A COMPARISON OF TRADITIONAL METHOD AND COMPUTER AIDED INSTRUCTION ON STUDENTS ACHIEVEMENT IN EDUCATIONAL RESEARCH

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ABSTRACT

Student learning is the focus of teaching learning process. Theorists and practitioners have always been made concerted efforts to facilitate students learning by enhancing the quality of learning experiences. Emergence of learning theories over time reflects the concern of educators to explore process, factors and conditions involved in human learning. Application of predominant learning theories have always been changing and modifying the methods of teaching and learning. This study examined the effect of computer aided instruction on student achievement in educational research course as compared to traditional method of instruction. An experiment was conducted with the students of three different programs of session 2009-2010 studying at Islamic University of Technology (IUT). The study was conducted using posttest only equivalent group design with matched groups based on grade point average of the winter semester of the academic year 2009-2010. Perfectly matched fourteen pairs of students were selected and assigned randomly to the experimental and the control groups. Students of the experimental group received computer aided instruction, for a period of eight weeks in the form of presentation and tutorials and the control group was taught through the traditional method of instruction. Two null hypotheses were tested by analyzing the data on achievement test. The results revealed that the experimental group outperformed the control group and there was no significant difference in the overall mean achievement scores of the three subgroups of the experimental group. This study was an effort to see how CAI affects the achievement of students in social sciences especially in research and statistics. The main objective of this study was to develop a well structured computer aided instructional package for educational research course so that the learners both students and teachers can understand the theory and at the same time implement the theory into practice.

Keywords: Computer Aided Instruction (CAI), Traditional Method of Instruction (TMI), Students Achievement.

INTRODUCTION

Computer aided instruction is described and defined by Frenzel (1986) as the process by which written and visual information is presented in a logical sequence to a student by a computer. Steinberg (1991) defines CAI as computer presented instruction that is individualized, interactive and guided. He is of the view that CAI is not a method of instruction. Many methods are implemented in it, including exploratory lessons, drills, games and simulations. According to Munden (1996) computer aided instruction is an educational medium in which instructional content or activities are delivered by a computer. Students learn by interaction with the computer and appropriate feedback is provided. Poole (1997) defined computer aided instruction as a computer based system designed to help students learn

subject matter of all kind. Roblyer and Edwards (2000) defined CAI as software designed to help teach information and/or skills related to a topic; also known as courseware. Locatis and Atkinson (1984) describe CAI as a mode of instruction that involves student interaction with the computer directly. Typically, students access program presented in segments, with each segment including information and questions or problems for students' response. The correctness of each response is indicated and remedial or new information is presented. Sometimes students also have the option of requesting help or skipping ahead.

However, the concept of computer aided instruction is not new. According to Wang and Sleeman (1993) the origin of computer aided instruction can be traced back to the invention of small multiple choice items scoring machine by Sidney L. Pressy in 1924 and B.F. Skinner' work to improve and expand the concept of programmed instruction in late 1950s and early 1960s. The use of computer for programmed instruction started in late 1960s.

During 1960s the computer aided instruction was developed and used at a few universities in the United States. The early efforts were designed for providing individualized interactive instruction to many learners simultaneously (van der Linden, 1995).

Brophy (1999) investigated the effectiveness of CAI in science classroom. He tested several pieces of science software. Test results revealed that CAI was an effective mode for teaching science. Carter (1999) examined the effectiveness of CAI in the realm of vocational education and found that CAI was superior to traditional program of vocational education for high school students. He found CAI more enjoyable for students of first grade in 'Math Family' program. Tangpornchotchuang (1997) developed a CAI program covering topics of passive microwave devices and conducted an experiment to check its efficiency. Result of the study proved the efficiency of CAI program higher than the established criteria.

CAI is being used at all grade levels from pre-primary to higher education. Observed effectiveness of CAI in vocational education, nursing and medicine indicates that it is more effective for adult learning. Children are also learning 3Rs (Reading, wRiting, aRithmetic) through CAI. Chauhan (1994) mentions that CAI system has been utilized at all levels of education ranging from elementary school to post graduate studies and on the job training in almost all subjects.

Developed countries have been using CAI for more than three or four decades. A lot of research on various aspects of CAI has been conducted in these countries. They have refined this mode of instruction in the light of findings of researches and are still looking for better use of it. Developing countries are also introducing CAI to their education systems. They have planned and are making efforts for the effective use of this innovative application. The international conference on computer aided instruction and training in developing countries held at Midrand, South Africa on October 10 to 14, 1994 indicates the interest of developing CAI. Participation of delegates from Bangladesh, South Africa, Malaysia, Botswana, Zimbabwe, Namibia, China and many other developing in the conference is manifestation of interest of these countries in quality education through the use of CAI (Alexander, 1995).

