

The Effects of Audience Response Systems on Active Learning

Jonathan Mamangkiang Mantikayan

Department of Information Systems

Kulliyah of Information and Communication Technology

International Islamic University Malaysia

Jalan Gombak 53100 Kuala Lumpur Malaysia

Media Anugerah Ayu

Department of Information Systems

Kulliyah of Information and Communication Technology

International Islamic University Malaysia

Jalan Gombak 53100 Kuala Lumpur Malaysia

Teddy Mantoro

Department of Computer Science

Kulliyah of Information and Communication Technology

International Islamic University Malaysia

Jalan Gombak 53100 Kuala Lumpur Malaysia

Hasni bin Mohammed

Adni International Islamic School

Jalan 1, Taman Sri Ukay, 68000 Ampang

Selangor Darul Ehsan Malaysia

Abstract - Research literature shows that isolation and lack of interaction and engagement exist in traditional classes. Audience Response Systems (ARS), which have been identified as a potential, innovative solution, to aid in fixing disconnection associated with traditional education practices. The aim of this paper is to investigate the effects of audience response systems on student active learning in secondary education. The sample learning institution in this research is Adni International Islamic School. This study used survey and observation method to determine the effect of audience response systems on active learning in computer studies class at Adni International Islamic School. Based on the pilot study's findings, continued use of audience response systems is recommended. ARS can trigger student active learning. ARS give teachers a means of presenting information and gauging comprehension while engaging students. Students learn using various learning styles and audience response systems give teachers another opportunity to meet those varied styles of learning. Changes in delivery of instruction are needed to meet all learning styles of children today. Leaders in education should embrace technological changes and incorporate them into instruction. Audience response systems may provide that change in instructional practices.

Keywords - active learning; audience response system; engagement; interaction; discussion

I. INTRODUCTION

Active learning is any instructional method that gets students involved in activity in the classroom rather than passively listening to a lecture [1]. Classroom assessment involves a wide range of activities from designing paper-pencil tests and performance measures to grading, communicating assessment results, and using them in decision-making [2]. To effectively monitor and influence the development of students' thinking processes, inquiry skills, attitudes toward science, and learning behaviors requires continuous forms of assessment integrated into everyday learning activities [3].

The use of Audience Response System (ARS) in learning institution is becoming more widespread. Lecturers have used ARS in their teaching without radically changing the traditional lecture format. With this method, standard lectures are supplemented with questions, and students' response provides feedback to both students and teacher on the learning process [4]. The equipment is essentially that of the TV show "Who wants to be a millionaire?": every member of the audience i.e. each learner in the classroom has a handset similar to that of a TV remote control, the presenter displays a multiple choice question (MCQ), each learner transmits the digit corresponding to their chosen answer by infrared, a small PC e.g. a laptop accumulates the answers, and it displays, via the room's projection system, a bar chart representing the distribution of the responses to audience and presenter alike [5]. Audience Response System greatly enhances communication among students and between students and the teacher, increasing active engagement during class and affecting both learning and instruction. Audience Response System gets immediate feedback about everyone in the class [6].

As an educator it is important to know the new emerging tools to assist educators in preparing and managing courses. ARS have been effective in higher education science classrooms, although almost no research has been done at the secondary school level [7]. Various authors describe ARS as facilitating a variety of good teaching practice. ARS in higher education can give the following: engage students, encourage peer instruction, facilitate diagnostic assessment, formative assessment, provide constructivist method of teaching, question based method, problem based method, critical thinking skills and anonymity [8]. However, existing literature on the use of ARS focus on the higher education [8]. It is not known to what extent ARS add to an active learning in secondary school classroom environment. Several study calls for the need for the research in this area [8-11]. The purpose of this research is to investigate the effects of audience response

system on student active learning. The objective is to increase student active engagement, discussion and interaction in secondary education classroom by using audience response system. The first part of this paper described active learning, audience response system and the needed to explore more in this area. Secondly, the literature review about active engagement, discussion and interaction are discussed. Part three and four outline the method used and result of the pilot study. The final section is the conclusion.

