The Impact of Technology on At-Risk Student's Achievement

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Abstract: In university education a lot of emphasis is placed on the use of a technology enhanced learning environment in teaching to enhance the student learning experience. This paper sought to investigate the impact of such environment in the performance of at-risk students in math courses. This paper reports on a study conducted on at-risk students to investigate whether the utilization of a technology enhanced learning environment had any impact on the final grades achieved by students. Moreover, we compared student's performances to determine whether students using a computer-assisted learning and technology enhanced learning environment learned better than traditional classroom learners. The sample of the study was 50 at-risk engineering students enrolled in different math courses. For data collection, grades were taken for students enrolled in math courses where no instructional technology were used. Then the same students took another math courses taught in an enhanced learning environment. Data were analyzed using StatCrunch software. At the end of the study, it has been concluded that studying in an enhanced learning environment increased the academic success of at-risk students in mathematics courses compared to the traditional classroom.

Keywords: Educational Technology; Student's Assessments; Mathematics

1 Introduction

Research has shown both positive and negative effects on student achievement through the implementation of technology. This area of research is very significant due to the changing world of technology.

According to Means et al. [11] the dominant teaching methods for at-risk students focus on basic skills, which are not providing the students with challenges. At-risk students need to be challenged and encouraged to use complex thinking skills. Teachers need to encourage the growth of reasoning, problem solving, and independent thinking for the at-risk students as they do for regular students [11] . The research conducted by Means [12] shows that technology can help students including at-risk students learn and practice a variety of skills and improves their attitudes to learning. Means et al. [10] suggests that technology in the classroom could provide authentic learning opportunities to at-risk students. A recent study done by Grira [6] had shown the positive impact of using a learning management system (MyMathLabs) in student's performance. The study had revealed that engineering students taken university math courses who did use MyMathlabs had their grades improved significantly comparing with the students who had taken traditional courses without the use of any technology.

Innovative advances in technology have introduced a variety of tools to enhance learning in higher education. Among these, Computer-assisted learning techniques which provide an environment to create interactive interfaces, due to the improvement of communications and computer technologies. The study done by Nguyen et al [13] had indicated that with the opportunities of drilling and practicing on the computer and receiving instant scores and adapted feedback, students had gained interests in doing mathematics, and formed a perception that they became smarter in problem-solving.

Moreover, emergences of technology had enabled the development of various innovative teaching-learning tools in education. The enjoyment offered by multimedia can increase learner's motivation and participation thus allowing them to retain the learning process in longer period compared to using traditional classroom method. As slow learners are difficult to maintain their learning attentions for long time span, multimedia courseware is believe to assist them. Su [16] investigated the effects of

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multimedia applications on science performance with the help of educational software. The results revealed that the use of multimedia applications contributed to student learning and positively affected their attitudes towards science. Another study, which implemented multimedia materials Chang et al [3] investigated the effects of multimedia applications on 7th graders performance in science class. The study focused on three different groups of students and concluded that learning was more effective in the group taught with multimedia applications. In the other hand, different studies suggested a weak impact of using technology in student's performance.

Across various academic disciplines, some studies support the notion that there is no significant difference in educational outcomes between web-based and traditional classroom-based education, Gagne, M and M. Shepherd [5] Johnson, M. [7] Randon et al [15] reached the conclusion that the game-based learning method is comparable to the traditional learning method in general and in short-term gains, while the traditional lecture still seems to be more effective to improve student's short and long-term knowledge retention. Demian & Morrice [4] had shown in their study the weak impact of the use of virtual learning environments on academic performance. Olson & Clough [14] presented the problems with technology and learning by saying "Although technology could assist teachers and students in making schooling effective, in many ways it exacerbates current problems". Technology is often used as a tool for entertainment to keep student interest (Klemm [8] , Olson & Clough [14]). Teachers often use the technology as an addition to their lessons, but the use of the technology often has nothing to do with the content of the lessons (Olson & Clough [14]). Most of the time, technology that is used in the classroom is used incorrect1y, and this is due mostly to the inexperience of the educator (Labbo [9]; Brinkerhoff [2]). Thus, the ineffective use of the technology ultimately leads to a decrease in the student's learning (Angelo & Woosley [1]).

In this paper we tried to shed some light on the effect of using technology on at-risk student's performance. We also compare the grades of student's learning in a technology enhanced environment versus traditional classroom learners.