South Korea began the use of computer as a new and powerful mode of instruction in 1980s which was more emphasized in early 1990s. South Korean government has decided to expand the use of CAI in schools and has planned to equip class rooms in schools with personal computer and multimedia. Development and distribution of CAI software is the responsibility of Korean Educational Development Institute, Private Industries, research institutions and individual teachers are also engaged in educational software development. Most of the software is for teaching mathematics and science at pre-primary and primary school level. Software for middle and high schools are also available, mostly in the areas of mathematics and science (Huh, 1994). South Africa is also benefitting from CAI especially in distance education. Open University and open colleges in South Africa have adopted this mode of instruction. Malaysian Government has also expanded personal computer laboratory in schools for the growth of CAI (Alexander, 1995).

Rapidly improving computer hardware technology and software development is continuously improving the quality and effectiveness of computer aided instruction programs. Enhanced potential of computer aided instruction due to sophistication in hardware, software and easy operating system invite educationists to inculcate pedagogical skills in the development of software for computer aided instruction. It also necessitates research studies to explore the effectiveness of CAI in various subject areas and at different grade levels. This study is an attempt to determine the potential of a CAI package in educational research. The specific objectives of the study were to:

1. determine the effect of computer aided instruction (CAI) on student achievement as compared to traditional method of instructions in educational research.

2. determine the impact of computer aided instruction (CAI) on the overall mean achievement scores of three sub-groups of experimental group.

3. find out opinion of the experimental group towards CAI after treatment.

METHODOLOGY

The study was based on three different programs of the Islamic University of Technology (IUT), Bangladesh in the academic year 2009-2010. Those were Diploma in Technical Education (DTE) stream and Diploma and Higher Diploma stream of Bachelor of Science in Technical Education (BScTE). Due to shortage of time and other constraints, only three programs were purposively selected for this study.

The first phase of this study was concerned with the development of package for CAI and in the second phase an experiment was conducted to determine the effectiveness of CAI. As no suitable CAI package covering the topics of educational research was available, computer aided instruction package to be used in the experiment was developed by the researcher. The package comprised three chapters from the educational research book and it included course materials in document format, presentation format and audio-visual format followed by multiple choice questions (MCQs) to which the learner responds and receives feedback.

Two matched groups of 14 students from the three programs were formed using paired matching technique on the basis of their Grade Point Average (GPA) of the winter semester of the academic year 2009-2010. The matched groups were formed from each of the program separately as the educational background of the students of different programs was not same and this factor might affect the result of the study. Students from each of the matched pair were assigned randomly to the experimental and control group. At the end necessary adjustment was done to keep the two groups equivalent by equalizing the average GPA of the two groups.

Post-test only control group design was employed in the present study. Experimental group students received treatment in the form of computer aided instruction while the control group students received instruction in the form of traditional method at the audio-visual laboratory of the department. Both the classes were conducted by the researcher himself one after another at the same day up to eight weeks duration. The supervisor himself often looked after the overall process of the study. In this experimental study various confounding variables like differential selection, novelty effect, inter-group interaction were carefully controlled by applying appropriate methods and techniques.

An achievement test comprised of 50 questions was used as posttest in this experiment. The questions in the test were framed with care and attention so that knowledge, comprehension and application level of the students could be assessed effectively.

To evaluate the CAI program used in the present study in terms of users' opinions, an opinionnaire comprising fifteen statements was constructed by the researcher. Each statement in the instrument invites response on five point scale as Strongly Agree (SA = 5), Agree (A = 4), Undecided (U = 3), Disagree (D = 2) and Strongly Disagree (SD = 1). This instrument elicits student opinion about four aspects of CAI; i.e. content organization, its presentation, questioning and on the whole impact of CAI in terms of likings or disliking as compared with the traditional method of instruction.

