in large lecture theatres, leading to increased student engagement and enjoyment. In addition, they provide teachers with feedback on how well students have understood key concepts. However, despite of these benefits, adoption of ECRSs has not been as rapid as one might expect. Some of the reasons for this are associated with the technology that is used to implement ECRSs, which generally consists of keypads that need to be distributed to or purchased by students. An alternative that overcomes many of the problems associated with traditional systems is the Votapedia ECRS system, which uses mobile phones as "keypads" and the internet as the receiver and processor of the signals. This paper presents a case study on how this system was used in the second year Environmental Engineering course at the University of Adelaide.*

Introduction

Actively involving students in their learning is vital for increasing student engagement and learning outcomes (Prince, 2004). One way to achieve this is in a lecture setting is to use electronic classroom response systems (ECRSs), or Clickers (Boyle and Nicol, 2003, Fies and Marshall, 2006, Felce, 2007). In addition to improving student learning outcomes, ECRSs have been shown to increase student enjoyment and to provide teachers with feedback on how well students have understood key concepts, enabling teaching to be adjusted accordingly (Fies and Marshall, 2006, Freeman et al., 2007).

However, despite of these benefits, adoption of ECRSs has not been as rapid as one might expect (Freeman et al., 2007). Some of the reasons for this are associated with the technology that is used to implement ECRSs, which generally consists of keypads that need to be distributed to or purchased by students, a receiver (generally infrared) and software that facilitates the collation and processing of the responses (generally integrated into MS Powerpoint) and include (i) the cost associated with purchasing the keypads and receivers (the software is usually included free of charge), (ii) the time it takes to set up and collect the equipment, (iii) the stress associated with setting up and running the system, particularly if there are frequent technology failures and (iv) the time it takes to become familiar with the required software (Freeman et al., 2007, Fies and Marshall, 2008).

The majority of these problems can be overcome or minimised by using an ECRS called Votapedia, as the system uses mobile phones as "keypads" and the internet as the receiver and processor of received signals. Consequently, there are no additional costs, there is no set up time and there is no need to become familiar with new software.

In this paper, a brief introduction to the Votapedia system is provided, including how it is used to set up and deploy quizzes and surveys, as well as its advantages and its disadvantages. An example of how Votapedia can be used in a classroom setting is also given, as are conclusions and recommendations.

The Votapedia System

Overview

Votapedia is an online system for eliciting audience responses that was developed by Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO). As part of the system, responses are generally provided using a mobile phone, but can also be provided online. The system can be accessed from the Votapedia website (www.votapedia.com) and works by generating a phone number for each potential answer to a multiple choice quiz or survey, which students can call to register their response. When a number is called, an engaged signal is obtained, so that each call is free, but a response is still registered. Within seconds of making the call, responses are received and displayed in the form of a bar chart on the Votapedia website.

Setting up quizzes and surveys

Quizzes and surveys can be set up on the Votapedia website. This is done very simply by entering the questions and responses and clicking a button, as shown in Figure 1. It should be noted that the quizzes / surveys are restricted to multiple response. However, there are a number of options, including whether responses are elicited via mobile phone or the internet and how long the quiz / survey should remain active. Once created, the quiz / survey is available online and can be linked to directly via a unique URL or accessed via the "My Quizzes" link on the Votapedia homepage.

