Computer Aided Presentation In Instruction: An Effect Size Approach.

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ملخص البحث

تهدف هذه الدراسة إلى تطوير و تقييم تصميم للإلقاء المعزز بالحاسوب لاستخدامه داخل صف دراسي. وقد بينت النتائج التي تم الحصول عليها أن لإستخدام الالقاء المعزز بالحاسوب أثر إيجابي عال على أداء الطلاب وكشفت الدراسة أيضا أن استخدام الإلقاء المعزز بالحاسوب يتأثر بالجنس وعدد الطلاب لكل كومبيوتر والمدرس والخبرة السابقة في الحاسب وتفاعلاتها.

Abstract

. This study aims at developing and evaluating a CAP design for in classroom use .The result obtained showed the significant positive impact of using CAP on student performance. The study also revealed that the use of CAP is effected by gender, number of student per computer, instructor, previous computer experience and their interactions.

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Introduction

The past ten year has seen a shift away from transmission model of lecture based courses to one where students take greater responsibility for their learning. Best practice recognizes that conventional lectures are relatively ineffective in terms of providing an opportunity for learning. However, lectures do have a role in motivating students and maintaining a sense of common purpose. Accordingly lectures are increasingly deploying Student-centered activities in lecture that encourage the student to reflect on the lecture content and provide the opportunity to refresh their concentration. Such developments gave rise to the question "what role do computers have to play in such developments."?

Computers can and should be used to provide multimedia illustrations of concepts introduced during the lecture, including images, diagrams, animations, video and sound. while all these media can be delivered individually without a computer, current presentation software also allows them to be integrated into a single presentation, thus creating an educational software for in-classroom use. The key to educational technology is software and what the students and teachers do with it. Judging the appropriateness, effectiveness and capability of technology in the

classroom is difficult. New classroom tools mean new opportunities for learning and teaching.Simple-to-use multimedia authoring applications, presentation software, digital media collections, the internet, and new educationally-valid curriculum-based software are all making the learning-centered classroom a reality. The use of presentation software in a classroom setting gave rise to the term computer-aided-presentation (CAP) which is the topic of the next section.

Computer Aided Presentation in Education

The use of presentation software technology has made instructional presentation more effective, so that instructors are able to lecture in relatively big classrooms and use a variety of media. In this method of presentation, instructors can utilize the power of computers and bring sound, text, graphics, motion pictures, and video clips into the classroom.

As noted by (azarmsa, 1991), maximizing the impact of a larg group Presentation is a key aim of every instructor. The fast pace of multimedia Presentation helps keep students alert and attentive.

The use of presentation software has been evolving rapidly in recent years. (Diabiase & krygier, 1994) described early work in

presentation software in their discussion of the design, production, implementation and evaluation of the use of presentation software as teaching resources for the Gaia course. (Whitnell et al, 1994), used presentation software to construct lectures for a multimedia physical chemistry course. They suggest that the most successful multimedia lectures are usually quite different from traditional lectures.

(Matthews, 1996) used presentation software to teach molecular biology for medical students. The software used was then embedded in a package called MOBY for use outside the classroom. MOPY uses a classical approach supplemented with hypertext, graphics, sound, and animation. His observations indicated that such use of presentations makes concepts easier to understand, and retention and application follow automatically . The study reported that MOBY has been high successful, as judged by instructors perception and several hundred students evaluations.(Pence,1996) used presentation software to give his lectures in general chemistry from a computer .He noted that presentation software combined the least presentation time with the greatest flexibility.

The study showed that this method allowed a close integration of text and images, which helps students to better understand and

remember the concepts. Student's response to this method of instruction has been very positive. The use of presentation software has been shown to be very useful in disciplines requiring extensive use of multimedia presentation such as geography.(Krygier,1997) described an educational application of multimedia for geography and earth science education based on the assumption that multimedia is more than mere technology. The results indicated that students strongly prefer multimedia resources with some kind of movement .Students also claimed enhanced understanding from some of the more complex resources as compared to static depictions of the same materials in their course reader.(Ellis & Riely,1998) reported their use of presentation software to maintain visual impact in key note lecture in civil engineering .There approach was a success based on students response to this approach .Their study encourages instructors to use presentation software in lecture delivery.

