

A GENDER BASED COMPARATIVE STUDY OF TEACHING PHYSICS THROUGH CAI AND ORDINARY LECTURE METHOD

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ABSTRACT

The recent study was undertaken to see the comparative effectiveness of CAI and traditional lecture method on the academic achievement and interest of the secondary school students in the subject of physics. A sample of total 144 students (80 female and 66 male) was randomly selected from two Schools (University Wensam College and St. Helens High School) of Dera Ismail Khan. The sample was equated into two groups on the basis of pre-test. One group was randomly assigned as experimental group which was taught through CAI method while the second was called the control group which was taught with the traditional lecture method. The research hypotheses that there is no significant difference between the CAI and traditional lecture method on student's achievements and interest were tested. The research hypothesis on gender differences was also tested. The achievement tests and interest inventory were used for the purpose of data collection. The result shows that there was significant difference between the two groups. The experimental group outperformed the control group on academic achievement and interest score. The Gender differences were also observed, the Female outperformed the male on academic achievement while male performed significantly better than female on interest inventory

INTRODUCTION

Computers are the most pretty and valuable gift of science and technology to the mankind. It has made miracles in all most all walks of life. In the present era there is no corner of human life which remained untouched by the computer. Just like the other fields of life computer are used in education discipline in different ways including the actual work of teaching. Computer Assisted Instructions are the type of instructions with the help of computers, which are one step advance in the use of teaching machines. Computer is one step ahead of the teaching machines because it can perform more and multiple tasks as compared to teaching machine.

The CAI is not the use of Microcomputer in education but it is the type of instructions in which course contents are provided to the learner at their own pace. The CAI is an interactive system in which students can gain according to their own

abilities and skills (Mangal & Mangal, 2011). This idea is supported by the definition of Mosby's Medical Dictionary (2009) which defined CAI as a teaching process in which instructional materials are presented through computer in such a way that there is an interactive environment with the students.

Currently we face the problem of low achievers among secondary school male and female students particularly in science subjects. Underachievement is a greater problem from the economic and social point of view because it involves wastage of human and economic resources. It is also a problem from the learner's point of view as it causes emotional unrest and psychological tension. Underachievement causes problem not only to the underachieving students, but also to their parents and teachers (Vamadevappa, 2006). The

problem of underachievement is linked to some other serious problems in the education system such as the lack of interest of students in the learning process. According to (Gardner & Tamir, 1989) the term interest usually refers to engaging in some type of activities rather than others. When we are interested in a particular phenomenon or activity we are favorably inclined to attend it and give time to it. The majority of the Students at school level with special reference to Pakistan are not interested in the teaching and learning process. Students at school level feel boredom, alienation, and disconnection with schooling (Larson & Richards, 1991) which results in increased drop-out rate from the school.

When science is addressed it is usually not taught in a way that enhances student achievement (Denny, 1978 as cited in Riggs & Enochs, 2006). There are many reasons for the low achievement in physics but experts suggest that the main reason is that the physics is taught with the autocratic strategies (traditional lecture method) and new methods of teaching are totally rejected. According to experts the books of physics are translated by the teachers in the school and only memorization of concepts (rote learning) is given the importance so that students could be able to pass the examination. This is not justice to the teaching of physics. This situation calls for a change in the teaching method of physics. The method of teaching in the science curriculum should be such that it compels the students on thinking, and through their efforts, interests and practical work the student is able to reach the conclusion. Achievement can be enhanced by adopting the best method of teaching (Roig, 2008)

Statement of the Problem

As we are passing through an age of technology the scientists are making dramatic changes in curriculum and instructions. Therefore this present study was a continuation of this practice in which researcher investigated the gender based effects of CAI and traditional lecture method on the academic achievement and Interest of Students at Secondary School Level in two schools of Dera Ismail Khan (Pakistan). This experimental study finds the comparative effectiveness of teaching physics with the help of CAI method and traditional lecture method. The study also attempted to see which of these two methods has a positive effect on the academic achievement, and interests of the students in two secondary schools in Dera Ismail Khan, Pakistan. The researcher has also tested the hypothesis about the possible role played by the gender.