2 Methodology

We compared the grades taken by at-risk students in math courses taught without using any technology with the grades in math courses taught using technology.The participants for this research were university Engineering students who their grades in pre-calculus and calculus I courses were 1.5 and below. They have taken these courses without the use of any technology. They were taught the traditional way using chalk and board. All the exams were given paper based. In the other hand, 50

students were selected and had taken calculus 2 and linear algebra using technology. They were taught using E-books and interactive multimedia. Videos were shown to students during lecture.In addition, Clickers, or student response systems, were used to promote active learning. Most research on the benefits of using clickers in the classroom has shown that students become engaged and enjoy using them. It gets shy and under-prepared students to participate. Moreover, in addition to the regular face-to-face office hours, online office hours were given using interactive whiteboard. Students logged in and used their tablets with stylus to write their questions and get instantaneous answers and feedback from instructors. A chat room were also used where discussion had taken place regarding questions wrote by students in the whiteboard. Students were given the possibility to answer other student's questions by writing on the whiteboard and act like a mentor which will increase their self-confidence. Students also did use Matlab software to solve mathematics problems and especially to enhance their skills to draw functions in both two and three dimensions.

All homeworks and proctored exams were given online using MyLabsplus. The grades used in the study are the final grades obtained by students in a course. If a student repeats a course, his new grade will be ignored in the study and only his grade taken the first time he took the course will be taken in consideration. We conducted a T-test for paired data and our hypotheses will be as follow:

H_0 : The mean grades of the difference is the same

versus

H_1 : The mean grades of the difference is negative.

3 Results and Discussion

Paired T hypothesis test:

$\mu_D = \mu_1 - \mu_2$: Mean of the difference between Grades without using technology and Grades using technology $H_0 : \mu_D = 0$ vs $H_A : \mu_D < 0$

Sample statistics:

Sample	n	Mean	Std. dev.
Grades without using technology	50	0.79	0.52576475
Grades using technology	50	1.38	1.1453544

Hypothesis test results:

Difference	Mean	Std. Err.	DF	T-Stat	P-value
$\mu 1 - \mu 2$	-0.59	0.18827357	49	-3.1337377	0.0015

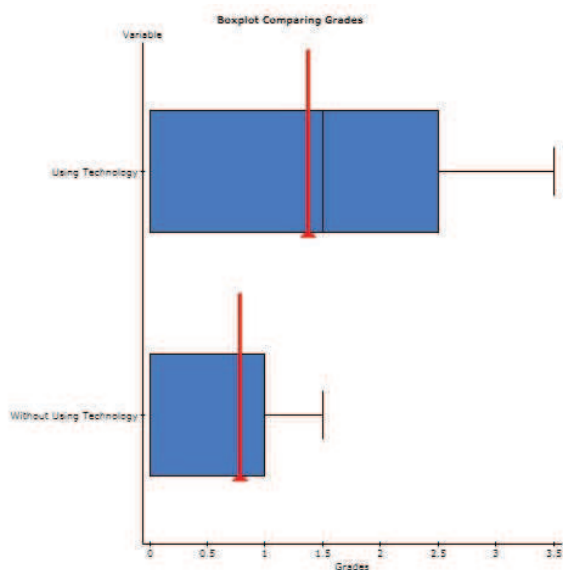**Fig. 1:** Statistics Summary Using StatCrunch

Fig. 2: Boxplot of Grades Using Technology vs Grades Without Using Technology
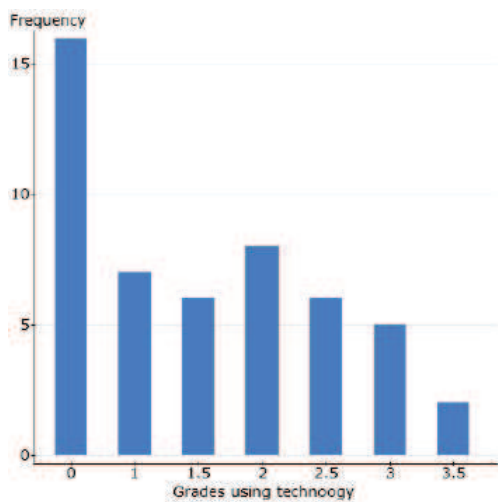

Fig. 3: Bar Graph of Grades Using Technology

The statistical results showed that P-value is small, therefore the grades of students had improved using technology. The study showed that at-risk students learned significantly more in a technology-enhanced environment than who studied via traditional lecture, note taking, and drill and practice. MyMathLab was used as a mean of communicating with students and administering and grading exams. Students using their laptops or smartphone can access the study plan in
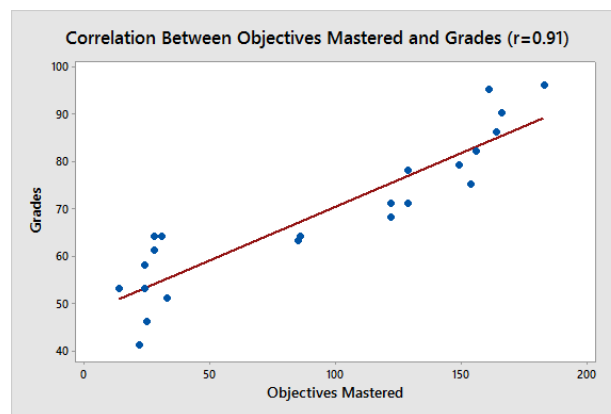

Fig. 4: Scatter Plot of Objectives Mastered and Grades

MyMathLab which consists of sets of problems and solve them. Students will get an immediate feedback and know if their answer was correct or not which will help the instructor to identify the students who are struggling.