(Moody,1998) studied the use of presentation software as the medium of delivery, as opposed to the traditional chalkboard or white board in chemistry courses. The study also reports the advantage of having the text and the images presented simultaneously. The result of student's opinion survey indicated that this approach was well received by the students.

(Biggs, 2000) used presentation software as apart of the collaborative learning environment (CLE) which is based on the assumption that every class can benefit from enhanced collaboration among students and between students and instructors .The results indicate that the level of collaboration increased. However, student's performance was not tested yet.

A recent application of presentation software is the production of web-based presentation for classes developed by (Furr, 2001). The implementation was in the form of a package called

Streaming Audio. Furr reports that the student response to the full Integration of streaming audio into the courses was very positive.

He also reports that such use of presentation software enhances student centered, interactive education.

The above studies don't indicate a particular best practice in designing computer-based presentations although such best practice was investigated for other online applications of computer-aided-learning (e.g., Graham et al, 2001). A best practice gives guidelines to effective designs along with criteria for evaluating such designs. Also all in-classroom use of presentation software use a particular instruction mod which is a computer linked to an LCD projector and a wide audience.

Individual uses of such software by students was only allowed outside the classroom to down load the lectures, or for individualized learning, no investigation was attempted regarding the use of such software for individual, pair, or group use inside the classroom supervised by an instructor, which is an obvious negligence of an important dimension of research concerning the educational use of presentation software. Another problem with computer-aided-presentations is "evaluation". All evaluations reported above are based on students and instructors response. Such evaluation are based on the assumption that no technology is effective if the audience for whom it is designed is unable or unwilling to use it, so the studies are actually reporting students attitudes towards such a technology, but what about the actual effect of using computer-aided-presentation on students performance ?.

Evaluation in general is a rich and wide area of research concerning the use of computer-aided-learning (CAL).

There are several frameworks for evaluating CAL effect, however, no such evaluation framework was developed for computer-aided-presentation .To develop a frame work for evaluating the effect of using computer-aided-presentation ,one

must review what has been done concerning CAL evaluation and what it misses which is the subject of the following section.

CAL Evaluation

Numerous people are involved in some way in introducing learning technology into teaching, whether in acquiring and using some software developed elsewhere or in authoring new software. Having put in considerable effort during a project, we generally whish (or are required by others) to be able to show something about the results. Simply delivering the software on a disk is seldom felt to be enough: what can be done to pull together and present further evidence?

Such further evidence is referred to as "evaluation", and the teaching material being evaluated is referred to as "courseware". (Draper, 1996) classified CAL Evaluation into four general types. These types are not mutually wholly exclusive, but distinguishing them may be helpful before they are combined in individual cases. These types are based on the different purposes or roles an evaluation can be designed for:

-Formative evaluation: to help improve the design of the CAL.

-Summative evaluation: to help users choose which piece of CAL to use and for what.

-Illuminative evaluation: to uncover the important factors latent in a particular situation of use.

- Integrative evaluation: to help users make the most of a given piece of CAL .

These types become the bases for evaluation framework developed later on.

Evaluation is a major concern when using learning technology. As (Harvey, 1998) points out, despite the support offered by government-led initiatives, many lecturers remain unwilling to use technology in the support of teaching and learning without an assurance of the long-term benefits, but supporting evidence and good case studies are not easy to find because the lecturers who are implementing learning technologies do not see the need to report their experiences to the wider academic community for the following reasons:

*an evaluation study will take too mach time.

*they feel that they already know whether her students are benefiting from the use of CAL .

*The results form summative assessments are taken as sufficient evidence of success(i.e., students response).