The statistical tests conducted in this study were: (i) t test to compare the mean achievement of the experimental group and the control group on the post test scores of both the groups; (ii) Analysis of variance to investigate the learning using CAI by the intellectual capability subgroups within the experimental group to see whether there was any significant difference between them; and (iii) weighted average and chi square test to evaluate each of the statements in the opinionnaire to elicit student opinion about CAI and its package. All data were analyzed using the Statistical Package for Social Science (SPSS for windows, version-15.0). Appropriate statistical procedures for description and inference were used. The weighted average (WA) were interpreted as: $WA \geq 4.5$ is "SA"; $4.5 > WA \geq 3.5$ is "A"; $3.5 > WA \geq 2.5$ is "U"; $2.5 > WA \geq 1.5$ is "D"; $1.5 > WA$ is "SD". However, weighted response value more than three for a statement indicates a favorable opinion for it and less than three value of weighted average response for a statement can be regarded as a negative opinion.

FINDINGS

There were twenty eight students in the study but due to sickness one student was absent in the test. So, for analysis of the scores on achievement test twenty seven students were taken into account which was 96.4% of the total participants. In the experimental group there were 13 students while in the control group there were 14 students. Students who took part in the experiment were classified randomly using paired matching technique and their group-wise performances are shown in table1:

Table 1: Performance of the experimental and control group in the study

Group in the Experiment	Mean	N	Std. Deviation	Minimum	Maximum	Range
Experimental	33.15	13	6.986	21	45	24
Control	19.79	14	4.677	14	30	16
Total	26.22	27	8.933	14	45	31

The above table indicates that the mean score and standard deviation for the experimental group are 33.15 and 6.986 and for the control group 19.79 and 4.677. The mean score of the experimental group is better than the control group but the deviation of the scores in the experimental group is higher than the control group. Based on this scenario it can be said apparently that the achievement of the experimental group is better than the control group. However, t value was calculated to compare the achievement or performance of the experimental and control group students and it is shown in table2:

Table 2: Calculation of t value for the experimental and control group using SPSS

	Levene's Test for Equality of Variances		t-test for Equality of Means		
	F	Sig.	t	df	Sig. (2-tailed)
Score in the Achievement Test	2.594	.120	5.883	25	**.000**

From table 2 it is observed that sig. (2-tailed) value is 0.00 which is less than 0.05 that means null hypothesis is rejected, so the research hypothesis is accepted. So, there is a significant difference between the mean scores of the experimental and the control group students on achievement test. It can be inferred that this significant difference is due to the teaching method, not by chance factors. So computer aided instruction (CAI) is better than traditional method of instruction (TMI) which in turn infers that experimental group is better than the control group in terms of their scores in the achievement test.

The F value for analysis of variance (ANVOA) was calculated to compare the achievement or performance of the three intellectual capacity subgroups of the experimental group. Table 3 shows the F value calculated for the three intellectual capacity subgroups of the experimental group using SPSS.

Table 3: Calculation of F value for the three subgroups of experimental group using SPSS

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	47.526	2	23.763	.442	**.655**
Within Groups	538.167	10	53.817		
Total	585.692	12			

From table 3 it is observed that sig. value is .655 which is greater than 0.05 that means null hypothesis is not rejected. So, there is no significant difference in the overall mean achievement scores of three sub-groups of the experimental group. That means educational background has not made any significant effect on this study. As the course 'educational research' was completely new to all of the students, so their previous knowledge on this particular course was thought ignorable.

Table 4: Summary of mean response and chi square values for student's opinion about CAI (N=14)

SN	Statement	5 (SA)	4 (A)	3 (U)	2 (D)	1 (SD)	WA	λ_0^2
**Content Presentation & Questioning**
1.	Content presented in CAI is according to the guide book	7 (50.0%)	4 (28.6%)	1 (7.14%)	1 (7.14%)	1 (7.14%)	4.07	10.29
2.	Understanding of the students is enhanced by the proper organization of the content	8 (57.1%)	3 (21.4%)	1 (7.14%)	1 (7.14%)	1 (7.14%)	4.14	13.14
3.	The objectives of each chapter is achieved to a great extent while studying through CAI	8 (57.1%)	3 (28.6%)	1 (7.14%)	1 (7.14%)	1 (7.14%)	4.14	13.14
4.	Questions given in the CAI provide the students with a chance to think	4 (28.6%)	7 (50.0%)	1 (7.14%)	1 (7.14%)	1 (7.14%)	3.86	10.29
5.	Answers to the questions of CAI program guide the students in understanding his current status	2 (14.3%)	9 (64.3%)	1 (7.14%)	1 (7.14%)	1 (7.14%)	3.71	17.43
**Comparison of CAI and TMI**
6.	CAI is interesting than traditional method of instruction (TMI)	10 (71.4%)	1 (7.14%)	1 (7.14%)	1 (7.14%)	1 (7.14%)	4.29	23.14
7.	CAI provides a student with a better opportunity to learn than traditional method of instruction	8 (57.1%)	2 (14.3%)	2 (14.3%)	1 (7.14%)	1 (7.14%)	4.07	12.43
8.	CAI brings clarity of concepts	10 (71.4%)	1 (7.14%)	1 (7.14%)	1 (7.14%)	1 (7.14%)	4.29	23.14
9.	I learned more through CAI than through TMI	9 (64.3%)	1 (7.14%)	2 (14.3%)	1 (7.14%)	1 (7.14%)	4.14	17.43
10.	I like CAI more than traditional method of instruction	9 (64.3%)	1 (7.14%)	2 (14.3%)	1 (7.14%)	1 (7.14%)	4.14	17.43
At 0.05 level of significance, $\lambda_c^2 = 9.49$ (df = 4)