II. PREVIOUS WORK

Increasing active engagement in the classroom is crucial. There are two aspects of engagement such as task involvement (attention, effort and verbal participation) and influence attempt (student and teacher verbal and non-verbal attempt to influence the behavior or decision of the other party in a constructive manner [12]. An implicit strategy for using ARS is the engagement value and if students are engaged, it is argued they are more likely to actively construct knowledge. In general, students in ARS based classes report being more interested or engaged in concepts presented and discussed [13-16] For example; students may be more engaged because they are actively involved in the learning process.

Audience response system increases the quantity and quality of class discussions, particularly when employed with a strategy known as “peer instruction” [17-20]. Peer instruction occurs when a teacher presents a question using an ARS, collects student responses and presents responses from the class, but does not provide the correct answer. Instead, the class is instructed to discuss possible solutions in pairs and then students are provided with the opportunity to vote. After the second vote, the issues are resolved through class discussion and clarifications from the teacher. The research indicates that students feel they are better able to discuss and calibrate their understanding of specific concepts when peer instruction is employed [19]. Moreover, Laurillard identifies dialogue between teacher and learner as the heart of the educational process [21]. However, she dismisses large group teaching - such as lecturing - as an environment where effective learning cannot take place, because of the lack of opportunities for dialogue. As Laurillard's model predicts, these interventions have been shown to improve educational performance significantly [22].

Interaction is, in principle, a series of events or actions that take place between at least two objects. Several types of interaction have been identified as parts of various educational approaches. These typically include: learner-tutor interaction, learner-learner interaction, learner-content interaction and learner-interface interaction [23]. Numerous studies suggest that frequent and positive interaction occurs when ARS are used [8, 17].

III. RESEARCH METHOD

A. Survey Method

The questions prepared based on the research objectives and research problems. There is only one type of questionnaires

that was used in this survey. A personally administer questionnaire was distributed personally by the researcher to the respondents. A survey was conducted toward the end of the semester (2010/2011) with all students using audience response systems. The survey was given to students in the treatment group to determine the effect of ARS on student active learning. The comparison group was not included in the survey because they used non-ARS instruction (Table I).

TABLE IV. EXPERIMENTAL DESIGN

Computer Pioneer Course Class	Semester 1 2010/2011
SEC2B	Traditional Method (Comparison)
SEC2D	ARS Treatment
SEC3B	ARS Treatment
SEC3D	Traditional Method (Comparison)
SEC3C	ARS Treatment
SEC4B	Traditional Method (Comparison)
SEC4C	ARS Treatment

B. Observation Method

There are observation notes taken weekly during the class regarding audience response system use on student engagement, discussion and interaction. The notes are analyzed through an open coding process in which generalizations are made. According to Strauss and Corbin open coding is a process in which concepts are identified and then broken down and examined to identify similarities and differences [24]. Observational notes acquired during audience response system use and instruction not involving the use of audience response systems is compared. Comparisons are made between treatment and comparison group (Table I) concerning student discussion, student engagement and student interaction.

IV. RESULT: PILOT STUDY

Pilot study was conducted for the survey and observation for both treatment and comparison group. The survey is pilot tested with 133 students in different classes in treatment group. Student observations are piloted with both treatment and comparison group compose of two eighth grades, three ninth grades and two tenth grades computer classes at Adni International Islamic School. The treatment groups are using ARS while the comparison group used the traditional method.

A. Student Survey

To answer research question, “What does audience response systems add to an active learning in secondary school classroom environment?” The survey was conducted. The descriptive statistics, means and standard deviations is used to provide a description of participants’ responses to the 10 items audience response system on student active learning survey. One hundred thirty three participants (n = 133) completed the audience response system survey. For each item participants are asked to rate their agreement (1 = *strongly disagree*, 2 =

disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree 6 = agree and 7 = strongly agree). Means and standard deviations are presented in Table II.