Another problematic issue with CAL evaluation is the evaluation methods. According to (Ehrmann, 1999), a range of different methods have been used to evaluate the use of CAL and each has advantages and disadvantages depending on the context. Such evaluations use checklists, questionnaires, observation methods, confidence logs, focus groups, and pre -and post-testing of students. Generally, staff are keen to select a method that is going to take as little time as possible but will also produce results with a certain level of academic credibility. Thus, their CAL evaluation usually involved either the class being split into two, with half being taught with traditional methods and half using a piece of CAL to cover the same material, or assessing students pre -and post use of CAL, or a combination of both approaches. These approaches are useful in revealing changes in student's knowledge, and can provide useful comparative studies. However, these method relay on comparing group means (i.e. tests of significance), but such a comparison was criticized by (Ehrmann, 1998) in that it doesn't provide the actual size of impact of the factor in question on the outcome. That is, an experiment may show that a certain factor has a significant impact on the outcome but it does not show the size of that impact and the percent of variation in the outcome accounted for by that factor. Another criticism comes from (kiess,1996) he

states that tests of significance are directly effected by sample size, which leads to situations in which significance is achieved because of a large sample size although the difference in means is very weak, or significance is not achieved because of a small sample size, although the difference in means is very large.

It is such criticism that made global findings in educational research hard to uncover and validate. Once found, they are by no means accurate predictors of what happens locally; too many other factors intervene. Thus global theories about CAL are at best hazardous guides to local realities. The deficiencies described limit the use of significance tests and make global comparisons nearly impossible, and the question rises"is there away to overcome these difficulties"?

To make up for the deficiencies associated with significance tests concerning CAL use, we suggest the use of effect size.

The effect size is a measure of the size of the difference or the relationship between two or more variables (Tabachnick & Fidell,1996;Marcoulides & Hershberger,1997).

Despite the widespread use of effect size in Educational and physiological research, it was ignored in any evaluation framework concerning CAL so far, but does the use of effect size

offer a solution to the problems associated with CAL evaluations and thus the Evaluation of computer-aided-presentation (CAP).

The answer is yes for several reasons. First, the effect size is independent of sample size, this makes up for the sample size dependency in significance tests. Secondly, the formulas for effect size computation cover all known Significance tests and use their comparison statistics. (e.g., chi-squar,t,... ,etc) as the bases for computation, so no extra work or a change in the research context is needed. Finally, the approaches to the interpretation of effect size provides a solution to the measurement of impact and the percent of variation accounted for by a certain factor.(e.g., instruction method) problems described earlier, and can also serve as a bases for global comparisons. The first approach classifies the effect size into three levels : small, medium, and large according to a reference table (Kiess,1996). The reference table is used to determine the level of effect size for each measure of effect size (e.g., d,r, eta,...,etc) . The table can be found in the statistical references of this research. Such a classification provides a bases for global comparisons, for example, if the effect size of a certain instruction method was found to be large in some local context, another study of the same instruction method may attempt to conduct a global comparison assuming that the effect size will

remain large. Such a comparison depends on the level of effect size not its value, because values may be local but levels are global within the same context. The second approach interprets the value of effect size as the percent of variance explained by the factor in the question (Marcoulides and Hershberger, 1997;Tabachnick & Fidell, 1996). This approach

Gives the actual value of impact of a factor in an experiment (i.e., the amount of variance accounted for by that factor).The remaining unexplained variance serves as an indication-for the researcher-of other factors that need to be investigated in the context of the experiment.

For these reasons we recommend that any CAL evaluation (in this case, computer-aided-presentation) should include the effect size of the factors being studied.Before proposing an evaluation framework for CAP, we should discuss a particular design to be implemented and then evaluated,which is the subject of following sections.

Purpose of Study

The study aims at developing a best practice in designing in-class computer-aided-presentation in an in- classroom context. The study also investigates factors that may effect the use of

computer-aided-presentation in an in-classroom context. Evaluating the effectiveness of computer-aided-presentation on students performance (evaluated by exam scores)and the impact of such use is another aim of the study.The study also demonstrates the benefits of adding the computation of effect size as a complement to conventional evaluation frameworks (controlled experiments).An important goal of this study is to evaluate the cost-effectiveness of using computer-aided-presentation in terms of software and settings (e.g., number of students per computer)

Objectives:

The context of using CAL in general and computer-aided-presentation in particular involves several issues such as: design criteria ,instruction mode, instructor, number of students per computer, cost-effectiveness, and factors effecting students performance other than the technology used such as :gender, previous computer experience, and computer attitudes(e.g., Abo nasr & Sulisel,2000;Busch,1995;shashaani,1994;Taylor & Mounfield,1994).