On the day of administration of the posttest, an opinionnaire was administered to the students of experimental group to elicit their opinion about CAI. The opinionnaire comprised of ten statements which were organized into two sections inviting response on five-point scale i.e. strongly agree to strongly disagree. Chi square value and weighted average were calculated on the responses of each statement of the opinionnaire to check whether the responses on the statement are significant or not. Table 4 indicates the calculation of weighted average and chi square value on the responses given by the students of the experimental group regarding the CAI package.

In order to check whether the responses on the statement are statistically significant or not, it is better to do interpretation statement wise using table 4. On the first statement the responses were: 50.0% strongly agree, 28.6% agree, 7.14% undecided, 7.14% disagree and 7.14% strongly disagree which is depicted in the figure 1.
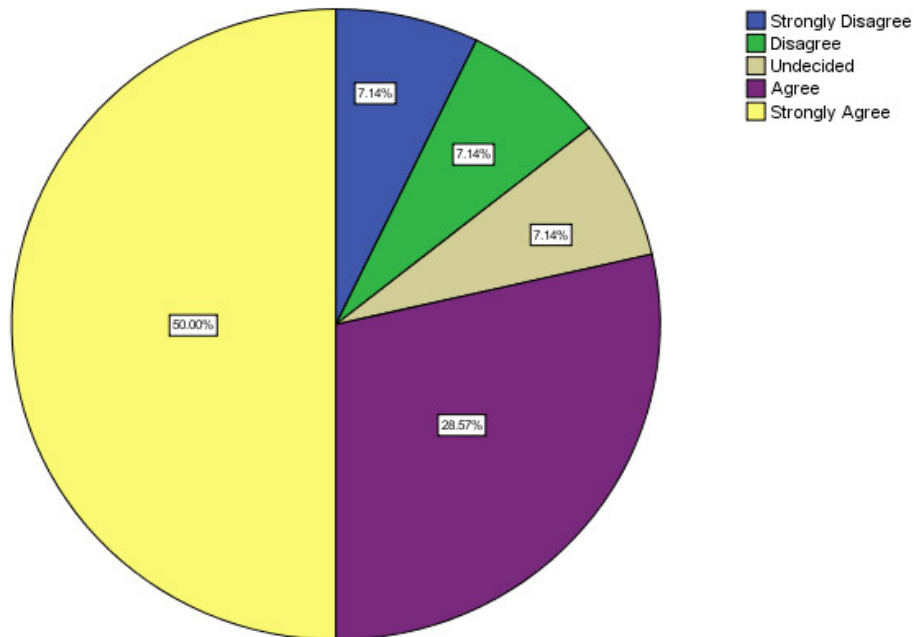

Figure 1: Student's opinion on the first statement in percentage

From figure 1 it can be stated that the responses on the statement 1 are statistically significant as majority of the responses are either in the category of 'agree' or 'strongly agree' without considering the value of weighted average (WA) and chi square. However, WA for the statement is 4.07 which indicate that the responses on the statement are in the category of 'Agree'. As the observed value (λ_0^2 = 10.29) > critical value (λ_c^2 = 9.49) which indicates that the null hypothesis is rejected that means the responses on the statement are statistically significant. Thus, from the value of weighted average and chi square from table 4, it is seen that the responses on the rest of the statements are also significant.