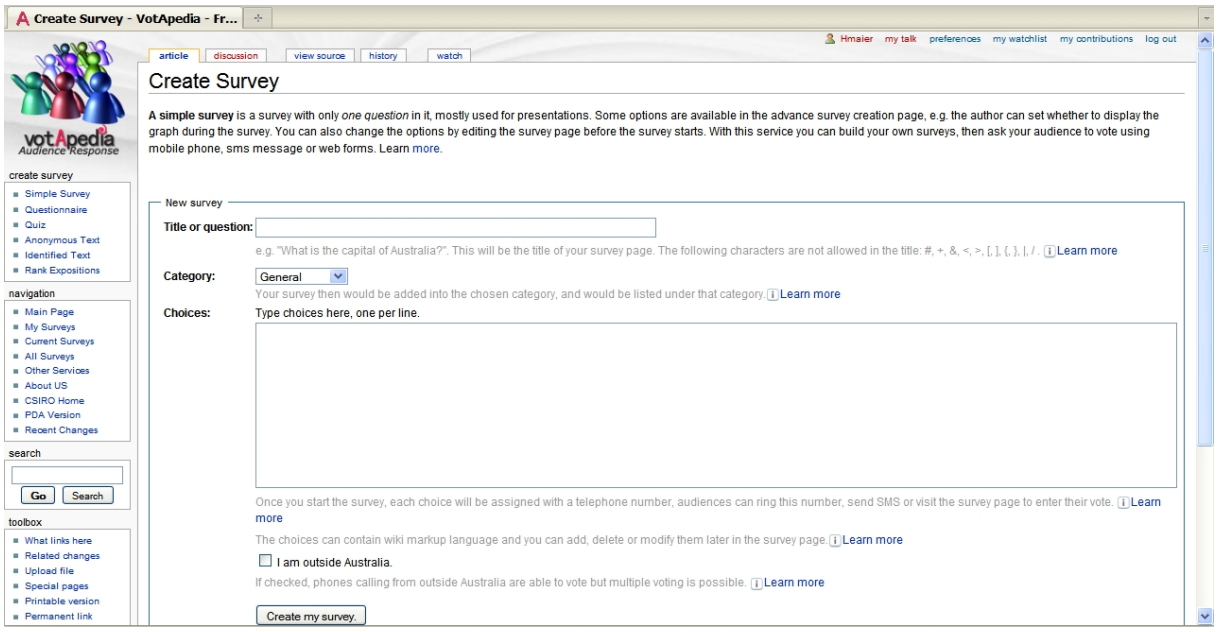

Figure 1: Setting up quizzes and surveys on the Votapedia website

Deploying quizzes and surveys

During a lecture, the URL at which a particular quiz resides needs to be accessed, which enables the quiz to be started by clicking a button. Once a quiz has been started, the question and possible responses are displayed, as are the phone numbers that correspond to each of the responses. A countdown timer, showing the time until the end of the quiz (i.e. the time after which no further responses are registered) also becomes visible (Figure 2).

Students can then dial the number that corresponds to their choice. The bar chart showing the selected responses for each option updates every few seconds, so that both students and teacher can see the responses as they are received (Figure 3). Once the quiz has been completed, the results are stored online and can be accessed at any time until the quiz is manually re-set by the teacher.

Advantages

As mentioned previously, the system overcomes or minimises many of the problems that have been encountered with traditional ECRSs. Firstly, there is no need to purchase any specialist equipment,

which means that there are no financial constraints associated with implementing the system. Secondly, there is no need to distribute the keypads at the beginning of the session and to collect them at the end of the session. This saves a considerable amount of time (especially with big classes, where the use of ECRSs is of most benefit) and makes it logistically considerably simpler to implement an ECRS. Thirdly, the system is much easier to use, as students are using "keypads" they are familiar with (i.e. their mobile phone) and there are fewer problems with ensuring student responses are received, as there is no need to "point" at a receiver (in the case where infrared receivers are used) and less ambiguity as to whether a particular response has been registered. Finally, there is no need for the teacher to become familiar with specialised software for displaying the results, as this is done automatically on the Votapedia website.

