Journal of Learning Design

IEngage

Using Technology to Enhance Students' Engagement in a Large Classroom

Sukanlaya Sawang
Queensland University of Technology
s.sawang@qut.edu.au

Peter O'Connor
Queensland University of Technology
peter.oconnor@qut.edu.au

Muhammad Ali
Queensland University of Technology
m3.ali@qut.edu.au

Abstract

This paper aims to answer how we can increase students' engagement in a large class. We hypothesised that the use of KeyPad, an interactive student response system, can lead to enhanced student engagement in a large classroom. We tested a model of classroom technology integration enhancing the students' engagement among first year undergraduate students (n=131). This study provides evidence of significant effect of positive attitude and social pressure on the intent to use KeyPads. In turn, the intent to use KeyPads leads to the actual use of KeyPads which is directly associated with the level of student engagement. In addition, we find evidence for the relationship between extraversion and level of engagement such that compared to extrovert students, introvert students felt more engaged.

Keywords

student engagement, large class, technology adoption, KeyPads, attitude, social pressure.

Introduction

Student engagement is the product of motivation and active learning. It is a product rather than a sum because it will not occur if either element is missing.

Elizabeth F. Barkley

Queensland University of Technology's Business School is the first Australian business school to achieve the prestigious "triple crown" of international accreditation (US-based AACSB International, European-based EQUIS and UK-based AMBA). Undoubtedly, the large number of student enrolments each year drives the faculty to provide a supersize classroom (300-500 students

each classroom).

Often, in a large classroom with hundreds of students, individuals tend to lose their attention toward a lecture and become disengaged students (Crosling, Thomas, & Heagney, 2008). Engagement in this project is defined as students' willingness to participate in learning activities with positive emotion (Chapman, 2003; Skinner & Belmont, 1993). Based on the teaching square observation, the common feedback that we received was the class size and a lack of students' participation. Unquestionably, the previous unit evaluation results of the three classes were in common, that was somewhat below the university average score. Obviously, we face a similar situation that supersize classroom and a lack of student engagement. Ideally, the simple solution to this issue is to reduce the class size although this may not be economically sound or logistically viable. Therefore, the question remains "*how can we increase students' engagement in a supersize class?*"

Technology and Students' Engagement

Technology has been integrated in classroom teaching in meaningful and transformative ways (Boling, 2008). Many educators use technology for support and to improve learning opportunities for students. For example, universities across Australia have been encouraged to adopt technology as a part of teaching and learning process (Hashemzadeh & Wilson, 2007). This includes the use of an interactive student-response system, so called clickers or KeyPads. Operating the KeyPad is a simple three-step process:

- during the lecture, the instructor displays a question or problem and choices of answers;
- all students using the wireless KeyPad to key in their answers; and,
- responses are received, aggregated, and displayed on both the instructor's computer monitor and a large screen at the front of the room or lecture theatre.

Previous studies have indicated that the use of KeyPad was very effective for a large classroom (e.g., Ross & Zeisler, 2005). With the simple technology and empirical proof of its effectiveness, we introduced KeyPad technology into our classes and investigated if it would enhance students' engagement.

Students' adoption of the interactive student-response system (KeyPad)

The road to becoming an innovative and engaging classroom is strewn with the wreckage of best intentions perhaps because, while most instructors want to integrate the technology as a part of teaching and learning process, they are not really sure how to achieve it (Ross & Zeisler, 2005). Inevitably, some technologies are unsuccessful in the sense that they fail to contribute to learning goals; others are abandoned during their introduction because students do not use them. Therefore, the question remains "How do we improve students' adoption of technology (KeyPad) in order to enhance the learning engagement?"

KeyPad adoption model

We incorporated the relevant findings from prior research into a comprehensive model of constructs and their relationships to explain the antecedents of effective technological adoption. Our model was founded upon the Unified Theory of Acceptance and Use of Technology (UTAUT) which applies the theory reasoned action (TRA), theory of planned behaviour (TPB) and technology acceptance model (TAM) (Venkatesh, Morris, Davis, & Davis, 2003). In addition, we also integrated the influence of perceived behavioural control predicting the students' intention

to use the KeyPad. Our proposed model is shown in Figure 1.