TABLE V. DESCRIPTIVE STATISTICS FOR END OF SEMESTER STUDENT SURVEY

Statements	N	Mean (Likert Scale)	Std. Deviation
1. I feel more engaged during class because we used Audience Response System.	132	4.96	1.292
2. My mind engaged with the topic during class because we used Audience Response System.	131	4.87	1.139
3. I found the Audience Response System made it easier for me to participate in class and learn.	133	5.11	1.176
4. Because we used Audience Response System, I have a great sense of participation in the class.	133	4.89	1.195
5. Using Audience Response System heightens my interest in whatever we do during class.	131	4.95	1.258
6. Audience Response System promotes class discussion and resolution of problem.	133	4.91	1.215
7. I have always opportunity to discuss with my neighbor because we used Audience Response System.	133	4.60	1.527
8. We always exchange answer and ideas with my classmate because we used Audience Response System.	133	4.98	1.288
9. I interact more with my peers to discuss ideas when using Audience Response System.	133	4.71	1.152
10. Using ARS increase my interaction with my teacher and classmates.	133	5.15	1.184

B. Interpretation of Survey Findings

Survey data suggests that, the students in the treatment group believed that using audience response systems in the classroom was a positive experience.

When asked if Audience Response System made it easier for them to participate in class and learn, student reported an average score of 5.11. Student’s average score is 5.15 when asked if audience response system increase their interaction with the teacher and classmates. When asked if ARS promotes

class discussion and resolution of the problem, an average score of 4.91 was reported. The highest average revealed through the use of the survey is on the question 10, when the student was asked if using ARS increase interaction with teacher and classmates. An average score of 5.15 was reported.

The engagement, discussion and interaction in the classroom are extremely important. If students are enjoying what they are doing, student understanding and eventually student performance outcome should increase. Student discipline problems may even decrease as a result of audience response system use.

The data revealed through this study suggests that audience response system can trigger and increase student engagement, participation, interest, discussion and interaction in computer studies classroom at Adni International Islamic School. Several studies [25-27] stated that learning is active.

C. Percentage of respondent’s choice in each statement

For this study statements 1, 2, 3, 4, and 5 are about student active engagement. Statements 6 and 7 are about class-wide discussion. Finally, statements 8, 9 and 10 are about student interaction in the classroom.

Almost 62 percent of students agreed that they were more engaged during class because they use ARS as opposed to the 7 percent of students who disagreed with this statement (Fig 1).

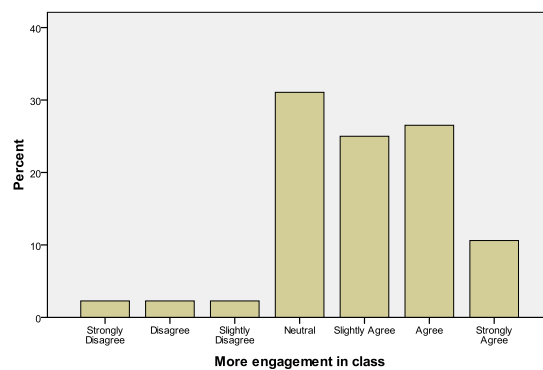


Figure 7. Results for statement: "I feel more engaged during class because we used Audience Response System."

About 60 percent of the students surveyed agreed that their mind engaged with the topic during class because they used ARS, while 5 percent disagreed with this statement (Fig 2).

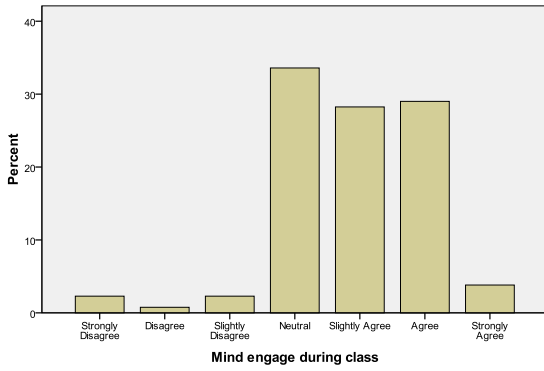


Figure 8. Results for statement: "My mind engaged with the topic during class because we used Audience Response System."