The use of Mylabsplus provided detailed tracking features, thereby enabling faculty to reliably and automatically monitor students performance and identify the at-risk students earlier at the beginning of the course. Also, MyMathLab provided students with additional multimedia resources, such as video lectures, animations, and an E-Book, to independently improve their understanding and performance. Moreover, a multimedia library is available which lets you access the multimedia resources related to your course. By linking to all multimedia from one place, the multimedia library makes it easy to identify and locate the resources needed by students. MyMathLab's acts as a personal tutor, updating in real time based on student performance throughout the course to provide personalized recommendations on what students should work on next. One of the most important features of MyMathlab is the study plan.Study Plan is designed for students to improve their skills by practicing problems and getting help to achieve the course objectives. Figure 4 showed that there is a correlation between the objectives mastered by students and their grades on a calculus course.It is obvious that working on the study plan and mastering the objectives had a positive impact on student's grades. Study plan helps students monitor their own progress, letting them see at a glance exactly which topics they need to practice. Students are motivated by the guided solutions, by the ability to immediately see what they did wrong. After completing each assigned question, Study Plan will generate questions that focus on each learning objective that the student have struggled with. Students are taking responsibility for and ownership of their learning. On the other hand, Figure 2 showed that the median of students grades who took courses using technology is greater than the median of students who took courses without

technology. Moreover, 54% of students had their grades above 1.5 and some students even reached 3.5. Figure 3 showed that 27 students did not improve their grades while 13 students did improve their grades to an average greater than 2.5. Furthermore 7 out of these 13 students did significant improvements by getting grades greater than or equal to 3. The remaining 23 students did not ameliorate their grades to such extend that they will not be considered as at-risk students. Overall we can say that more than half of the students had their learning experience enhanced by the use of technology while the remain students, although some of them may had benefit from using technology and had improved slightly their grades they are still considered as at-risk students. There are a number of reasons to explain why many at-risk students did not really take advantage of using technology. One of them is that some students had lack of basic technical and computer skills. In addition, we deducted from Figure 4 that many students did not practice enough problems, which had reflected in their performance by not mastering objectives of the course. Therefore, their grades were very low. Although all the features available in MyMathlab as guided solutions, videos, interactive animations and e-professor, did not stimulate and pushed enough the students to reach to pass the course with an acceptable grade. Maybe the reason is that many students had a weak math foundation and in this case the effect of using technology in student's performance was irrelevant. In the other hand, for other students the use of technology had a positive impact in their performance and they really benefit from being in a technology enhanced learning environment. Such environment had allowed students to achieve what is beyond their ability to accomplish independently.

4 Challenges

Technology-based instruction provides built-in support for struggling learners. Many changes will be necessary to provide such exciting, technology-supported activities for all students. Resources and effort are needed to bring students to a level of computer literacy. Students as well as teachers may encounter technical difficulties in accessing some features of the interface. They may not be able to install the plug-ins and players required to use those features. Instructors need support and strong system of professional development to implement technology in their teaching approach. Many instructors are hesitant or resistant to use technology. In addition, many universities have inadequate network infrastructure or outdate devices and softwares and due to budget limits they will be enable to implement technology in their curriculum. University needs to have state-of-art classroom to enhance learning experience, which will be an extra financial burden on the university and students as well. Moreover, many universities do not see immediate need for more technology. In addition, students may lack the time management skills that make them successful in the e-Learning environment

5 Limitation

There are several limitations to the present study. The results were drawn from data collected from students enrolled in math courses at a single University and, therefore, the results may not be generalized to hold for different populations such as non-math students or students at universities in other parts of the world. Furthermore, the study was done using math courses and maybe the results will be different for other fields of specialization. In addition, the sample size used was not too large, however these results provide the basis for additional work with larger samples.

6 Conclusion

The finding of this study showed significant differences in at-risk students achievement between studying in technology enhanced learning environment and traditional environment. A proper use of technology had stimulated the student's learning experience especially when the subject under study is mathematics, which is considered by the majority of students as a difficult topic. A technology enhanced learning environment will play a major role for improving at-risk student's grades which will have a positive impact on student retention. Improving student retention is a key area where many universities can bolster student satisfaction, graduation rates, and make financial savings.

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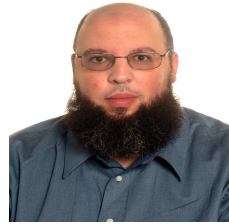
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