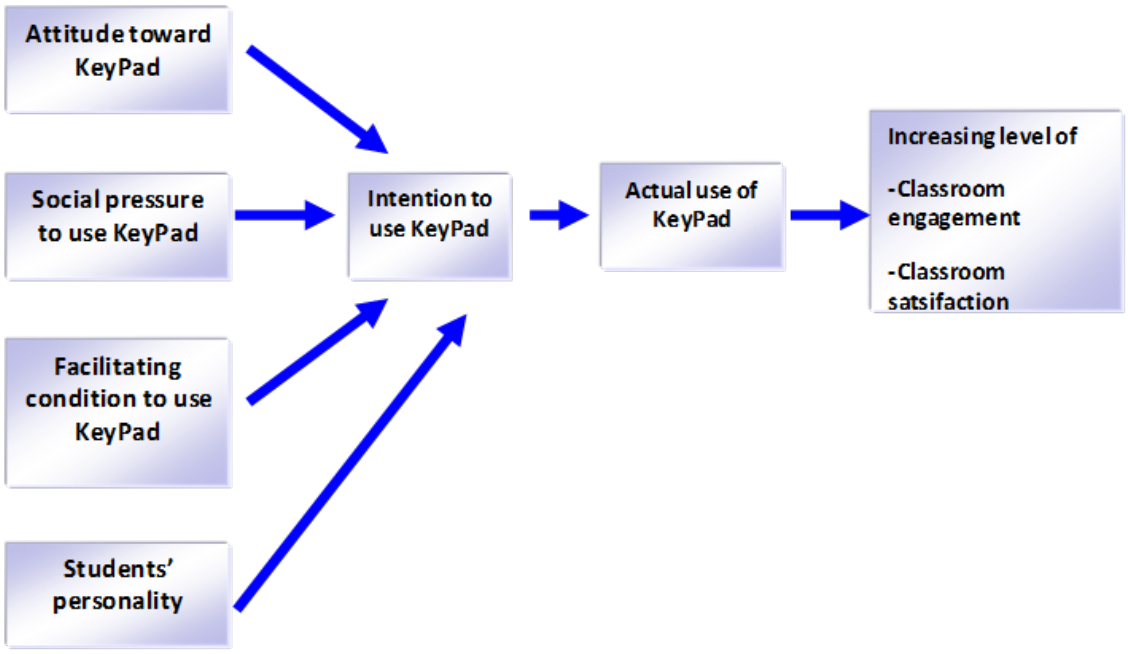

Figure 1. Proposed model for classroom-technology integration enhancing the students' engagement in a supersize classroom.

Attitude toward using KeyPads

The UTAUT postulates that a person's intentions to use (or not use) a technology are the immediate determinant of their behaviour. In turn, the person's intentions are a function of the person's attitude toward the technology. The UTAUT identifies performance expectancy and effort expectancy as determinants of attitude toward technology (i.e., KeyPad), intention to use and actual use.

Pressure towards using KeyPads (Social Influence)

TAM has been tested in several studies of technology use (Colvin & Goh, 2005; Dishaw & Strong, 1999). It has also been suggested that social influences are an important factor in technology adoption (Taylor & Todd, 1995). For example, students may feel some pressure from peers, lecturer or unit coordinators to use the KeyPads.

Perceived Behavioural Control (PBC) Toward Using KeyPads

The PBC is defined as the extent to which individuals have complete control over their behaviour. The PBC variable measures a person's perceptions of the ease or difficulty of performing a behaviour. This variable reflects aspects of the person, such as her or his level of self-efficacy, and aspects of the behaviour, such as the necessity of obtaining the cooperation of others to accomplish it (Cordano & Frieze, 2000). According to the UTAUT, the PBC is determined by the level of facilitating conditions (e.g., technical support, manual or training). These conditions directly affect intention to perform (using KeyPad) and directly affect behaviour in situations where the users intend to perform the behaviour, but are prevented from doing so (Dishaw & Strong, 1999).

