# Effect Of Technology Based Learning As A Supplement To Traditional Technology On Student's Achievement

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## Abstract

This paper describes a practical study on the impact of learning's partners, Bluetooth Broadcasting system, interactive board, Real – time response system, notepad, free internet access, computer based examination, and interaction classroom, *etc*, had on undergraduate student performance, achievement and involving with lectures. The goal of this study is to test the hypothesis that the use of such learning techniques, tools, and strategies to improve student learning especially among the poorest performing students. Also, it gives some kind of practical comparison between the traditional way and interactive way of learning in terms of lectures time, number of tests, types of tests, student's scores, and student's involving with lectures.

This paper studies the effect of using relatively new technology appearing in classroom today which is real time response system (voting system), that serves as real – time windows into each students understand of concepts. These devices can provide a foundation decision making based on data at scale never before possible as well as increasing students learning and engagement with each other as well with the lecturer, also, another new technology the "Bluetooth broadcasting system" is applied which is one of the moderate technique towards M- learning, this tool is used to transfer audio, video, text, notes, etc to the mobile of the students as well as laptop.

The computer based examination, interactive board, and notepad as well as free wire and wireless internet access are used to close the digital divide and increasing technology literacy in all students which was one of the challenges, additional challenges include "social loafing," characterized by students who work less diligently than they otherwise might, or who become frustrated by course material or technology and thus less engaged. Finally the other colleague's resistance to the use of technology in learning and its effect on students learning is discussed based on practical situations.

Keywords- e-learning, m-learning, voting system, automated examination, smart board, bluetooth broadcasting system

تأثير التعليم القائم على استعمال التكنولوجيا كمتمم للتعليم التقليدي على تعليم الطلبة

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الستخلص

يصف هذا البحث دراسة عملية لتأثير شركاء التعلم، انظمة البث بواسطة تقنية البلوتوث، السبورة التفاعلية، نظام التصويت، اللوح التفاعلي، الوصول المجاني إلى الإنترنت، الامتحانات المؤتمته بواسطة الحاسوب، ونظام الفصول الدراسية التفاعلية، على أداء الطالب الجامعي ومشاركته بالتكنولوجيا، الهدف من البحث هو اختبار الفرضية القائلة بأن إستخدام مثل هذه التقنيات، والأدوات، والاستراتيجيات في التعليم تؤدي إلى تحسين تعلم الطالب وخصوصاً الطلاب الأقل أداءً ، كما إنه يعطي نوعاً من المقارنة العملية

بين الطريقة التقليدية والطريقة التفاعلية في التعلم من حيث الوقت المستغرق للمحاضرات، وعدد الأختبارات وأنواع الاختبارات، ودرجات الطلبة، ومدى مشاركة الطلبة في المحاضرات.

درس البحث أثر إستعمال تقانات جديدة نسبياً والتي بدأت تظهر في الفصول الدراسية اليوم والذي هو جهاز الاستجابة اللحظي (نظام التصويت) ، والتي هي بمثابة نافذه – حقيقية لقياس مدى إستيعاب كل طالب للمفاهيم. يمكن لهذه الأجهزة أن تكون أساساً لتنمية القدرة على صنع القرار إستناداً إلى البيانات على نطاق واسع لم يكن بالسابق ممكناً كذلك يزيد من قدرة التعلم والتفاعل للطلاب مع بعضهم البعض من جهة ومع المحاضر من جهة ثانية، كما تم تطبيق تقانه البث بواسطة البلوتوث والتي تعد من أحدث التقانات في مجال التعليم الألكتروني، هذه الأداة تستعمل لنقل الصوت، الفديو، النص، الملاحظات،ألخ الى هواتف الطلاب الخليويه والحاسبات المحموله.

إن الإمتحانـات المؤتمتـه بواسطة الحاسوب، السبورات التفاعليـة ، اللوح التفاعلـي ، وكذلك خدمـة الإنترنـت السلكية واللاسلكية المجانية المستخدمة هي تقانات تم إستخدامها لردم الهوة الرقميـة وزيادة الإلمـام بالتكنولوجيا لجميـع الطلبة والـذي كـان واحداً من التحديات التي تعامل معها البحث، من التحديات الاخرى التي تناولها البحث "التواني الاجتماعي"، والذي يصف الطلاب الذين يعملون بدأب أقل، أو الذين يشعرون بالاحباط بسبب المـادة الدراسية أو بسبب استعمال التكنولوجيا، ويعمل بالتالي بإهتمـام أقل. وأخيراً تمت مناقشته أثر الرأي المعارض للزملاء الآخرين لإستعمال التقانات الحديثة في التعليم على الطلاب لما يحدثه ذلك من إرباك لدى الطلاب وبالإعتماد على حالات واقعية فعلية.