Objectives of the Study

The main objective of the study was to determine the comparative effectiveness of CAI and traditional Lecture method in the subject of physics. The study also investigated which of these methods had a positive effect on the academic achievement, Interest and Retention of students at secondary school level. Keeping in view the main objective, the following sub objectives were formulated,

1. To determine the difference of CAI and traditional lecture method on students' achievements and interest in Physics.
2. To determine the gender differences on the Academic achievement, and Interest of the student

Significance of the Study

Traditional method of teaching is being practiced throughout the Pakistan at the secondary school level. More time, energy and effort are exercised in lecturing the student's and memorizing the concepts. The student's achievement, interest and concept formation are totally neglected. This study may decline the concept of rote learning and bring the positive changes in the classroom teaching. As this method challenges the mental abilities and students are practically involves in the lesson. Therefore student's interests and achievement can be enhanced though CAI which can't be achieved by simple lectures or book reading.

The findings of the study may bring a positive change in the teachings of our science teachers at secondary school level. Science is taught with lectures and book method, which pays no attention to the interest, needs and abilities of the students (Mangal & Mangal, 2011). Although science demands for the problem solving, discovery approach in which student is active learner and recipient of knowledge (Mangal & Mangal, 2011) but this is either totally rejected or not done with zeal and devotion. This research will float the findings that may prove fruitful for science teachers and may mold their teaching techniques and approaches towards a positive direction.

Limitations of the Study

As the study was conducted in two schools of Dera Ismail Khan therefore it cannot be generalized in all schools of Pakistan. Also the present study was conducted on the subject of physics at secondary level; therefore it cannot be generalized in all other subjects.

Research Hypothesis

Following Null hypothesis were tested:

H01: There is no significant difference between the CAI and traditional lecture method on student's achievements in Physics.

H02: There is no significant difference between the CAI and traditional lecture method on the student's interest in Physics.

H03: There is no significant difference between male and female on academic achievement (Post-test) in Physics.

H04: There is no significant difference between male and female on Interest of students in Physics.

LITERATURE REVIEW

Theoretical Framework

The roots of CAI are in the different theories of learning. Theorists remain busy to facilitate students learning by enhancing quality of learning experiences. Theories of learning have great concern with the CAI because these theories focus on the improvement and advancement of methods of teaching and learning.

The origin of CAI is not recent. The earlier work in the field of CAI is traced back to Pressy, a psychologist of Ohio State University who developed a machine in 1920 called a "Drum Tutor". Pressy is truly called the first inventor of teaching machines (Rifat, 2000). This machine was able to present the students a series of questions. These questions were of multiple choice and students were asked to select the choice by pressing a suitable key. It was a testing machine, which incidentally improved learning. This concept was forgotten by the peoples till B. F. Skinner restarted it in 1954 (Natarajan, 2005)

The concept of operant conditioning at the hands of B. F. Skinner led to the development of educational technology

(Rifat, 2000). Skinner Machine is well known in education circles for programmed instructions. One of the major contributions of Skinner was that organized material was presented through this machine. The contents were divided into small steps and these were presented one by one. If a learner solves the one step then there was no difficulty in moving towards the next one. The learner was reinforced immediately (Stones, 1971)

Apart from the operant conditioning, Gestalt psychology is another school of thought whose main proponents are Kohler, Kurt Koffka, and Karl Duncker. They rejected the S-R (Stimulus Response) theory and instead talked about the whole rather than parts, figure and ground. For example Kohler said that animal can obtain reward through insight rather than time consuming in “stamping in” and “stamping out” responses. Their idea helps in the simulation and problem solving modes of CAI (Rifat, 2000).

RESEARCH METHODOLOGY

According to Jackson (2003) the method section describes exactly how the study was conducted. The method section is generally divided into subsections; the most common subsections are participants, instrumentation and procedure.

Population of the study

In a study the term population means all of the peoples about whom a study is meant to generalize (Jackson, 2003). The population may be the entire subjects of a particular type or a more restricted part of that group (Best & Kahn, 2003). The population of the present study comprised of all the 9th Grade science students of Government High and Higher Secondary Schools of Dera Ismail Khan City.

Sample of the study

To study a whole population is very difficult if not impossible (Best & Kahn, 2003), instead we select a subgroup or sample from the population which represent the population (Jackson, 2003). In this particular experimental study, only two English medium schools i.e. University Wensam College, and St. Helen High School Dera Ismail Khan were selected as the sample out of the six Government High and Higher Secondary Schools of the Dera Ismail Khan city. In these schools a sample of 146 students from the 9th grade science classes was selected. The 66 (male) students of the two 9th grade sections (C and D) of University Wensam College and 80 (female) students of the St. Helen High School were selected on a random basis.

