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USE OF I-CLICKERS TO ENHANCE LEARNING OUTCOMES ASSESSMENT IN CLASSROOM: A CASE STUDY IN KING SAUD UNIVERSITY

Abstract:

Educators in King Saud University understand that helping students learn is a continual process, requiring a commitment to assessment and evaluation. Nowadays, formative assessment is a crucial component of teaching and learning. Hence, teachers are in need of tools to assess students' understanding and skills into classroom to improve students' academic achievement. i-clickers are simple technology allowing formative assessments due to the immediate information received by the teacher concerning the students' mastery of a given concept. Thus teachers can adjust their teaching methods accordingly on time. This paper reports an experience conducted in the Department of Information Technology (IT) in King Saud University (KSU). i-clickers served as an assessment tool of Course Learning Outcomes (CLOs) in classroom. Findings revealed that firstly students were much better in performing course projects and secondly teacher was able to improve her course strategies more efficiently and identify students difficulties on time.

Keywords:

Formative Assessment; Course Learning Outcomes; Student; i-clicker; Feedback.

1. Introduction

The usage of Technology Enhance Learning (TEL) in education has evolved significantly over the last decades and government spending for education in Kingdom of Saudi Arabia is growing abundantly. A fund of SR 204 billion was allocated to the educational sector in 2013 (Irfan, 2013). The Department of Information Technology (IT) is one of the five departments of the College of Computer and Information Sciences (CCIS) at KSU. It is the first department in this specialization for female students in Saudi Arabia. Convinced by the important role of women in Saudi society, KSU has undertaken the task of developing the skills of women in order to ensure qualified graduates to work in the field of Information Technology. From this standpoint, IT department considers linking academic excellence to completion is essential and must be done. To fulfill its core mission, essential and ongoing assessments are done to structure an environment of student success and completion in IT department.

Literature reviewer

Even e-learning exists everywhere nowadays, traditional face to face delivery of courses is still the main way to give and receive learning. In IT department at KSU, a blended learning (Osguthorpe, 2003) is offered where lectures are done in traditionally way and other parts of academic delivery as: materials, homework, announcements, calendar occur using online platform via a Learning Management System (LMS). Consequently, motivation, engagement and assessment play a fundamental role to improve learning.

According a study conducted by Hartley and Davies (1978) the amount of information retained for the last ten minutes of a lecture decreased to 20%. Thus the traditional teaching dilemma is how to get students involved in classroom.

To enhance students' retention, motivation, participation, and assessment during learning process (Thomas, 1972), KSU launched an experience in Spring 2014 to adopt Student Response Systems (SRS) in classroom. The experience was launched in attempt to offer active learning rather than passive learning and formative assessment rather than only summative assessment. Passive learning is a teacher-centered approach to learning in which student's role is limited to listening and taking notes (Blumberg, 2008) while active learning is focusing not only on teacher but also on student. The student is required to be involved in classroom (Biggs, 2011). Summative assessments are administrated for grading purposes. They lead students to focus much more on grades then knowledge. They are not suited for assessing higher-level understanding and skills (Wirth, 2005). Formative assessments are a pro-active approach to education due to the immediate information received by the teacher concerning the students' mastery of a given concept (Hayes, 2012). Performed regularly, they allow students to situate their knowledge throughout a semester, especially before exams. There is a real need of simple tools as SRS in classroom that: **1)** increase motivation and retention during lecture; **2)** provide formative assessments of Course Learning Objectives (CLOs) immediately following the lecture; **3)** turn assessment in knowledge by supporting immediate feedback; **4)** can be easily used by students to reflect on and monitor their progress; **5)** can be used by teachers to identify students' misunderstanding and adjust their teaching methods accordingly on time.

As instructors are always seeking to elevate students' performance and engagement in classroom, the SRS offer a potentially helpful teaching and assessment tool.

Student Response Systems: i-clicker

i-Clickers are simple technological devices that enable instructors and students to interact dynamically in minutes. They are used to promote active learning by increasing the opportunity for the student to participate in classroom. They allow students to actively take part in lectures by anonymously respond to interactive questions such as multiple choice, true/false, or opinion questions previously selected by the teacher. Current technology i-clicker software provides histograms of the aggregated responses and includes time for students to compare their viewpoints and possibly revise their answers. Prompt feedback on understanding is an essential contributor to student learning (Nelson & Pearson, 1999) and many studies proved that SRS enabled professors to gauge student understanding and respond accordingly. The most important benefit of SRS is that, they can engage learners and instantly provide feedback for teachers to validate student achievement (Ducan, 2005; Weerts, Miller, & Altice, 2009; Kimo, 2010). According to Siew, both teachers and students would benefit from an assessment tool such as SRS that enables formative assessments or feedback to be provided at different points during the learning process (Siew, 2003). Furthermore, the use of TEL as i-clickers into (CLOs) assessment will enable faculties to reconsider learning and teaching strategies and improve their efficiency in managing assessment.