الكلمـات الرئيسية- التعليم الالكترونـي، التعليم المتنقل (الموبايل)، نظـام التصويت، الاختبارات المؤتمتـة، السبورة الذكيـة، البث بواسطة البلوتوث

# I.  Introduction

There is an argument that the best way of maintaining a learning process is traditional learning. Other models are always considered to be inferior or less efficient. There is no finding to support this argument, and researches show that technology learning models are at least as good as traditional learning if not better [Sven G. Bilén, M. Tutunea]. When comparing learning of an identical course in a traditional framework to a computer mediated

learning framework, students have expressed higher satisfaction from the computer mediated learning, and rated the learning as more effective than in the traditional framework. In other studies, too, it was argued that technology – based learning is more effective and interactive. Technology – based Learning includes advantages which are not found in traditional learning, such as: time for digesting the information and responding, enhanced communication among the learners, both as regards quality and as regards urgency, knowledge being acquired and transferred among the learners themselves, the ability to conduct an open discussion, where each learner gets more of an equal standing, a higher motivation and involvement in the process on the part of the learners [Sue Pieper and Kathleen Thatcher].

Organization: This paper is organized as follows:
Section 2 describe a brief comparison between the traditional learning and technology based learning
Section 3 states the problem and promises of improving the student interaction via involving technology in learning
Section 4 describe the employed solution including the controls and type of data collected
Section 5 contains the evaluation based on several parameters

Section 6 is the results obtained which was divided into Two categorize, positive findings and negative findings, based on the effect of the applied technology.
Finally section 7 which include the conclusions.

# I.  Traditional Learning versus Technology Based  Learning

The very use of technology for learning has been found to have a positive effect on the student's commitment to the learning process. Also, use of technology creates a greater commitment on the students' part to learn. Too many points have to be taken under consideration when evaluating the technology based learning as compared with the traditional learning, in terms of reaction for example, gathering feedback continuously, recording a meaningful statistics automatically, in terms of learning, in technology – based learning, tests can be automatically administered, scored, recorded, and reported. Automatic testing reduces the difficulty, effort, and costs of creating and administering tests, which means one can use them more widely. With pretests, you can determine whether learners are ready to begin a course or module [Giuseppe Favretto]. Diagnostic tests will help identify the specific modules or learning objects learners should take. Post-tests will confirm learning or shunt learners to remedial learning experiences, and within-course modules help learners to monitor their accomplishment of the learning objectives [Jason Harloww].

Technology based learning provides learners with inexpensive and easy-to-use testing tools to create tests and standards-based reporting mechanisms to record and report scores. Many tools include

components to create test questions and administer real time tests [Mofreh A. Hogo].

The advantage for evaluation is that the tedious, time consuming and expensive process of distributing, conducting, gathering, grading, and recording tests is automated from start to finish. The effort and costs of tests are reduced, and the results of testing are available for immediate analysis.

The following table summarizes several opinions regarding the comparison between traditional learning and technology based learning [Kimberle Koile]:

**TABLE 1** A brief comparison between traditional learning and technology based learning

|  | **Traditional Learning** | **Technology Based Learning** |
|---|---|---|
| **Classroom Discussions** | The teacher usually write more than talking | The teacher discussion more than writing |
| **Subject Matter** | The teacher conducts the lesson according to the study program and the existing curriculum | The student participates in determining the subject matter; the studying is based on various sources of information, including web data banks and net-experts located by the student. |
| **Emphases in the Learning Process** | The students learn "what" and not "how"; the students and the teachers are busy completing the required subject matter quota; the students are not involved in inquiry-based education and in solving problems, but rather in tasks set by the teacher. | The students learn "how" and less "what"; the learning includes research study which combines searching for and collecting information from web data banks and authorities on the communications network; the learning is better connected to the real world, the subject matter is richer and includes material in different formats. |
| **Motivation** | The students' motivation is low, and the subject matter is "distant" from them. | The students' motivation is high due to the involvement in matters that are closer to them and to the use of technology. |
| **Teacher's Role** | The teacher is the authority | The teacher directs the student to the information |

## I. Problem Statement and Context

A promise for improving student interaction and learning, a work has focused on development and deployment of Voting systems, automated examination, interactive board, notepad, and multimedia in the classroom, as well as a free access to wire and wireless internet inside and outside the classroom. Also and as a step towards m-learning, the Bluetooth broadcasting system was used. As with any other kind of technology, it is required to investigate whether the promised benefits can be realized. Our hypothesis has been that such a system will improve student learning, especially among students who might otherwise be left behind. Our goal has been to test this hypothesis by rigorously

assessing student learning in controlled studies involving deployment of the system. We report here the findings from our most recent and most valid study till the time of this writing.