Given the above issues, the objectives of this research are formulated as follows:

1-Proposing a design for in-classroom use of computer aided presentation that implements a best practice concerning text and images association, embedding video clips in the presentation and level of interactivity allowed for students.

2- Evaluating the effect of the purposed design on students performance (measured by exam scores) ,and the size of such an effect.

3-Evaluating the effect of factors related to the in-classroom use of computer-aided-presentation: number of students per computer, sex, instructor, previous computer experience (measured by students scores in the conventional computer course offered in high schools) and their interactions.

4-Evaluating the cost-effectiveness of the purposed computer aided presentation design.

Questions

1- Is the proposed computer-aided-presentation design in its instruction modes (one student per computer, two students per computer, and three students per computer) more effective than the conventional method (chalk and talk) in terms of students performance evaluated by exam scores?.

2- What is the size of impact (i.e., effect size) of using the proposed design on students performance?

3- Does students gender in the CAP groups effect their performance? and if so, what is the size of this effect?

4- Does the performance of students in the CAP groups vary according to the instructor using the presentation? and if so, what is the amount or size of such a variation.?

5- Is there a relationship between students performance in the CAP groups and their previous computer experience within the school context (i.e., computer course offered in high schools),and if so, what is the size of this relationship?

6- Does the interaction between gender, instructor, and number of students per computer effect students performance in the CAP groups?

7- Is using the proposed CAP design cost-effective?

Hypotheses

1- There are no significant differences in students performance between the CAP groups (1 student per computer,2 students per

computer, & 3 students per computer) and the conventional groups. Thus the effect size of the instruction method small.

2- There are no significant differences in performance between CAP students according to gender and thus, the effect size of gender is small.

3- There are no significant differences in performance between CAP students according to the instructor using the presentation and thus, instructor as a factor has a small effect size.

4- There is a strong positive relationship between students performance in the CAP groups and their previous computer experience. The size of this relationship is large.

5- There are no significant differences in performance between CAP students due to interactions between the number of students per computer, gender, and instructor (i.e., gender x instructor, gender x number of students per computer, instructor x number of student per computer, and gender x instructor x number of students per computer).

6- The effect size of each interaction is small.

The Proposed Design

The proposed design is based on our interviews with the instructors in high school in Gaza .The interviews aimed at identifying a set of best practices that the instructors-based on their experience- feel that when implemented in a context of in-classroom presentation would give the maximum impact on students learning and performance.

The proposed design focuses on three practices: the association of images with text, embedding video clips in the presentation, and student's interactivity with the presentation. Best practice advises that:

1- Text and relevant images should be presented in the same slide because the association of images with text has a positive educational effect.

2- The embedding of video clips into the presentation should be in a separate frame (a branching process) from the slid presenting the topic discussed in the video clip. The use of video clips in presentations is quite easy because "there is a video clip for almost every thing".

3- The level of interactivity allowed for students should be on the form of backward and forward buttons. this allows the students

to move the slides forward and backward as instructed by the teacher giving them a feeling of interactivity and at the same time

keeps the teacher in control of the pace of the in-classroom presentation. branching to a video clip should be activated by Students via a button added to the slide which employees the video clip .Another benefit of this design is that it can be easily used for outside the class activities as a learning resource, however ,the investigation of the effects of such use is beyond the scope of this research .The design was implemented using power point presentation software because:

1- Power point is simple to use, and learning its various features is not time consuming.

2- It is cost effective compared to most other authoring packages.

3- It is readily available to anyone.

4- It is excellent from the point of view of the presentation of still Images, video clips and their integration with text, sketches and graphics. The course module covered by the presentations is emprology, which is a topic in which students traditionally encounter difficulties ,and the teachers feel that the students

might benefit from video-based presentation. Each presentation contained 15sildes on the average along with the associated video clips ,and the duration of each presentation was 35minites on the average .The course module was covered in three presentations

Frame and Sample

The study involved high school students in Gaza in the period from 1\4\2001 to 1\6\2001 .the students(male and female)were selected randomly from high school across Gaza.

The selected sample comprised or 2160 students (1080 males and 1080 females. The selection was made from consistent student population (i.e., students of the same level of previous performance or nearly so). The relatively large sample size was intended to provide more stable results and to show the importance of using effect size as will be shown later. All students had no previous computer experience other than the computer course offered at their schools.