CONCLUSION

The present study was conducted to assess the effectiveness of computer aided instruction (CAI) package as compared with traditional method of instruction (TMI) in the subject area of educational research for the university level. The purposes of the study were two fold; firstly the development of a computer aided instruction package and secondly to assess the effectiveness of such a package. Findings of this experimental study led to the following conclusions: (i) computer aided instruction proved as more effective method as compared with traditional method of instruction to enhance student learning at knowledge, comprehension and application levels of the cognitive domain in the subject area of educational research at university level; (ii) learner's active participation in

instructional process resulted in better achievement; and (iii) audio-visual material used in CAI is found to be feasible and more effective for teaching educational research. To face the challenges of present and future, to compete the nations in this information age, every nations will have to enhance the quality of its education systems, which is possible only by exploring the new dimensions and benefitting from latest means of communication. This study will explore new dimensions for the enhancement of quality education in Bangladesh. Findings of this study may be a source of encouragement for the widespread use of CAI at various grade levels and in varied subject areas.

RECOMMENDATIONS

The study revealed that computer aided instruction was better than the traditional method. Therefore, the study suggested number of points for improving the widespread use of CAI. Those were:

1. Government should establish a computer aided instruction promotion cell department under the ministry of education or ministry of science and technology to plan, organize and coordinate efforts to utilize computer aided instruction. Development of CAI software and administration and control regarding hardware in educational institutions may be major tasks of these cells.

2. Widespread use of computer aided instruction requires a very high number of computers. Availability of such number of computers and adequate software is not possible in near future. Government should take steps to lower the price of hardware either by encouraging indigenous hardware manufacturing industry or by offering incentives to hardware importers or by reducing taxes on the parts associated with computer.

3. Government should offer incentives for teachers who increase their proficiency in computer studies and contribute to enhance computer aided instruction.

4. Much can be learnt through the experiences of the others. Selected experts in the field of computer aided instruction can be sent to those countries which are utilizing this mode of instruction successfully. Government support is needed in this regard.

5. Personnel with expertise in pedagogy and computer programming are needed to benefit from computer aided instruction. Hence teacher education institutions are required to introduce courses to prepare teachers equipped with pedagogy and computer programming skills.

6. There is a scarcity of literature about computer aided instruction in the libraries of our institutions. Steps should be taken to meet the needs of the literature. There are a number of computer aided instruction learning journals which can be subscribed for the libraries.

7. Future researchers should undertake researches to determine the effectiveness of various types of computer aided instruction for various subject areas and at different levels.

REFERENCES

Alexander, P.M. (1995). *Paper delivered at the International Conference on Computer Aided Education and Training in Developing Countries.* Pretoria: University of South Africa.

Brophy, K.A. (1999). *Is Computer Aided Instruction Effective in the Science Classroom?* Online Master's Thesis. California State University, Dominguez Hills.

Carter, F.I. (1999). The Effect of Computer Aided Instruction of Vocational Education High School Students. Online master's thesis. *www.OCLC.com.* California State University. Fullerton, MAI. 37.06, p. 160.

Chauhan, S.S. (1994). *Innovations in Teaching Learning Process.* New Delhi: Vikas Publishing House.

Frenzel, I.E. (1986). The Personal Computer Last Chance for CAI? Byte, 5 (7), 86-96.

Huh, U. (1994). Computer Based Education: The Korean Experience in Alexander, P.M. (1995). *Paper delivered at the International Conference on Computer Aided Education and Training in Developing Countries.* Midrand: University of South Africa.

Locatis, C.N., & Atkinson, F.D. (1984). *Media and Technology for Education and Training.* Columbus: Charles E. Merrill Publishing Co.

Munden, C.D. (1996). *What is Computer Aided Instruction? Retrieved from www.google.com.*

Poole, B.J. (1997). *Education for an Information Age.* Madison: W.M.C. Brown Communication, Inc.

Roblyer, M.D., & Edwards, J. (2000). *Integrating Educational Technology into Teaching* (2nd ed.). Upper Saddle River: Prentice Hall, Inc.

Steinberg, E.R. (1991). *Computer Aided Instruction: A Synthesis of Theory, Practice and Technology.* Hillsdale: Lawrence Erlbaum Associates Publishers.

Tangpornchotchuang, M. (1997). *The Development of Computer Aided Instruction Covering Topics of Passive Microwave Devices.* Online Master's Thesis. University of Kmitnb.

Van der Linden, W.J. (1995). "Computer Managed Learning". In Husen, T. and Postlethwaite, T. N. (Ed.) *The International Encyclopedia of Education.* Second edition, Volume 2, New York: Pergamon.

Wang, S., & Sleeman, P.J. (1993). A Comparison of the Relative Effectiveness of Computer Assisted Instruction and Conventional. *Journal of Instructional Media.* Vol. 20(1), pp. 225.