Approximately 71 percent of students found the ARS made easier for them to participate in class and learn, while almost 6 percent did not agree to the statement (Fig 3).

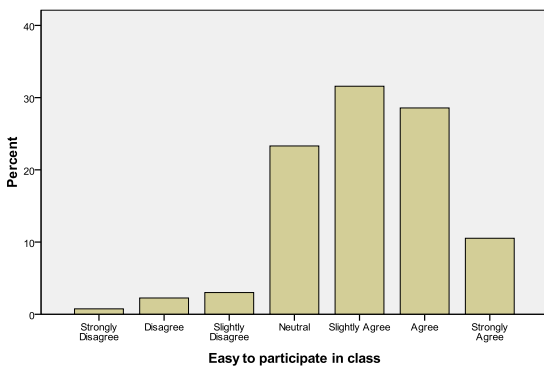


Figure 9. Results for statement: "I found the Audience Response System made it easier for me to participate in class and learn."

About 62 percent of the students have a great sense of participation in the class because they used ARS, while only about 9 percent of the students disagreed with this statement (Fig 4).

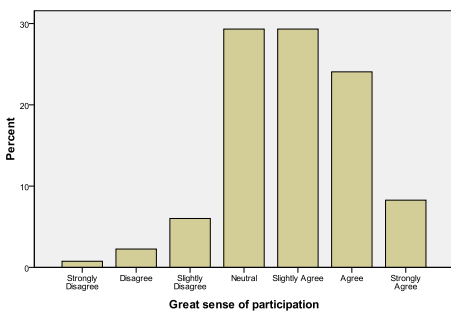


Figure 10. Results for statement: "Because we used Audience Response System, I have a great sense of participation in the class."

Nearly 45 percent of students said that, ARS heightens their interest during class and only about 7 percent said they disagreed with the statement (Fig 5).

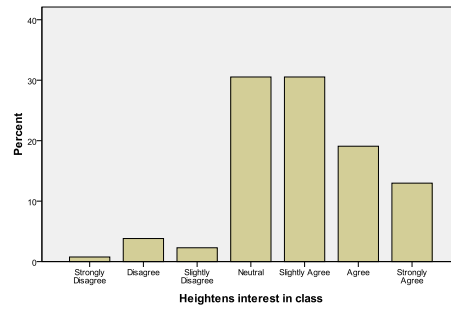


Figure 11. Results for statement: "Using Audience Response System heightens my interest in whatever we do during class."

About 63 percent of the students believed that using ARS promotes class discussion and resolution of problem, while only about 10 percent of the students disagreed with this statement (Fig 6).

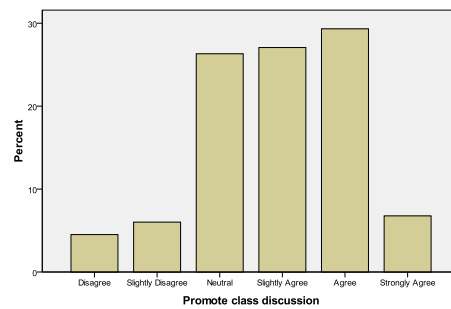


Figure 12. Results for statement: "Audience Response System promotes class discussion and resolution of problem."

About 53 percent of students said that they have always opportunity to discuss with their neighbor because they used ARS and only about 19 percent said they disagreed with the statement (Fig 7).