Procedure and Data Collection

The sample was divided into tow groups (the conventional group and the CAP group),each group had a total of 1080 students (540 males and 540 females).

The CAP group was sub divided into three groups (180 males and 180 females each):

Group 1(1 student per computer), group 2(2 students per computer),and group 3 (3 students per computer) . The conventional group was denoted by group o.

The instruction in the conventional group was carried out using conventional methods (chalk and talk). The CAP groups were taught using the proposed Design. Four different instructor were assigned to each CAP group, so each Instructor taught 90 students in each CAP setting (1 student per computer, 2 students per computer, and 3 students per computer). At the end of instruction, students were given an exam in the subject taught and their scores were collected .The exam was developed and provided by the department of evaluation and measurement in the ministry of education in Gaza .

The exam contained 20 questions (true or false, and multiple choice) with one grade for each correct answer, so the total score is 20 grades for the entire exam.

Statistical Analysis

A number of statistical procedures were used to verify or refute the hypotheses as follows:

1- An analysis of variance (ANOVA) was performed on students exam scores to test for differences in performance between the control (conventional) and experimental (CAP) groups.A scheffe multiple comparison tests were then performed to determine between groups differences.

2- Based on the results of the (ANOVA) test, the effect size was computed to determine the impact of using CAP on students performance and the amount of variance Accounted for by the instruction mode. The formula used for comparisons that for Eta-squared:

Eta-squared = SSA/AAT

3- A univariate analysis of variance (experimental design)was conducted on students exam score in the CAP group, to test for differences in students performance according to gender, instructor, number of student per computer ,and interactions, and to determine the effect size of each factor on students performance. The formulas for computation of effect size used here can be found in the statistical references of this research.

4- A t-test was performed on student grades in the computer course offered in high schools in Gaza (as a measure of computer experience) to test for differences between male and female

students. The test was conducted to confirm the researcher doubts that the differences in performance between male and female students that appeared in the experimental design were actually a result of differences in computer experience, rather than a result of gender differences.

5- Finally, the correlation coefficient (R) between student's exam scores in the CAP group and their grades in the computer course offered in their schools. The produced coefficient was then used to compute the size (i.e., effect size) of the relationship between the two score-using R-squared and the amount of variance in students exam scores accounted for by variations in the computer grades.

6- The sum of all effect sizes serves as a measure of total variance accounted for by the factors of this study. The amount of variance unaccounted for is either error or uninvestigated factors.

Result and Discussion

1- The result showed significant differences between the conventional group and the CAP groups in favor of the CAP groups.

Table (1) gives descriptive statistics of the sampl Groups

Group number	Mean	N	Std-deviation
0	6.25	1080	3.54
1	17.55	360	1.74
2	17.58	360	2.28
3	17.4	360	2.12

Table (1) descriptive statistics.

The table shows a clear advantage of CAP groups over the conventional group in the course taught using the two methods.

Table(2) gives the ANOVA results and the associated effect size.

Source of variation	Sum of squares	df	Mean squares	F	SIG	Eta squared
Between groups	68451.488	3	22817.163	2714.3	*	0.791 (large)
Within groups	18123.975	2156	8.406			
Total	86575.463	2159				

*Significant at the 0.01 level.

Table (2). ANOVA table

The table shows a large effect size of the instruction method used that is accountable for 79% of the variation in student's scores. The result indicates a significant impact of Using CAP on

student's performance. The result also indicates that there are possible factors other than the instruction method responsible for remaining 21% unexplained variance. Such factors may be related to the classroom context, which indicates the need for further investigation of the classroom environment.

Table (3) gives the result of the scheffe multiple comparison tests for group differences

Group(i)	Group(j)	Mean differences (I-J)	Std. Error	Significance
0	1	-11.3(*)	0.18	Sig
	2	-11.33(*)	0.18	Sig
	3	-11.15(*)	0.18	Sig
1	0	11.3(*)	0.18	Sig
	2	-0.025	0.22	Non sig
	3	0.15	0.22	Non sig
2	0	11.33(*)	0.18	Sig
	1	0.025	0.22	Non sig
	3	0.18	0.22	Non sig

3	0	11.15(*)	0.18	Sig
	1	-0.15	0.22	Non sig
	2	-0.18	0.22	Non sig

*Significant at the 0.01 level

Table (3). Scheffe test.