Personality and adoption behaviour

The use of the KeyPad will lead to varying levels of engagement depending on the characteristics of users. In particular, we argue that KeyPad use will increase engagement for introverts more than extraverts since extraverts are, by their very nature, more likely to take part in the lecture than introverts. Thus, we hypothesise that the relationship between KeyPad use and level of engagement will be moderated by the personality trait of extraversion.

Method

Participants and measures

Participants were first year students (n=131) enrolled in a unit of study at an Australian university. The average (mean) age of participants was 18.3 years (SD = 2.9) ranging between 16 years and 36 years.

The variables that the study considered were: (a) attitudes toward keypads; (b) social influence to use keypads; (c) facilitating condition to use keypads; and, (d) intention to use keypads. These variables were measured using a self report questionnaire based on survey items developed by Venkatesh and Zhang (2010). The items were initially designed to test Venkatesh and Zhang's (2010) Unified Theory of Acceptance and Use of Technology (UTAUT) and were modified in this study to measure the use and acceptance of KeyPads. For example, one item from the original "attitude" scale was "using the system is a good idea" whereas, in our questionnaire, this was modified to state "using KeyPads in lectures is a good idea". Participants were requested to respond to each item on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree." The questionnaire items are summarised in Table 1.

Table 1. *Summary of variables and example statements in student questionnaire*

	Variable	Example statement
a.	attitude toward keypads	Using the keypads enhanced my interaction during the class.
b.	social influence	I used the keypads because of the proportion of classmates who used the system.
c.	facilitating condition	I was encouraged to try out the keypads.
d.	intention to use	I intend to use the keypads in my class.

Procedure

Students were invited to participate in the study at the completion of their regular weekly lecture. Students were told that participation was completely voluntary and that they could withdraw at any time. The lecture finished 5 minutes early on the day of data collection so that students could complete the questionnaire without being concerned about being late for their next class. Most students completed the survey within 10 minutes. Students were asked to fold the survey and hand it to a lecturer on their way out of the lecture theatre. Students were instructed not to include their name or any identifying details on the survey.

Results

Descriptive statistics (means, correlations, standard deviations and alphas) are summarised in Table 2. As can be seen from this table, all values are within range and there are a number of moderate sized correlations between the various IVs and DVs.

Table 2. *Means, correlations, standard deviations and alphas of all variables used in this study*

	M	SD	Alpha	1	2	3	4	5	6
Use of KeyPads (1)	2.14	0.85							
Social Pressure to use KeyPads (2)	3.61	0.54	0.72	.18*					
Lecture Engagement (3)	3.23	0.24	0.68	.33**	.26**				
Facilitating Conditions for KeyPads (4)	2.45	0.46	0.71	-.17	.08	-.29**			
Extraversion (5)	3.83	0.69	0.81	-.11	-.05	-.17*	-.01		
Intention to use KeyPads (6)	4.13	0.41	0.7	.42**	.326**	.35**	-.24**	.15	
Attitude towards KeyPads (7)	4.05	4.05	0.89	.06	.22*	.30**	-.41**	.19*	.42**

The model illustrated in Figure 1 was tested using Path Analysis in AMOS. Path analysis was used as it allows for the simultaneous estimation of all parameters in the model, and assesses the fit, or model likelihood based on the data. Parametric bootstrapping was used to test indirect effect between IVs, mediators (intention, actual use) and engagement. Results of hypothesised direct effects are summarised in Figure 2.