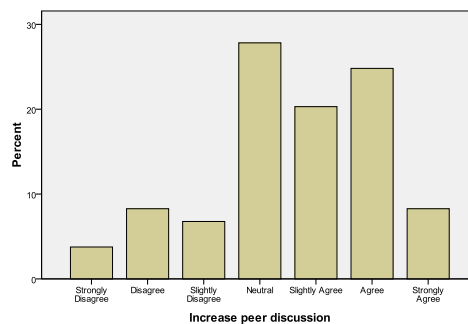


Figure 13. Results for statement: "I have always opportunity to discuss with my neighbor because we used Audience Response System."

About 66 percent of the students exchange answer and ideas with their classmates while only about 9 percent of the students disagreed with this statement (Fig 8).

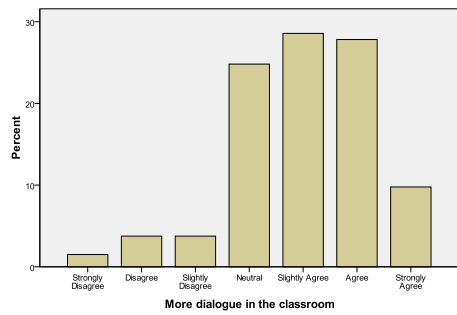


Figure 14. Results for statement: "We always exchange answer and ideas with my classmate because we used Audience Response System."

Approximately 50 percent of students interact more with peers to discuss ideas when utilizing ARS, while almost 11 percent did not agreed with the statement (Fig 9).

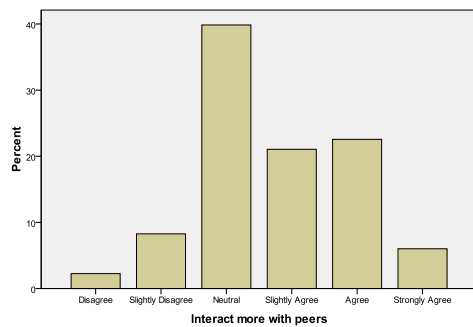


Figure 15. Results for statement: "I interact more with my peers to discuss ideas when using Audience Response System."

Nearly 73 percent of students said that it increases their interaction with teachers and classmates and only about 7 percent said they disagreed with the statement (Fig 10).

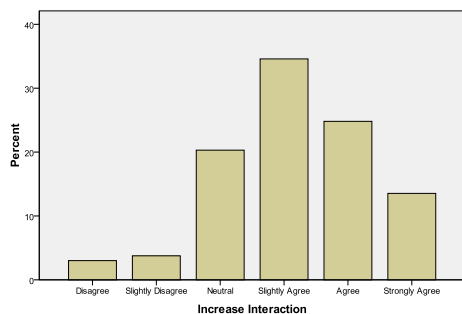


Figure 16. Results for statement: "Using ARS increase my interaction with my teacher and classmates."

TABLE VI. PERCENTAGE OF EACH FACTOR

Active Learning	Factor	Agree (%)	Disagree (%)
Engagement	More engaged	62	7
	Mind engaged	60	5
	Easy participation	71	6
	Sense of participation	62	9
	Heightens interest	45	7
Discussion	Promotes class discussion	63	10
	Increase peer discussion	53	19
Interaction	More dialog	66	9
	Interact more with peers	50	11
	Increase interaction	73	7

The percentage of each factor in table III shows that utilizing audience response system in computer studies class can increase active engagement, discussion and interaction.

D. Observational Data Analysis

Through the analysis of the observational data, several generalizations can be made. Observations allowed the researcher to evaluate, direct, how audience response systems affect students' active learning. For the purposes of the observational data analysis, each observation category will be discussed independently, comparing the observations using audience response systems, and the observations in which audience response systems are not used.

E. Student Interaction

During observations which involved the use of ARS, students increase their interaction during the lesson. Student conversation, for the most part, is focused on the lesson. Students are excited about the use of the ARS and are eager to answer questions. They particularly enjoyed seeing the answer slide and how everyone else answered. All of the students answered quickly and there is much interaction after each question. Many of the students asked questions and made several positive comments.