The table shows significant differences between CAP groups and the conventional group in favor of all CAP groups, this indicates an advantage of using CAP with a different number of student per computer (1,2,or3) against the conventional method. Further more there are no significant differences between CAP groups, which is an indication of the coast-effectiveness of using CAP in terms of number of students per computer. The results in table 2 and 3 Clearly show that using the proposed CAP design is more effective then the conventional method especially in subjects that are considerably difficult (the performance of the conventional group was relatively low) . The CAP instruction mode used (1,2 or 3 per computer) allows variations in students number per computer without significant differences in performance and yet maintains an advantage over the conventional method, which is the essence of coast-effectiveness.

2- The results of correlation between students performance

(measured by exam scores) in the CAP groups and students pervious computer experience (measured by their grades in the high school computer course) show a strong positive relation ship between the two variables with R=0.74 The size of this relationship (i.e.,effect size) measured by R-squared = 0.54 Which indicates that the size of the relationship is large and that the variations in student computer course grades are accountable for %54 of variation in student's exam performance thus, students performance when taught using CAP is greatly effected by their computer background. But what about the remaining %46 of unexplained variance in the CAP group exam scores The answer lies in the variables of the CAP context (i.e., gender, instructor,
students number per computer, and their interactions) as will be show next.

3-Table (4) gives the results of the univariate analysis of variance and tests of between subjects effects for gender , instructor , number of students per computer , and their interactions in the CAP group

Source of variation	Type III sum of squares	df	Mean squares	F	Eta squared
Gender	39.675	1	39.675	13.486(*)	0.013
Instructor	144.825	3	48.275	16.409(*)	0.045
Student num/comp	6.45	2	3.225	1.096(-)	0.002
Gender x instructor	499.425	3	166.475	56.585(*)	0.138
Gender x student num /comp	20.85	2	10.425	3.543(**)	0.007
Student num/comp x instructor	447.15	6	74.525	25.331(*)	0.126
Gender x instructor x student num/comp	378.75	6	63.125	21.456(*)	0.109
Error	3106.8	1065	2.942		
total	335709	1080			

(*) Significant at the 0.01 level

(**) Significant at the 0.05 level

(-) Non significant

Table(4) Univariate ANOVA

The results show that in the CAP group:

A- There are significant differences in students performance due to gender. Students gender is accountable for %1.3 of variance in student's exam performance scores, thus, gender is statistically

Classified, as having a small effect size despite its statistical significance.

B- There are significant differences in students performance according of to the instructor using CAP. Instructor as a factor is accountable for %4.5 of variance in students performance, and is classified as having a small effect size.

C- There are no significant differences in students performance according to the number of students per computer. This factor is accountable for only %0.2 of variance in students performance. This result is another indication of the cost effectiveness of CAP.

D- There are significant differences in student's performance due to gender and instructor interaction.

This interactions accountable for %13.8 variance in students performance and is classified as having a medium effect size.

E- There are significant differences in student's performance due to gender and students number per computer interaction.

This interaction is accountable for only %0.7 of variance in students performance and is classified as having a small effect size.

F-There are significant differences in students performance due to instructor and number of students per computer interaction. This interaction is accountable for %12.6 of variance in student's

performance and is classified as having a medium effect size.

G- There are significant differences in student's performance due to gender, instructor, and students number per computer interaction this interaction is accountable for %12.6 of variance in students performance and is classified as having a medium effect size.