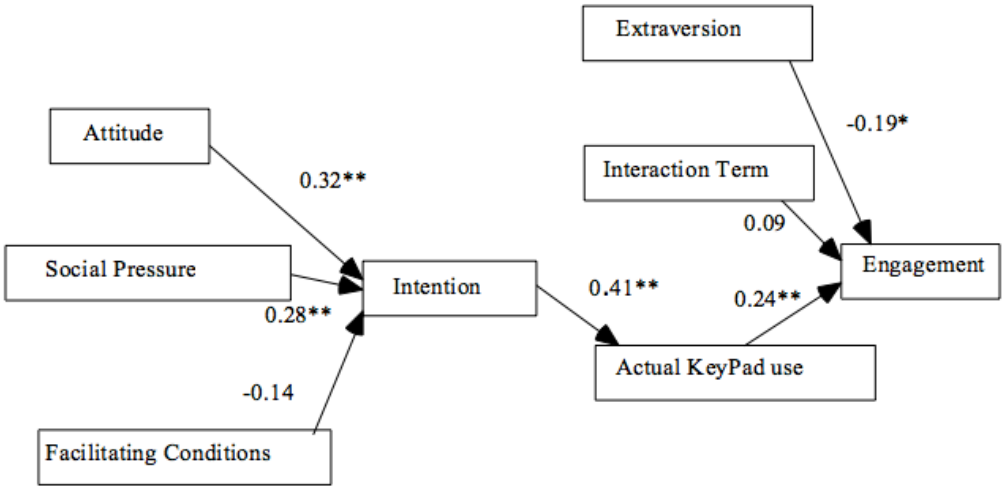

Figure 2. Summary of direct effects in proposed model

As can be seen in Figure 2, most hypothesised pathways were supported through the findings. Individuals with a positive attitude toward KeyPad use and those who felt a social pressure to use KeyPads were more likely to intend to use KeyPads than those low in these variables. Furthermore, consistent with the hypothesis, intention to use KeyPads was a moderate positive predictor of actual KeyPad use. Results also demonstrated a relationship between KeyPad use and engagement; those who used KeyPads tended to be more engaged by the lecture than those who did not.

Results also revealed a number of significant indirect (mediated) effects. Social Pressure was found to be a significant indirect predictor of actual use (indirect effect = 0.19, $p < 0.05$) as was attitude (indirect effect = 0.21, $p < 0.05$). This means that social pressure and attitude towards the use of KeyPads influence actual use via intention to use. This is consistent with the Theory of Planned Behaviour.

The final hypothesis was not supported. Actual KeyPad use was not moderated by extraversion in the prediction of student engagement. Interestingly however, there was a weak negative relationship between Extraversion and Engagement (independent of KeyPad use). This might reflect the somewhat introspective nature of the subject, which is more likely to appeal to introverted personality types.

Discussion

We tested a model of the classroom technology integration enhancing the students' engagement (shown in Figure 1) in a supersize classroom. The main objective of testing the model was to investigate whether the use of KeyPads might lead to enhanced student engagement in a large classroom. Moreover, the research sought to examine the various predictors of intentions to use KeyPads in large classrooms. This study provides evidence of significant effect of positive attitude and social pressure on the intent to use KeyPads. In turn, the intent to use KeyPads leads to the actual use of KeyPads which is significantly associated with the level of student engagement. In addition, we found evidence for the relationship between extraversion and level of engagement such that compared to extrovert students, introvert students felt more engaged.

Student engagement is a broad concept with multiple quantitative and qualitative, technology and non-technology related dimensions (Krause & Coates, 2008). In terms of technology related tools of engagement, there are various types of technology that can be used to encourage students to actively participate in the classroom learning process. Past research shows that a low level of technological skills can hinder the effective use of technology in large classes (Coles, 2009). In contrast to engagement tools such as Web 2.0 and Wikis, KeyPads are quite easy to use in large classroom settings and thus are an effective tool to enhance the level of student engagement as found in this research.

This study provides academics and university management with some useful insights into the impact of technology on the level of student engagement. There are a number of important implications of the findings of this study. For instance, the use of KeyPads leads to higher levels of student engagement helping students to move from being passive listeners to active thinkers (Salemi, 2009). In other words, it can help make "Robert learn like Susan (deep learning approach)", when Robert adopts surface learning approach while Susan uses deep learning approach (Biggs & Tang, 2007). This is especially important because active learning (which comes through student engagement) determines the effectiveness of education (Coates, 2010). It is also important to note that active learning depends on how effectively KeyPads are used in lectures. The KeyPad questions should not test the memorisation skills rather they should be intellectually challenging.