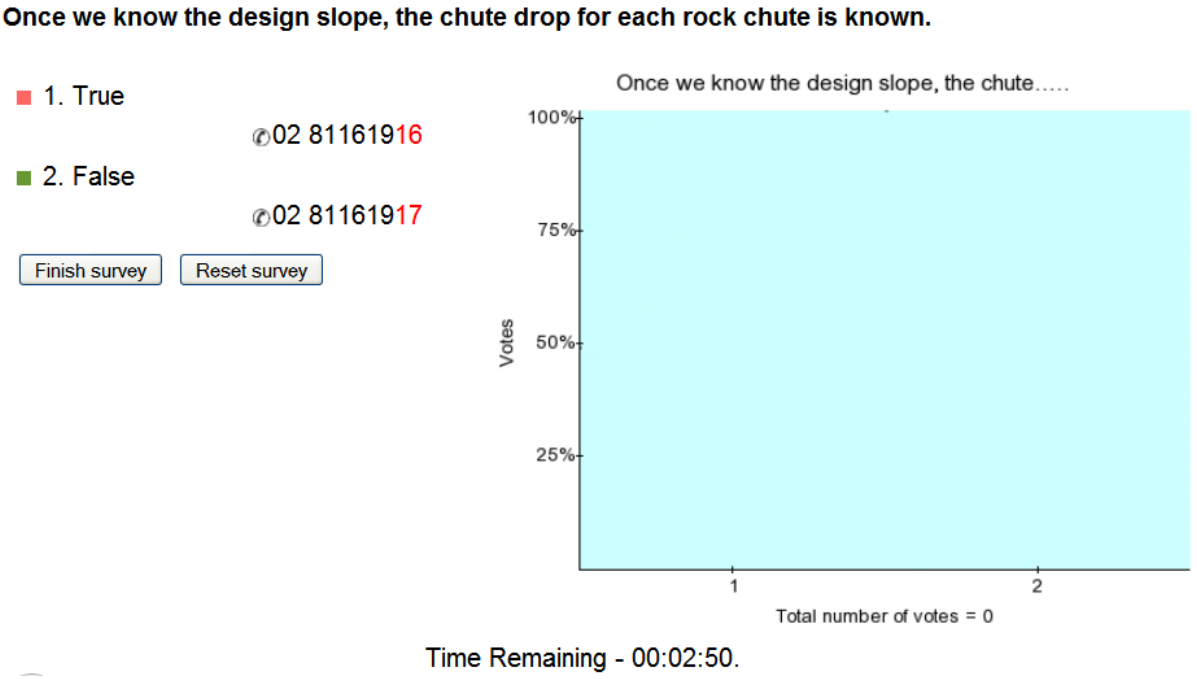

Figure 2: Deployment of example quiz

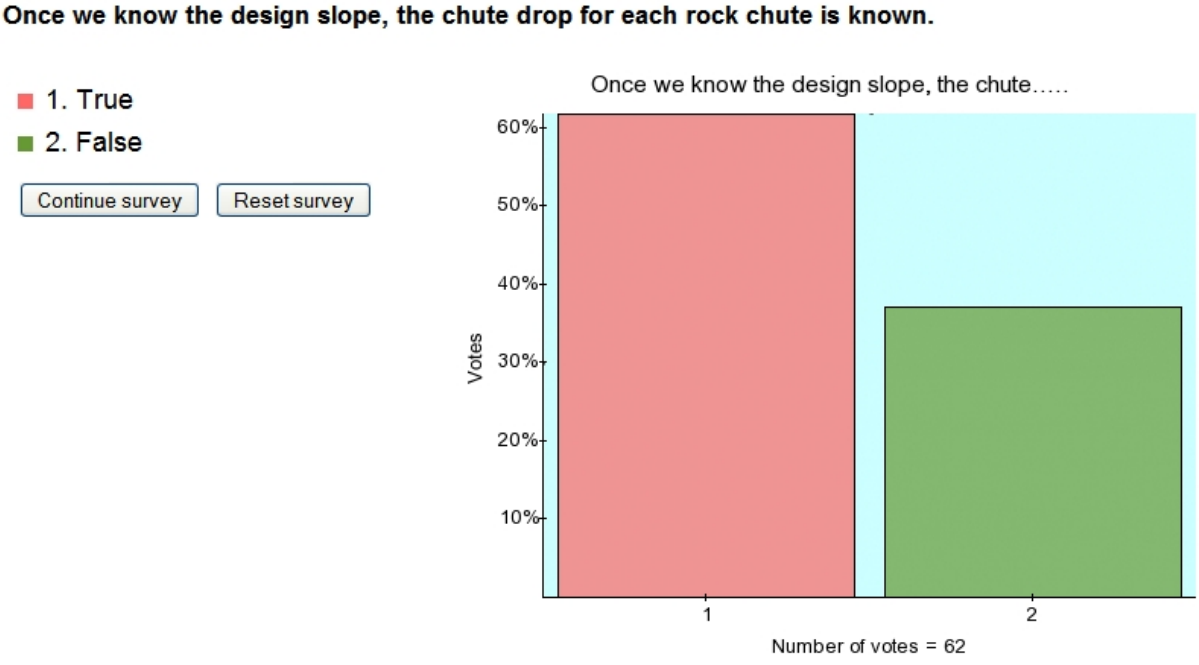

Figure 3: Example response graph

Disadvantages

The Votapedia system also has a number of potential disadvantages compared with conventional ECRSs. Firstly, because all responses are anonymous, the system can only be used for formative purposes. In contrast, the responses provided using conventional systems can be linked with particular keypads, and hence particular students if there is a record of which student has which keypad. Consequently, conventional ECRSs can be used for summative, as well as formative purposes. Secondly, the only question type that is supported by the Votapedia system is multiple choice, whereas some conventional ECRSs are quite sophisticated in that they allow numerical answers to be provided, for example. Thirdly, because the quiz and responses are hosted online, internet access is required, but this would generally not expected to be a problem in a modern lecture theatre. Fourthly, a mobile phone is required to provide a response. However, since the quizzes and surveys can only be used in a formative manner, the fact that some students might be unable to provide a response is not critical. Finally, the quizzes and surveys cannot be integrated seamlessly within a powerpoint presentation, requiring switching between the lecture presentation and the Votapedia website.