These Factors and their interactions account for %44 of the variance in student's performance. However the greatest impact on students performance in the CAP groups comes from there computer experience (%54), which suggests that the effectiveness of using CAP depends mostly on student computer background obtained from the computer course offered at their schools, this is another indication of the cost effectiveness of using CAP because the computer course is already a part of the school environment, no adaptations or extra expense is need to prepare students for CAP. In fact ,computer experience may be responsible for the significance achieved by factors of the study and their interactions, we start by gender. The effect size of gender is small suggesting that the differences in performance between male and female students are a result of variations in computer experience rather than gender. Table (5) give the result of the t- test performed on CAP group students (male &female) computer course grades

Gender	N	Mean	Std-deviation	T	df	sig
Male	540	16.05	2.16	-3.28	1.078	*
Female	540	16.48	2.17			

*Significant at the 0.01 level

Table (5). T-test results for CAP group students (male, female)

The results of the test show significant differences in computer background in favor of females . Female students also performed better than male students in the subject taught using CAP. Thus, gender and its interactions are effected by computer experience. The variations in computer background of instructors who participated in this experiment maybe responsible for the differences observed in each instructors groups, because some instructors were more familiar with computer and presentation software than others, but this assumption needs more validation in terms of attitudes which is beyond the scope of this research. Nevertheless, the influence of computer experience in a CAP context is evident . The factors of this study combined account for %98 of the total variance in CAP group students performance, the remaining %2 are either an indication of measurement error or factors that need investigation. Note that without the use of effect size as a complement to the conventional evaluation framework for CAL in general and CAP

in particular one has no way of reporting the relative importance of a significance achieved by a certain factor or how much variance is accounted for by a factor or a group of factors or the total variance in date explained by the researcher's proposed factors of study .That is , effect size can be used as a measure of what has been explained (in terms of variance) and what has been left unexplained, thus giving global as will as local indications and helps in narrowing the gap between local findings and global generalizations.

Summary of Results

The obtained results of analysis show that:

1- The proposed CAP design in its instruction modes (1-student,2-students,3-students per computer) is more effective as a method of instruction than the conventional method .The effect size of the instruction method used is large and is accountable for 79% of variance in students performance in sample .

2- Student's performance in the CAP group is strongly related to their previous computer course performance (i.e., previous computer experiences). Such an experience has a large effect size (%54 variance explained) and has the greatest effect on students performance in CAP groups compared to other factors.

3- The number of students per computer has no significant effect on their performance.

4- Gender, number of students per computer, instructor and their interactions account for 44% of variance in CAP students performance , however , their respective effect size ranges from small to medium .

5- The study gives evidence that the variation in performance between male and female students is a result of variations in their computer course performance.

6- The factors investigated in the proposed CAP context (i.e., computer experience, gender, instructor , number of students per computer , and their interactions) account for 98% of variance in students performance suggesting that the experiment was somewhat comprehensive .

7- The use of proposed CAP design is cost effective in terms of software and settings.

Conclusion

This research has shown great potentials of using LAP as a method of instruction for high school science. The CAP design investigated by this study was shown to be cost effective in terms of software and number of students per computer and since any computer lab in a high school contains 20 computers on the average, it is clear that the use of CAP in the proposed context

can accommodate a class size of 20 to 60 students without any lose of effectiveness.

The use of CAP dose not have to replace the conventional method entirely, instead we suggest the following:

Course material that can befit from the use of CAP capabilities and from embedding video clips in a presentation are taught using the proposed CAP design in the school's computer lab while other subjects are taught using the conventional methods . This approach enhances the quality of teaching and thus students performance, it also increases the cost effectiveness of CAP , and activates the role of the school's computer lab in the teaching process .

The research has also shown the importance of adding effect size computation to the conventional evaluation framework (e.g., controlled experiment) of CAL in general and CAP in particular . Such an approach gives new insight into the research results and is a valuable tool in determining the impact of the factors of a study as well as determining what has been covered (or variance explained) by the study and what has not .

For effective use CAP in schools, instructors must be trained to handle presentation software. A cost effective way of doing so is by introducing presentation software in computer courses offered to students in education colleges because instructors tend to use

what they know to teach and if they know how to use presentation software, they will use it in teaching and thus enriching the teaching process which will have a positive impact on students performance.

Students computer experience has been shown to be a very critical factor in their performance when taught using CAP , we suggest extra effort in developing the computer course offered in a high schools .

Finally, the CAP design proposed is by no means the only effective design. Other effective designs should be investigated with different settings. Further research should be conducted to compare different CAP designs with different settings against our design, such a comparison can be enriched by reporting the associated effect size of each proposed CAP design.

We hope that this research has shown the effectiveness of using CAP in teaching and the importance of embedding effect size in an evaluation framework concerning CAP .

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