Instrumentation

The whole process of preparing to collect data is called instrumentation. It involves not only the selection or design of the instruments but also the procedures and the conditions under which the instruments were administered (Fraenkel & Wallen, 2006). Achievement tests are used in schools to measure learning or the effectiveness of instruction (Fraenkel & Wallen, 2006). In research achievement test scores are used frequently in evaluating the influence of teaching methods (Best & Kahn, 2003). Interest inventories attempt to yield a measure of the types of activities that an individual has tendency to like and to choose (Best & Kahn, 2003). In the present experimental study achievement tests (pre-test and post-test) and Interest inventory were used as instruments

Validity and Reliability of Instruments

All the instruments pre-test, post-test and interest inventory were self-made instruments. These instruments were

made valid and reliable. The tests were made valid through content validity, face validity and criterion validity. Another check on the reliability of an instrument is to calculate an alpha-coefficient (frequently called Cronback alpha after the man who developed it). This coefficient alpha (α) is a general form of KR20 formula to be used in calculating the reliability (Fraenkel & Wallen, 2006). Tests (pre-test and post-test) were

checked by the 30 science teachers and professors on a five point scale for the purpose of reliability . The reliability coefficient of the pre-test and the post-test using SPSS (version 16.0) was found to be 0.82 and 0.84 respectively. The same procedure of reliability was used by Sotayo (2008), Azar & Sengulec (2011) and Oche (2012). The reliability coefficient of the interest inventory using SPSS (version 16.0) was found to be 0.92.

Research Design of the Study

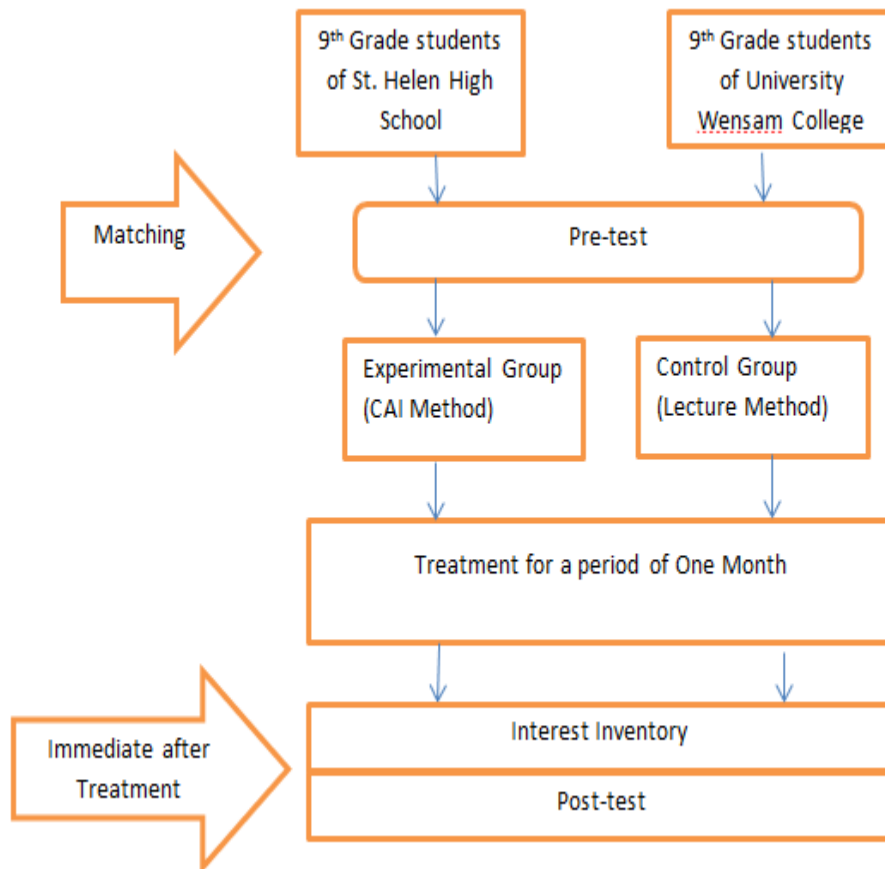


Fig 1: Research design of the study

Procedure of the Study

As discussed in the sample data was collected from the 146 9th grade students of two schools. The pre-test was given to the sample of 146 students of 9th grade science.

The all other conditions of time, weather, like and dislike were same for all the students.

Two equated groups were formed on the basis of pre-test. One was called the control

and other the experimental group. Both the groups were taught by the same teachers of the school (at each school). Both the groups were taught the same contents of 9th grade physics but with two different methods of teaching. The experimental group was taught by the CAI method in the computer laboratories and the control group was taught by the traditional Lecture method in the normal classrooms. Duration of the teaching was one month with one period on a daily basis in both the groups. At the end of the treatment, the post test and interest inventory were given to the students of both the experimental and control groups. After collecting the answer scripts, these were marked and the scores were entered in data matrix on SPSS (version 16.0) for the purpose of analysis

Data analysis

The data collected through pre-test, post-test, and interest inventory were presented in the data matrix form. With the intention of answering research questions, data collected were analyzed by using descriptive and inferential statistical methods using the SPSS (version 16.0).