Case Study – Environmental Engineering and Sustainability II

Course context

Environmental Engineering and Sustainability II is a compulsory second year course for students taking the Civil & Structural, Civil & Environmental and Mining Engineering degree programs in the School of Civil, Environmental and Mining Engineering at the University of Adelaide. The course explores the relationship between engineers and river systems. The themes covered include the value of river systems, the modifications that have been made to river systems as a result of engineering activities, some of the negative impacts this has had, and continues to have, on our natural resources, as well as the role engineering plays in rehabilitating and managing these resources and ensuring the mistakes of the past will not be repeated by adopting sustainable planning and design practices.

The course is based on the hybrid project based / just-in-time teaching approach introduced by Maier (2008a), as part of which students work on a design project on river rehabilitation, which is supported by a number of just-in-time learning cycles consisting of online learning modules (see Maier, 2008b), online quizzes and face-to-face lectures.

Example applications

The Votapedia system was used to facilitate interaction in the face-to-face lectures mentioned above. This was done for different purposes, including managing student expectations, clearing up common misconceptions and developing student understanding of key concepts. Examples of each of these are given below.

An example of how the Votapedia system can be used to manage student expectations is given in Figure 4. The question asks how many children the class thinks the teacher has, with possible responses ranging from 0 to 5. While students will have to guess the answer to this questions, this is a light hearted way of introducing that the teacher has three children and is limited in his ability to respond to student queries after hours and on weekends, thereby managing student expectations.

A question that illustrates how the Votapedia system can be used to clear up common student misconceptions is given in Figure 3. As part of the design project for the course, students have to design a series of rock chutes in order to reduce the slope of a river so as to prevent streambed erosion in the reaches of the river between the rock chutes. In order to do this, students need to calculate the vertical drop of the rock chutes based on the initial and reduced design slopes. While the mathematics associated with achieving this is based on simple trigonometry, students generally have difficulty with conceptualizing this problem, as seen by the split in class responses to the question whether knowledge of the design slope will enable the rock chute drop to be calculated. However, the student responses to this question elicited via the use of Votapedia provides an opportunity for this issue to be discussed before students have to tackle it as part of the design.

An example of how Votapedia can be used to help students with developing an understanding of key concepts is given in Figure 5. This question tests whether students have developed a good

understanding of the meaning and limitation of using a one-dimensional version of the Streeter-Phelps (S-P) model for modelling dissolved oxygen levels in rivers. Again, the split in student responses indicates some confusion about this issue, which can be cleared up by subsequent class discussion.