During observations when audience response systems are not used, the students did not seem as excited about the lesson. For the first few minutes of the period, students seem to pay attention, but lost focus after a few minutes. Some of the students did not pay attention at all. Behaviors observed during these observations included; playing game and talking not related to the subject matter.

F. Student Engagement

While ARS are used, 100% of the students participated in the lesson. That could be verified through the graphical feedback chart that can be presented after each question. The students seemed excited about entering their answer to

observe how they did as compared to the rest of their class. Sometimes teacher did not have to remind a few students to enter their response.

During lessons presented that did not require the use of ARS, only a few students answered to the pose questions. The teacher called on students who raised their hands most of the time many of the students did not actively participate in the lesson.

G. Student Discussion

The teacher structured the class period around the class-wide discussion of questions. The closure of one question often leads to the presentation of a second so that instruction has a cyclical quality. For ease of presentation, the teacher break down question cycle into 6 stages: 1) Concept question posed, 2) student provide individual responses, 3) peer discussion, 4) student receive feedback, 5) class-wide discussion, and 6) teacher summarizes and explains correct response. The students oblige to discuss with their peer when the teacher ask to talk about their answer to their neighbor in utilizing ARS.

The comparison group which is basically not using ARS, there are also discussion but it is not related to the subject matter. Some of the students play computer game.

H. Observation Result

Observation data suggest that, students enjoy using ARS during classroom instruction. Students appear to be more eager to participate and more attentive during lessons which incorporate ARS. The following behaviors are evident from the observations: confidence, peer discussion, engagement and participation, and interaction. Students have shown a high level of satisfaction while using ARS.

Evidence also suggests that, students are engaged in the lessons and are less hesitant to respond. That is a result of the anonymity that the system provided. Teachers are able to see student answers and provide appropriate feedback. Student participation is 100% when ARS are used. The participation level is evident through the graphical feedback which is provided after each question.

During observations in which ARS are not used, student did not appear to be as engaged in the lessons. Only a few students answered posed by the teacher. Several students exhibited off task behavior during many of the observations in which ARS are not used.

In summary, the majority of students are more actively engage, discuss and interact in learning when audience response systems are used during lessons.

V. CONCLUSION

There is a growing acceptance of ARS as tools to enhance student active learning [17, 28] as well as in this study. Audience response systems are far more than mere multiple choice/true-false quizzing or attendance-taking tools. Their potential spans all academic disciplines, and is especially

useful in increasing active learning. ARS technology provides an avenue for strengthening the teaching-learning connection and active learning, as evidenced in this pilot study by improved student engagement, interaction and discussion. Further research is needed to investigate all of these variables before arriving at definitive conclusions on the effects of ARS on student active learning in other learning institution specifically in secondary level education.