The use of KeyPads can facilitate an indirect interaction between staff and students. Although a direct interaction between staff and students is incredibly important to achieve a high level of student engagement, this becomes very challenging to achieve in large classrooms. The 2008 Australian Survey of Student Engagement (AUSSE), the largest data collection from students in Australasia, indicates that 43.5-54.7 per cent of students never discuss ideas with their teaching staff outside of class (Coates, 2010). To these students, KeyPads offer an alternative to participate in class discussion and interact with their lecturers. Some scholars argue that the use of KeyPads in itself is a form of student engagement (see, for example, Nelson Laird & Kuh, 2005).

Similarly, the use of KeyPads can also help students get immediate feedback on their level of understanding of the content. Students feel disengaged if they think that they do not understand the basic concepts the rest of the lecture will be built on. The KeyPad questions provide this opportunity to the teaching staff to gauge the level of students' understanding of the basic content of the lecture. If a large proportion of the students did not understand an important part of the lecture, the lecturer can go back and further explain those concepts. Providing this type of feedback to students on their learning is especially important because, as noted in the 2008 AUSSE, 61.4 per cent of students either never receive feedback or only sometimes receive feedback on their understanding/performance (Coates, 2010).

The implications of high level of student engagement on the level of student retention are also worth noting (Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008). The 2008 AUSSE survey indicates that 33.1 per cent of university students intended to leave the university before completing their degree (Coates, 2010).

Further, students have positive perceptions about the use of mobile wireless devices in higher education classrooms (Chompu-Inwai & Doolen, 2008). The use of KeyPads can make the lecture content interesting as well as challenging.

In addition, student engagement in lectures can work as a catalyst to improve engagement in other areas such as student-faculty interaction and active and collaborative learning (Nelson Laird & Kuh, 2005), possibly leading to improved retention level.

Most importantly, the level of engagement achieved through the use of technology, which, in this case are KeyPads, and other determinants has important implications on the level of academic performance. For instance, student engagement is positively related to academic outcomes and the

effect is particularly stronger for students with less ability (e.g., lowest scores on SAT) and students from minority backgrounds (Kuh et al., 2008). The academic outcomes that are linked with engagement include such desirable outcomes as extended attention span (Petropoulakis & Flood, 2008), critical thinking and grades (Carini, Kuh, & Klein, 2006). Past research suggests that certain institutions benefit more from engagement in terms of converting student engagement into academic performance of their students (Carini et al., 2006). This is possibly through providing professional development opportunities to staff and personal development opportunities to students to improve their engagement skills (SoundOut, 2007). Although this research does not support the facilitating conditions as a predictor of the intent to use KeyPads, past research indicates that supportive infrastructure affects student attitudes toward the use of KeyPads (Chompu-Inwai & Doolen, 2008).

The successful implementation of KeyPads requires careful planning on the part of university management in view of the needs and interests of academics, students and administrative staff (Chompu-Inwai & Doolen, 2008). Like any other organisational initiative, the top management commitment towards the implementation of KeyPads should be reflected in the allocation of adequate time and other resources with a long-term cost-benefit analysis (Nelson Laird & Kuh, 2005). A KeyPad program must also incorporate the notion that perceptions of student engagement vary across various demographic groups (Krause & Coates, 2008) and such programs should be based on careful planning (Coates, 2010).

Current responsive technologies such as KeyPads have evolved. Apart from the physical "clicker," learners can engage through mobile and web-based apps that integrate with the same system (i.e., Turning Point). Due to advancing technology, this may lead to greater use and increased levels of students' engagement. Future study can compare the different types of Response Ware and their learners' engagement effectiveness.

References

Biggs, J., & Tang, C. (2007). Teaching for quality learning at university: What the student does. Maidenhead, UK: Open University Press.