## I. Solution Employed

We conducted a study in Baghdad University – College of Science for Women – Computer Department – First Year – logic design subject and Third Year – modeling and simulation subject in 2010 – 2011. The course had an enrollment of 32 first year students and 25 third year students taking the course met in 2 hours classes one time a week—lecture plus 2 hours laboratory for both subjects. The technology used in the study consisted of PCs in a network connected Classroom with free access to internet, interactive board, notepad, voting system, multimedia, automated examinations, Bluetooth broadcasting system. The PCs is used for wire and wireless internet access as well as for automated examination using "Quiz Creator" software as well as using other software or tools in the exams like the MATLAB, calculator, etc. The interactive board gives a very wide options never been available in the white board, which intern increases the interactivity, ability to explain some difficult ideas with easer way and less time which intern gives more time for the lecturer for contacting with the students and the ability to give more material within the same lecture time, no mention for the ability to store the lectures as text or as a video file where the audio is taken from the tutor and students discussion and the video captured from what is written on the interactive board, it is important here to add the curiosity of the student to use the interactive board and the effect of that on his skills. Notepad, on the other hand allows students to wirelessly and anonymously submit digital ink answers to in-class exercises. The instructor chooses student submissions—both correct and incorrect—to be used as the basis for class discussion. Automated examination gives an excellent way testing the students with different kinds of questions for any time with the ability to each students to know his/her score immediately, there are two important thinks; first, the right answer, second, his/her level of understanding among the other students. Voting system, from the other hand is one of the most promising interesting systems to be used in the classrooms. The system enables real-time performance tracking (real – time windows into each student's understand of concepts), immediate feedback and review. These devices can provide a foundation decision making based on data at scale never before possible as well as increasing students learning and engagement with each other as

well with the lecturer, the wireless design saves time, paper and investment costs in networking or purchasing, student PC, with this total solution, teaching environment can be more interactive and be different from traditional presentation style. Finally, the wire/ wireless free internet access is used to close the digital divide and increasing technology literacy in all students which was one of the challenges.

*A.* **Controls**

The study was run with one control class and one experimental class. Students in the experimental class used technology based learning; students in the control class used paper handouts as well. The study employed the following strict controls[Graham Attwell, Philip S. Anto'n].

- Teaching style:
  We controlled for teaching style by having the same instructor teach both the control and experimental classes. The instructor began each class with a review of material, lecturing and writing on an interactive board,…, or referring to class handouts. The instructor spent the majority of class time (between 75% and 90%) engaged in high levels of teacher-student interaction: Students asked and answered oral questions, worked written problems individually or in small groups, participated in class discussions of problem-solving approaches and solutions, and worked at their own pace on extra problems when they want. As a result, the students spent most of class time in two ways:
  processing information by solving problems and answering questions, and getting immediate feedback on responses to problems and questions. The voting system greatly facilitated both processing, by letting students easily handwrite answers, wirelessly and anonymously submitting them to the instructor; and feedback, by allowing an instructor to choose submissions for public display and class discussion, often "inking" directly on the submissions. In the control class, the students spent the same amount of time processing information and getting feedback, but at the loss of anonymity and/or discussion of incorrect answers (since students were reluctant to share incorrect answers).

- Class material and exams:
  For the first Year class, in the experimental class, the students received the same information and problems (with 2 hours per week and with much more quizzes and

exams compared with control class of 3 hours per week and less quizzes and exams). For the third Year class, the students in the experimental class receive approximately 40% more information and much more quizzes and exams compared with the control class students.

- Time of day:
  The control and experimental classes met at approximately the same time of day. In this way, we expected to mitigate the problem of students not attending early morning or late classes.

- Student characteristics:
  We only included students who were taking the class for a grade; no listeners included, since such students may not have been as motivated as for-grade students. No graduate students or upperclassmen were included because we felt that they might have had better study habits or might have taken other courses that would have benefited them in the current course.

- Attendance:
  It is included in the study, just as a reflection of student's interest and involving with the subject without making it as factor affecting the students score.