Course Assessment Methodology at IT Department

IT Department makes Learning Outcomes (LOs) assessment an explicit part of department culture. With 2010, IT department have become increasingly engaged in articulating and assessing learning outcomes to account for and ensure quality in its educational programs. The KSU academic calendar is divided into two semesters and a semester is an average of 15 weeks lectures. The IT Department offers generally, courses that contain three semester credit hours of content, of which two contact hours are dedicated to laboratory practice. The assessment is based on the assessment of Student Outcomes (SOs) covered by each course. The assessment is mandatory for all courses in each semester. Each faculty member teaching a course must produce a Course Assessment Report (CAR) as part of the course portfolio. If a course has several sections and each section is taught by a different instructor, assessment must be done for each section separately. The CAR must contain both direct assessment and indirect assessment. The direct assessment considers the point of view of the instructor through exams, quizzes, assignments and projects. The indirect assessment considers the point of view of students through surveys. Indirect assessment evaluates the attainment of specific learning outcomes of the course as well as student outcomes covered by the course. The CLOs survey is posted for students at the end of the academic semester to assess their learning outcomes from the course. The questionnaire is answered by the enrolled students in the course. Table 1 gives the list of CLOs to be achieved in Intelligent Systems (IS) course, Fall 2013-2014. Direct assessment evaluates the attainment of CLOs covered by the course. For both direct and indirect assessment, faculties use the percentage (%) of students achieving the satisfactory or exemplary levels. Each faculty member must keep her data at the most detailed level. Results of this assessment are collected at the end of each semester in a CAR. Faculty members compare performance levels of current students with those of students in previous offerings of the same course. Based on the results, the teacher relates learning barriers and issues expressed by the student while filling the survey. The teacher is asked to propose a plan to overcome these barriers next semester. Quality unit staff intervenes to highlight

problems but unfortunately this intervention is not on time. The results are carried too late to undertake any action for the actual students whom from the feedback about teaching was taken. Therefore we intend to do the process along the semester in a timely manner where it will be most beneficial and giving students a sense of their progress.

Table 1. Students Outcomes addressed by the course IS.

#	Student Outcome addressed by the course
(o)	An ability to acquire knowledge of best practices and their applications;
(m)	An ability to acquire knowledge of standards and their application;
(b)	An ability to analyze a problem, and identify the computing requirements appropriate to its solution;
(a)	An ability to apply knowledge of computing and mathematics appropriate to the discipline;
(g)	An ability to analyze the local and global impact of computing on individuals, organizations and society.

2. Methodology

We (the author) taught Information Systems (IS) course three semesters without SRS. At the end of these semesters, while gathering data to assess and evaluate the course, we found a gap between direct assessment and indirect assessment especially for the student outcomes **(g, m, o)**. We observed also that students have difficulties to apply the concepts and techniques learned in real world problems while performing mini-projects of the course. Figure 1 illustrates the results of course assessment and comparison between direct assessment and indirect assessment. It shows that the attainment of SOs: **g, m** and **o** is under expectation in Spring 2013. In attempt to address these gaps, this study aims to explore the effects of lectures that incorporated i-clickers as formative assessment on students' achievement immediately following the lecture.

This paper reports on the use of i-clickers as a formative assessment tool in undergraduate course. The purpose of this assessment was to elevate engagement in classroom and increase students' performance. No grades were given to this assessment.

2.1. Study setting

The experience launched by KSU was conducted in many departments such as IT Department in CCIS. The participants in IT Department were volunteers among faculty members in many courses, such Data mining, Software Engineering, IS, Data Structure and Architecture. There was not a uniform use for i-clickers in the classroom. The participants were free to choose in which manner to use these devices in classroom. As mentioned earlier, the experience had as aims but not limited to: first, evaluate the effectiveness of SRS in increasing students' academic performance, compare passive learning (lecture without i-clickers) versus active learning (lecture with i-clickers) on students' motivation and participation in class and second, use i-clickers as CLOs assessment tools. This paper study concerns the introduction of the SRS in classroom by the students (n=47) enrolled in IS course. It was conducted with two sections of this course. The intent of this paper was to evaluate the effect of using

SRS to assess LO and the effectiveness of these devices on student's academic achievement.