PRESENTATION AND ANALYSIS OF DATA

As already discussed in Methodology the Experimental Group (EG) was taught by CAI method and Control group (CG) by traditional Lecture method.

Table-1: Showing the Mean pre-test score of the control and experimental Groups

Variable	N	Mean	SD	T	df	p-value
CG	73	18.89	2.65	-0.093	144	0.926
EG	73	18.85	2.69			

* Significant at 0.05 level

Table 1 shows that the result of t-test is $t(144) = -0.093$, ($p=0.926 > 0.05$) which shows that there is no significant difference between the control and experimental

group. Therefore it was concluded that both the control and experimental groups were equivalent before starting the experiment.

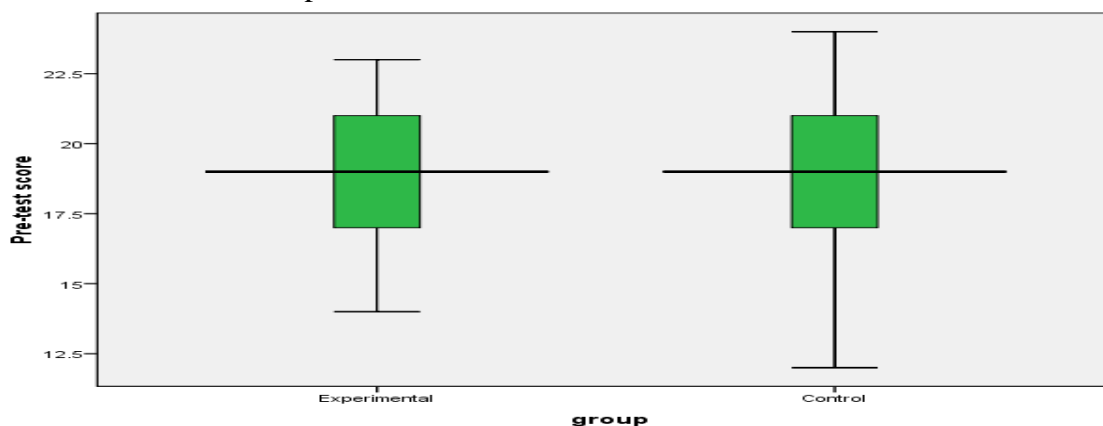


Fig 1: Showing the Mean Pre-test Score of the control and experimental groups

Testing of Null Hypothesis 1: There is no significant difference between the CAI and traditional lecture method on student's achievements in Physics

Table-2: Showing the Mean academic achievement (Post-test) Score of the control and experimental Groups

Variable	N	Mean	SD	t	df	p-value
CG	73	20.66	6.86	6.326	144	.000*
EG	73	28.14	7.40			

* Significant at 0.05 level

Table 2 shows that the result of t-test is $t(144) = 6.326$, ($p = .000 < 0.05$) which means there is a significant difference between the control and experimental group. However the Experimental Group is assumed to be effective than control group when mean scores of EG is 28.14 and CG

is 20.66. Therefore it was concluded that experimental group which was taught by the CAI method performed significantly better than control group which was taught by lecture method in achievement (post-test).