- Other colleague's resistance:
  The other colleague's resistance against the use of new technology in learning, prefer the traditional ways, and their effect on students learning are discussed based on practical situations

*B.* **Types of Data Collected**

- Amount of technology use:
  The number of minutes that technology was used in the experimental class was recorded. Inherent in our hypothesis of improve in learning is the idea that the amount of time spent learning a task is correlated with the amount learned [Sue Pieper and Kathleen Thatcher].

- Performance metric:
  Exam score was used, percentage of attendance, student's involvement with lecture, gradual interest and involvement of the students with technology (mainly the increased number of internet users out of the lecture time, their curiosity about updating their knowledge about technology) as the performance metric.

- Interaction metric:
  In the experimental class, we used the number of answers submitted by each

student for each problem within the specified time as a quantitative measurement of interaction in the class, as well as the student interest, rush, and passion .

We compared the number of answers expected with the number actually submitted and computed an average daily submission fraction for each student. Our goal is to see if this measure of interaction would correlate with performance scores. No such metric was easily computed in the control class, so our analysis was limited to the experimental class.

- Learning preferences and interests:
  Data on learning preferences, self-perceptions, and levels of interest and satisfaction was collected by evaluating questions asked of students in two surveys, one survey given at the beginning of the term, a second at the end. We only considered "*disagree*" and "*agree*"; we insured that the learning preferences were more validly reflected in the statistical results.

  Multiple timed few-minutes observation periods of students and short after-class interviews with students validated or clarified observed learning preferences and individual surveys.

## II.   Evaluation
- Technology use [Jason Harloww, Mofreh A. Hogo]

The technology was used in 2 of 4 classes by both design and circumstance. During each class that technology was used, we did not count the minutes used for administrative procedures, such as login; or time spent fixing technology glitches, such as interference with wireless connectivity. At the end of the Year, we tallied approximately 900 minutes of technology use for the third class over the 30 days, which accounted for 35% of available class time and approximately 1600 minutes of technology use for the first class over the 30 days, which accounted for 66% of available class time, the reason for this time difference was mainly for the other colleague's resistance and social loafing.

- Attendance:
As mentioned above, the attendance in the study was included to reflect the student's interest with subject because of the use of technology. We started with 80-90% attendance at beginning of the Year and ended with normally zero absence students (without

excuse) at the end of the Year, comparing that with normal 80-90% attendance in the controlled class.

- Performance metric:
When comparing exam scores for the experimental and control classes, we saw highly statistically significant differences in the scores of the experimental class compared with controlled one. We looked at this performance data in several different ways.

## II.   Results
To see the impact of education technology on student's achievement (regarding the case studied), the results of this work divided into two categorizes based on the effect of applying these technologies:

### C.   Positive findings
1) On average,  students who used technology in learning scored at the 75th percentile on tests compared to students in the conditions without computers who scored at the 55th percentile
2) Students learn more in less time and the lecturer can  give more in less time
3) When the technology used, the contact between the lecturer and all students and each student so that each student know that he may be the focus point at any time during the lecture
4) Students like their class more and develop more positive attitudes when their class include technology   and  their  own  self-concept improved consistently
5) Through the use of technology – based learning students  surpass  students  in  traditional classroom  on  measures  of  depth  of understanding, maximizing their reflection and encourages progressive thought, taking multiple perspectives, and independent thinking

### D.   Negative findings
1) A lot of students think about the technology first and the education later
2) Technology resistive colleagues
3) Technology resistive student
4) Class level at which the technology employed
5) Lecturer experience in the used technology and how to get use of it perfectly towards his subject.
6) Drill, practices, home works, and some materials that required focusing and more time for understanding is better done with traditional way, otherwise it will require professional technology user to make it more understandable

The higher performance of the students in the experimental class was evident when we looked at the performance distribution, (Fig 1 and Fig 2).

When we ranked final exam scores for both classes, we saw that eight of ten scores in the control class were below the lowest, two scores in the experimental class (Fig 3 and Fig 4).

## VII.  Conclusions

This work makes important contributions: a sound assessment methodology and validation of learning gains among students using technology-based classroom interaction system, especially among the low performing students. The instructor's teaching style matched the technology well in that it emphasized student problem-solving and immediate feedback. The goal of the study was to test the hypothesis that the use of technology based learning system improves student learning, especially among the poorest performing students, as well as increase their engagement with  each other and with the lecturer, no mention for the increase of attendance. This paper describes our validation of that hypothesis, and the controls, performance metric, and assessment methodology that we developed in the course of our study. The study shows that the students with better basic computer and Internet skills prefer the moderate learning methods. On the other hand, the concern should not be just with whether moderate learning methods is conducted successfully using the technological tools available, but more on whether the institutions did what they set out to do, i.e., educating students.