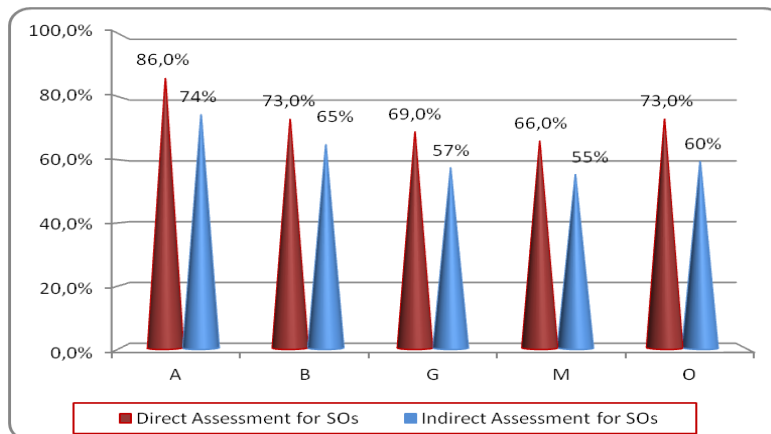


Fig. 1. SOs/CLOs assessment - Fall 2013

2.2. Description of the course

The course IS introduces students to the wide field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems. During the academic semester, the course IS covers three hours of lectures and two hours of lab per week. During lectures, various fundamental topics of AI including methods and algorithms are explained and demonstrated to be understood and put in practice by students during the lab work through exercises. This course is also an opportunity for students to discover important applications of AI technology. At the end of the course, students practice programming skills by achieving a mini project where they have to find a problem's solution by applying AI algorithms and techniques. On completion of this module, students should relate in a mini research project what they have learned to what impact AI is making to society. The course addresses five Student Outcomes (SOs) shown in Table 1. The course was split into six units. Each one has a CLO shown in Table 2.

Table 2. CLOs of IS course and their mapping with the SOs

#	Course Learning Outcomes
1	Solve a problem and provide the suitable formulation. (b)
2	Apply the different search techniques: uninformed search, informed search and constrained search Select the suitable. (a)
3	Select the suitable AI technique to solve a particular problem. (m)
4	Apply the different ways to represent knowledge: propositional logic and first order logic. (b)
5	Describe and apply the inference rules and algorithms. (o)
6	Analyze the impact of AI based technologies. (g)

2.3 Procedure

We incorporated questions about CLOs in lectures at the end of each unit. Questions were in three forms: multiple choice, true/false and opinion questions. Students answered questions anonymously. Results' data were displayed immediately upon completion of each interactive question to serve as immediate feedback to the teacher and the student. This encouraged discussions between teacher and students and also between peers. A survey questionnaire (part of indirect assessment) in form of

opinion question was given to students after each unit i.e. after achieving each CLO. Table 3 shows the survey results for all the CLOs in Spring 2014.

At the end of the semester, data was collected as usual, on student grades based on common test questions on the quizzes, midterm, mini-projects and final exams for both sections as direct assessment process. Data of the questionnaire survey was gathered from i-clickers report to perform the indirect assessment.

3. Findings

The purpose of this section was to examine the effects of clickers as assessment of CLOs to improve students' learning and course evaluation. The results show that the SRS are useful tool to conduct formative assessment throughout the course to provide immediate feedback to teacher and students to improve students' achievement. Indeed results show that students did a progress while performing their mini-projects mentioned in the description of the course and increase their grades in the summative assessment. The attainment of CLOs exceeds expectations in both direct and indirect assessments. Table 3 shows the percentage of Satisfactory. Results have shown also that the gap between direct and indirect assessments was significantly reduced.

The findings revealed that the use of i-clickers has a positive impact on overall student learning.

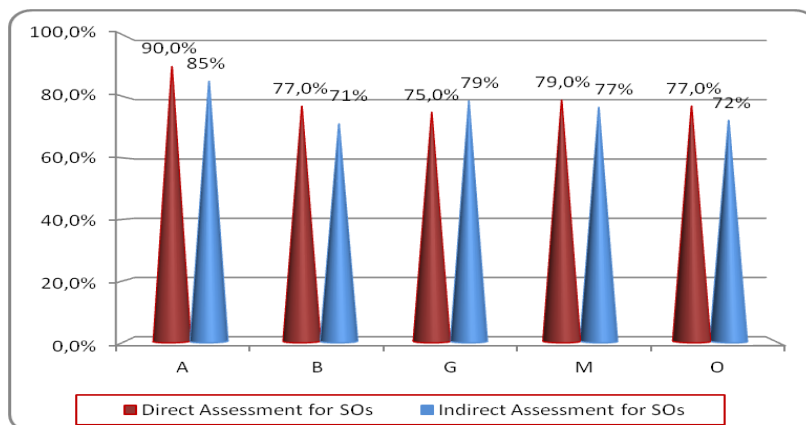


Fig. 2. SOs/CLOs assessment in Fall 2013

Figure 2 above shows that attainment exceeds expectations for CLO1 and CLO2 and meets expectation for the remaining CLOs for both direct and indirect assessment. Findings have shown and confirm that by using i-clickers students are more attentive and encouraged to share accountability with teacher into classroom.