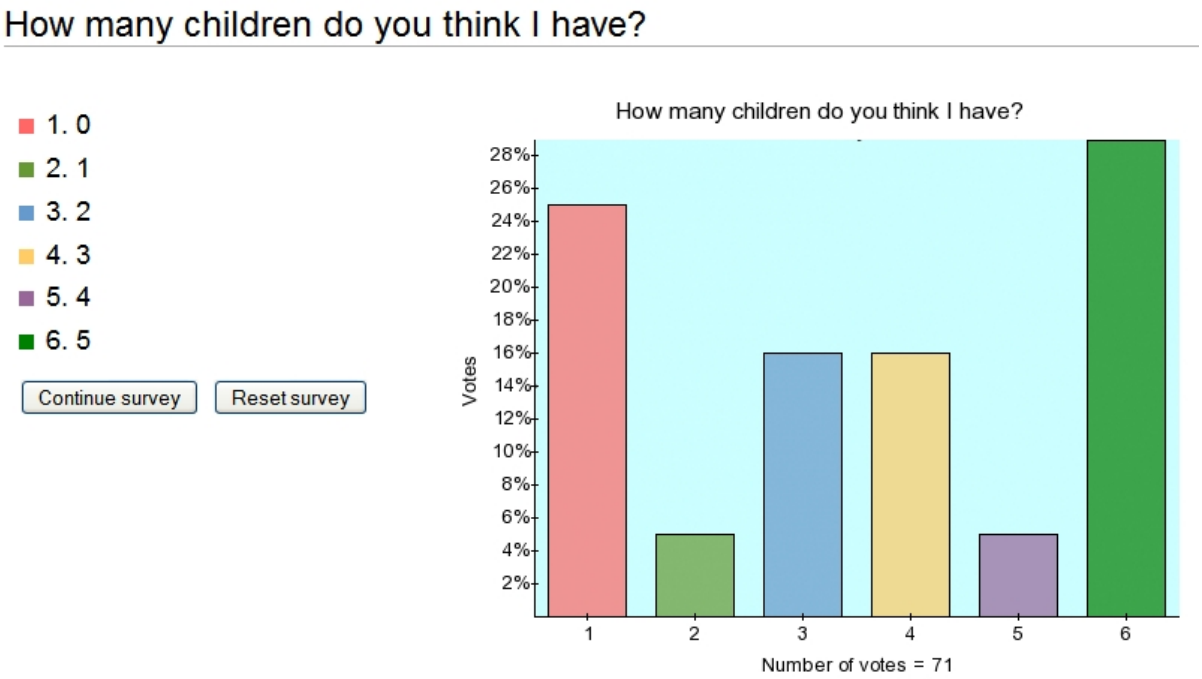

Figure 4: Example of how the Votapedia system can be used as to manage student expectations

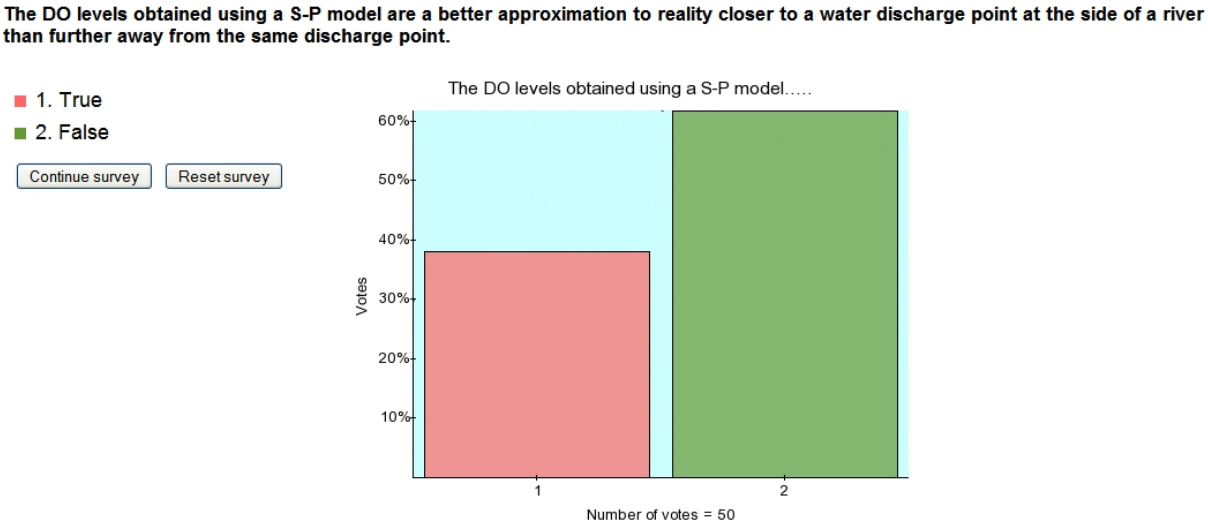

Figure 5: Example of how the Votapedia system can be used as to develop student understanding of key concepts

Teacher reflections and lessons learnt

Use of the Votapedia ECRS has significantly increased student participation in lectures, which is evidenced by the results of the Student Experience of Learning and Teaching (SELT) survey for the course, in which the average class response to the question "This person encourages student participation" was 6.4 on a 7-point Likert scale in the year use of the Votapedia system was introduced (2009). In contrast, the average of this value for the previous four SELTs for this course was 5.6.

However, while the use of Votapedia provided an excellent trigger for classroom discussion on key topics, it is difficult to judge how much it actually improved student understanding.

One of the lessons learnt was not to "over-use" Votapedia in a particular lecture. While students were generally enthusiastic about using Votapedia, its over-use tended to reduce its impact and effectiveness. Consequently, it is recommended to only ask about 2 to 3 questions per lecture.

Conclusions and Recommendations

The Votapedia system provides a means of implementing an electronic classroom response system (ECRS) without the disadvantages of traditional systems, including set up costs, difficulties in distributing and collecting keypads, difficulties with registering student responses and difficulties with teacher familiarisation with new hardware and software. When applied to a second year Environmental Engineering course, it resulted in increased student interaction in a classroom setting, although there is no evidence that it increased student learning outcomes.

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