However, Technology – based learning should not be used as a replacement for traditional learning. It should be considered as a supplement to traditional learning, as an added-value for the learners, and the optimal system would be the integration of traditional learning and technology based learning.

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Distribution of performance average score
for traditional (controlled) and technology
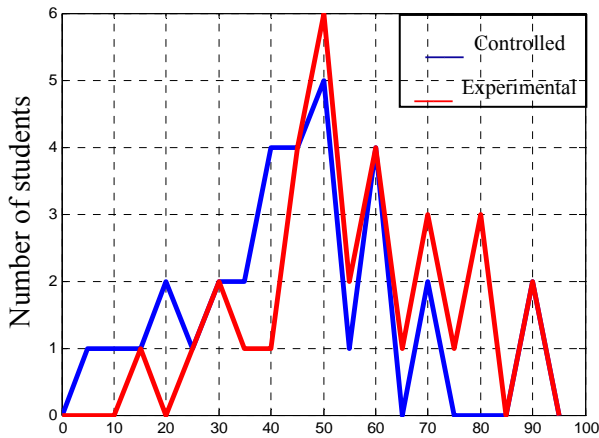based (experimental) students



Figure 1  Distribution of 1$^{st}$ Year average
students ranks

Ranked performance average score for
traditional (controlled) and technology based
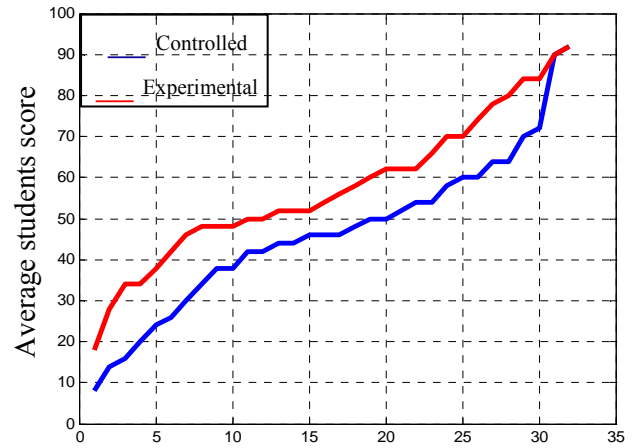(experimental) students



Figure 3  average rank ordering of 1$^{st}$ Year
students

Distribution of performance average score
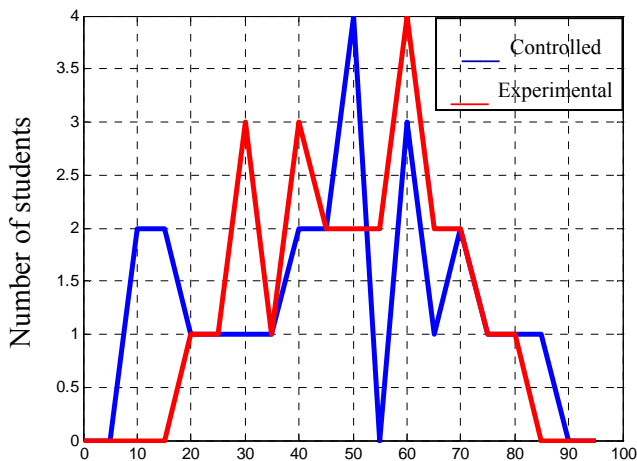for traditional (controlled) and technology
based (experimental) students



Figure 2  Distribution of 3$^{rd}$ Year average
students ranks

Ranked performance average score for
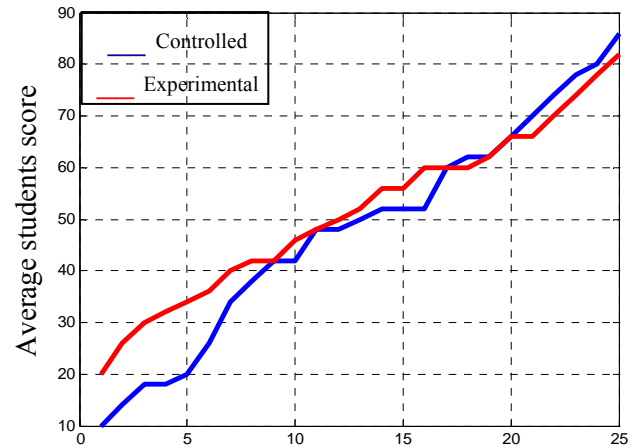traditional (controlled) and technology based
(experimental) students



Figure 4  average rank ordering of 3$^{rd}$ Year
students