Table 3. CLOs assesment - Spring 2014

I am able to	SA	A	N	D	SD
1. Solve a problem and provide the suitable formulation.	19%	72%	8%	1%	0%
2. Apply the different search techniques: uninformed search, informed search and constrained search Select the suitable.	34%	51%	14%	1%	0%
3. Select the suitable AI technique to solve a particular problem.	34%	51%	14%	0%	0%
4. Apply the different ways to represent knowledge: propositional logic and first order logic.	18%	51%	25%	2%	2%
5. Describe and apply the inference rules and algorithms.	22%	51%	24%	2%	1%
6. Analyze the impact of AI based technologies.	15%	63%	19%	3%	1%

4. Conclusion and Limitations

The Student Response Systems as i-clickers are a useful tool for enhancing learning. The study shows an increase of level overall understanding in class. There is also a significant increase of students' performance comparing the results of course evaluation before adopting SRS and after. For the student, i-clickers provide an explicit guide to the concepts, techniques and learning objectives of a course. They are an efficient formative assessment tool and can be used to help students develop self-assessment skills. Instructors can use i-clickers' results to assess student understanding and the effectiveness of new course strategies. SRS results indicate they are correlated with other assessment tools as exams and course grades. These results are largely consistent with case studies in other countries cited above in the literature review.

We recognize that this pilot study is limited by the small size of students. We intend to expand our experience further in other courses with large classes for 2 semesters.

Acknowledgements

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Reference

- Biggs, J. & Tang, C. (2011). Teaching for Quality Learning at University. The Society for Research in Higher Education. Fourth Edition. UK.
- Blumberg, P. (2008). Developing Learner-Centered Teaching. San Francisco: Jossey-Bass.
- Duncan, D. (2005). Clickers in the classroom: How to enhance science teaching using student response systems. San Francisco: Pearson.
- Fies, C. & Marshall, J. (2006) Classroom Response Systems: A Review of the Literature. *Journal of Science Education and Technology*, 15, 101-109.
- Gauci, S., Dantas, A., Williams, D. & Kemm, R. (2009). Promoting Student-Centered Active Learning in Lectures with a Personal Response System. *Advances in Physiology Education*, 33, 60-71.
- Hartley, J., & Davies, I. (1978). Note Taking: A Critical Review. *Programmed Learning and Educational Technology*, 15, 207-224.
- Hayes, J. A. (2012). *A comparison of lecture and interactive lecture using student response systems in an inclusive and non-inclusive classroom*. A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Education. The University of Memphis.
- Irfan, M. (2013). Kingdom tops world in education spending. *Arabnews*. 4th January. Available from: <http://www.arabnews.com/saudi-arabia/kingdom-tops-world-education-spending>. [Accessed: 10 October 2014].
- Kimo, A. Y. (2010). The effects of Clickers on Student Learning. *Academic Exchange Quarterly*. Vol.14, Issue 1.
- Nelson, P. E. & Pearson, J. C. (1999). Large lecture classes, in: A. L. Vangelisti, J. A. Daly & G. W. Friedrich (Eds) *Teaching communication: theory, research, and methods* (Mahwah, NJ, Lawrence Erlbaum), 347-358.
- Osguthorpe, R. T. & Graham, C. R. (2003). Blended learning environments: definitions and directions. *Quarterly Review of Distance Education*, 4(3), 227-233.
- Thomas, J. (1972). The variation of memory with time for information appearing during lecture. *Studies in Adult Education*, 4, 57-62.
- Trees, A. R. & Jackson, M. H. (2007). The learning environment in clicker classrooms: student processes of learning and involvement in large university-level courses using student response systems. *Learning, Media and Technology*, Vol. 32, No. 1, March 2007, pp. 21-40.
- Siew, P. (2003). Flexible on-line assessment and feedback for teaching linear algebra. *International Journal of Mathematical Education in Science & Technology*, 34(1), 43.
- Weerts, S., Miller, D., & Altice, A. (2009). "Clicker" Technology Promotes Interactivity in an Undergraduate Course. *Journal of Nutrition Education & Behavior*, 41, 227-228.
- Wirth, K. R. & Perkins, D. (2005). Knowledge Surveys: An Indispensable Course Design and Assessment Tool. *Innovations in the Scholarship of Teaching and Learning*.