REFERENCES

- [1] C. Bonwell and J. Eison, "Active Learning: Creating Excitement in the Classroom," *ERIC Clearinghouse on Higher Education Washington DC*, 1991.
- [2] Z. Zhang and J. A. Burry-Stock, "Classroom assessment practices and teachers' self-perceived assessment skills," *Applied Measurement in Education*, vol. 16, pp. 323-342, 2003.
- [3] R. J. Dufresne and W. J. Gerace, "Assessing-to-learn: Formative assessment in physics instruction," *The Physics Teacher*, vol. 42, pp. 428-433, October 2004.
- [4] G. E. Kennedy and Q. I. Cutts, "The association between students' use of an electronic voting system and their learning outcomes," *Journal of Computer Assisted Learning*, vol. 21, pp. 260-268, 18 April 2005.
- [5] J. Cargill, et al., "Electronically Enhanced Classroom Interaction," *Australian journal of educational technology*, vol. 18 pp. 13-23, 2002.
- [6] R. J. Dufresne, et al., "Classtalk: A Classroom Communication System for Active Learning," *Journal of Computing in Higher Education*, vol. 7, pp. 3-47, 1996.
- [7] A. LeSage, et al., "Examining the Use of Audience Response Systems in Secondary School Classrooms: A Formative Analysis," *Journal of Interactive Learning Research*, vol. 21, pp. 343-365, July 2010.
- [8] D. A. Banks, "Audience Response Systems in Higher Education: Application and Cases," *Idea Group Inc. Australia*, 2006.
- [9] E. Scornavacca and S. Marshall, "TXT-2-LRN: improving students' learning experience in the classroom through interactive SMS," *Proceedings of the 40th Hawaii International Conference on System Sciences*, pp. 1-8, 2007.
- [10] R. H. Kay and A. LeSage, "A strategic assessment of audience response systems used in higher education," *Australasian Journal of Educational Technology*, vol. 25, pp. 235-249, 2009.
- [11] Q. I. Cutts, "Practical lessons from four years of using an ARS in every lecture of a large class," *Audience response systems in higher education*, pp. 65-79, 2006.
- [12] M. J. Furlong, et al., "Handbook of Positive Psychology in Schools," *LEA* 2009.
- [13] G. Bergtrom, "Clicker Sets as Learning Objects," *Interdisciplinary Journal of Knowledge and Learning Objects*, vol. 2, pp. 105-110, 2006.
- [14] V. Simpson and M. Oliver, "Electronic voting systems for lectures then and now: A comparison of research and practice," *Australasian Journal of Educational Technology*, vol. 23, pp. 187-208, 2007.
- [15] R. W. Preszler, et al., "Assessment of the effects of student response systems on student learning and attitudes over a broad range of biology courses," *CBE-Life Sciences Education*, vol. 6, pp. 29-41, 20 December 2007.
- [16] J. Hu, et al., "Wireless interactive teaching by using keypad-based ARS," *Audience response systems in higher education*, pp. 209-221, 2006.
- [17] I. Beatty, "Transforming student learning with classroom communication systems," *EDUCAUSE Research Bulletin*, vol. 2004, pp. 1-13, 2004.
- [18] C. A. Brewer, "Near real-time assessment of student learning and understanding in biology courses," *BioScience*, vol. 54, pp. 1034-1039, 2004.
- [19] S. W. Draper and M. I. Brown, "Increasing interactivity in lectures using an electronic voting system," *Journal of Computer Assisted Learning*, vol. 20, pp. 81-94, 26 January 2004.
- [20] J. T. Boyle and D. J. Nicol, "Peer Instruction versus Class-wide Discussion in Large Classes: a comparison of two interaction methods in

- the wired classroom," *Society for Research into Higher Education*, vol. 28, pp. 457-473, October 2003.
- [21] D. Laurillard, "Rethinking university teaching: a conversational framework for the effective use of learning technology, 2nd Ed.," *London: RoutledgeFarmer*, 2002.
- [22] R. R. Hake, "Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics text data for introductory physics courses," *American Journal of Physics*, vol. 66, pp. 64-74, 4 May 1998.
- [23] N. Mattheos, "Information Technology and Interaction in Learning: Studies of Applications in Academic Oral Health Education," *Centre for Educational Research and Technology in Oral Health, Sweden*, 2004.
- [24] A. Strauss and J. Corbin, "Basics of qualitative research: Grounded theory, procedures and techniques," *Newbury Park, CA: Sage*, 1998.
- [25] C. Bonwell and J. A. Eisen, "Creating Excitement in the Classroom," *ASHE-ERIC Higher Education Report No. 1 Washington, DC: George Washington University, School of Education and Human Development.*, 1991.
- [26] J. Roschelle, *et al.*, "Classroom Response and Communication Systems: Research Review and Theory," *American Educational Research Association*, 2004.
- [27] N. Meedzan, "Clickers in Nursing Education: An Active Learning tool in the Classroom," *OJNI Online Journal of Nursing Informatics*, vol. 13, pp. 1 - 19, 2009.
- [28] E. Mazur, "Peer Instruction: A User's Manual," *New Jersey: Prentice Hall*, 1997.
- .