Boling, E. C. (2008). Learning from teachers' conceptions of technology integration: What do blogs, instant messages, and 3D chat rooms have to do with it? *Research in the Teaching of English, 43*(1), 74-100. Retrieved from http://www.jstor.org/stable/40171818

Carini, R., Kuh, G. D., & Klein, S. P. (2006). Student engagement and student learning: Testing the linkages. *Research in Higher Education, 47*(1), 1-32. doi: 10.1007/s11162-005-8150-9

Chapman, E. (2003). Alternative approaches to assessing student engagement rates. *Practical Assessment, Research & Evaluation, 8*(13). Retrieved from http://PAREonline.net

Chompu-Inwai, R., & Doolen, T. (2008). The impact of mobile wireless technology on student attitudes in higher education classrooms. *International Journal of Engineering Education, 24*(1), 14-22. Retrieved from http://stu.westga.edu/~bthibau1/MEDT%208484-%20Baylen/Good1.pdf

Coates, H. (2010). Development of the Australasian survey of student engagement (AUSSE). *Higher Education, 60*, 1-17. DOI: 10.1007/s10734-009-9281-2

Coles, C. (2009). The role of new technology in improving engagement among law students in higher education. *Journal of Information, Law and Technology, 3*, 1-6. Retrieved from http://go.warwick.ac.uk/jilt/2009_3/coles

Colvin, C. A., & Goh, A. (2005) Validation of the Technology Acceptance Model for police. *Journal of Criminal Justice, 33*, 89–95. doi: 10.1016/j.jcrimjus.2004.10.009

Cordano, M., & Frieze, I. H. (2000). Pollution reduction preferences of U.S. environmental managers: Applying Ajzen's theory of planned behavior. *Academy of Management Journal, 43*(4), 627-641. Retrieved from http://www.jstor.org/stable/1556358

Crosling, G., Thomas, L., & Heagney, M. (2008). *Improving student retention in higher education: the role of teaching and learning*. London: Routledge.

Dishaw, M. T., & Strong, D. M. (1999) Extending the Technology Acceptance Model with task-technology fit constructs, *Information and Management, 36*(1), 9-21. doi: 10.1016/S0378-7206(98)00101-3

Hashemzadeh, N., & Wilson, L. (2007). Teaching with the lights out: What do we really know about the impact of technology intensive instruction? *College Student Journal, 41*(3), 601-612.

Krause, K., & Coates, H. (2008). Students' engagement in first-year university. *Assessment & Evaluation in Higher Education, 33*(5), 493-505.

Kuh, G. D., Cruce, T. M., Shoup, R., Kinzie, J., & Gonyea, R. M. (2008). Unmasking the effects of student engagement on first-year college grades and persistence. *The Journal of Higher Education, 79*(5), 540-563. Retrieved from http://www.jstor.org/stable/25144692

Nelson Laird, T. F., & Kuh, G. D. (2005). Student experiences with information technology and their relationship to other aspects of student engagement. *Research in Higher Education, 46*(2), 211-233. doi: 10.1007/s 11162-004-1600-y

Petropoulakis, L., & Flood, F. (2008). Interactive student engagement using wireless handheld devices. *International Journal of Engineering Education, 24*(1), 46-55. Retrieved from http://strathprints.strath.ac.uk/19790

Ross, J., & Zeisler, A. (2005). *Determining your TCO: Introduction to the revised K12 Total Cost of Ownership Calculator*. Presentation at the annual Florida Educational Technology Conference (FETC), Orlando, FL, January 26-29, 2005. AEL.

Salemi, M. K. (2009). Clickenomics: Using a classroom response system to increase student engagement in a large-enrolment Principles of Economics course. *Journal of Economic Education, (Fall),* 385-404.

Skinner, E., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behaviour and student engagement across the school year. *Journal of Educational Psychology, 85*(4), 571-581.

SoundOut. (2007). 10 ways to kill student engagement. *Promoting student voice in schools, 3-4*. Retrieved from https://search.informit.com.au/fullText;dn=265358811492181;res=IELHSS

Taylor, S., & Todd, P. (1995) Decomposition and crossover effects in the theory of planned behavior: A study of consumer adoption intentions. *International Journal of Research in Marketing, 12*, 137-55. doi: 10.1016/0167-8116(94)00019-K

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F.D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425–478.

Venkatesh, V., & Zhang, X. (2010). Unified Theory of Acceptance and Use of Technology: U.S. Vs. China. *Journal of Global Information Technology Management, 13*(5), 5-27.