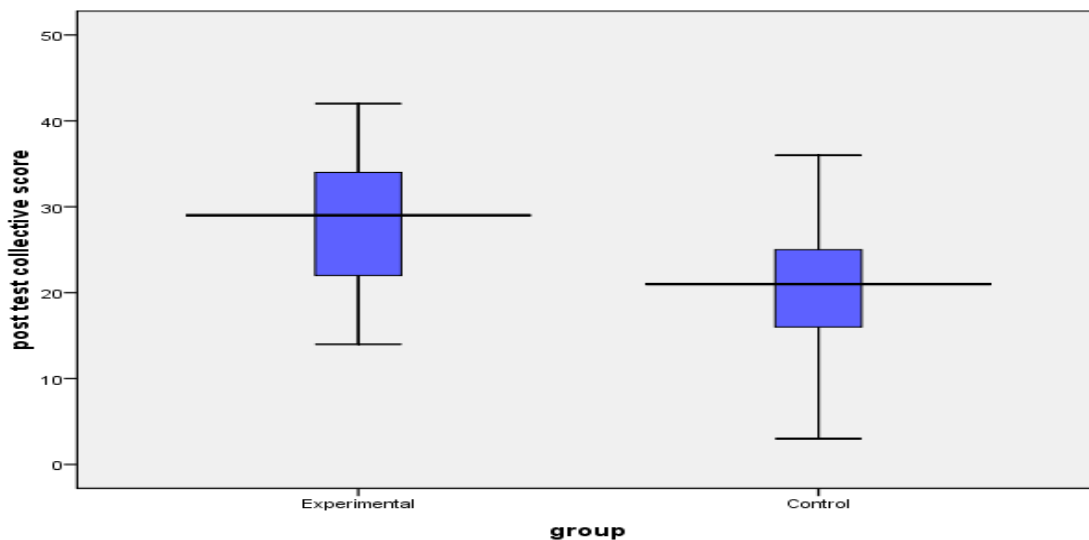


Fig 2: Showing the Mean academic achievement (Post-test) Score of the control and experimental Groups

Testing of Null Hypothesis 2: There is no significant difference between the CAI and traditional lecture method on student's interest in Physics

Table-3: Showing the Mean Interest Inventory Score of the control and experimental Groups

Variable	N	Mean	SD	t	df	p-value
CG	73	3.31	.70	8.14	144	0.000*
EG	73	4.25	.68			

* Significant at 0.05 level

Table 3 shows that the result of t-test is $t(144) = 8.14$, ($p=0.000 < 0.05$) which means there is a significant difference between the control and experimental groups. However the Experimental Group is assumed to be effective than control

group when mean scores of EG is 4.25 and CG is 3.31. Therefore it was concluded that experimental group which was taught by the CAI method showed better interest as compared to the control group which was taught by the lecture method.

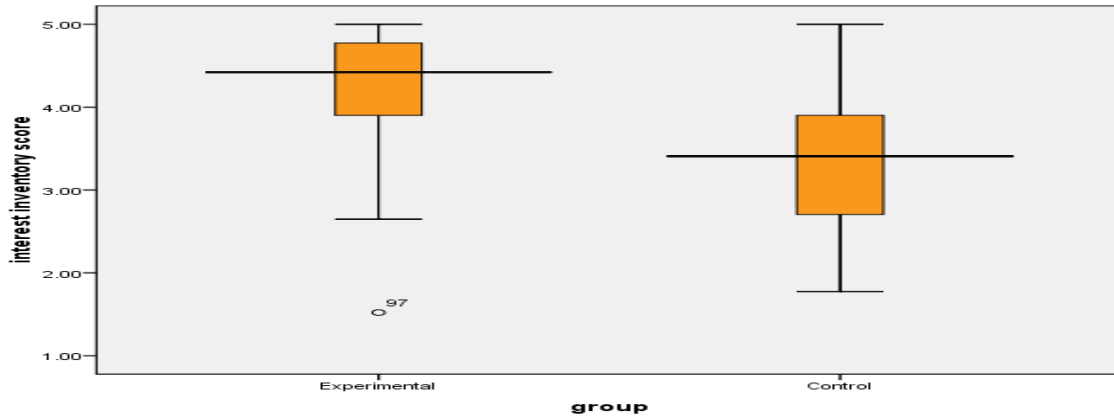


Fig 3: Showing the Mean Interest Inventory Score of the control and experimental groups Gender

Testing of Null Hypothesis 3: There is no significant difference between the Male and Female on student’s achievement in Physics

Table-4: Showing the Mean academic achievement Score of the Male and Female Groups

Variable	N	Mean	SD	t	df	p-value
Male	66	21.64	7.191	-3.951	144	0.000*
Female	80	26.68	8.042			

* Significant at 0.05 level

Table 4 shows that the result of t-test is $t(144) = -3.951$, ($p=0.000 < 0.05$) which means there is a significant difference between the male and female groups .However the female Group is assumed to

be effective than male group when mean scores of female is 26.68 and that of male is 21.64. Therefore it was concluded that females outperformed the male on academic achievement.

Testing of Null Hypothesis 4: There is no significant difference between the Male and Female on student’s interest in Physics

Table-5: Showing the Mean Interest Inventory Score of the Male and Female Groups

Variable	N	Mean	SD	t	df	p-value
Male	66	4.0732	.60309	3.995	144	0.000*
Female	80	3.5428	.92875			

* Significant at 0.05 level

Table 5 shows that the result of t-test is $t(144) = 3.995$, ($p=0.000 < 0.05$) which means there is a significant difference between the male and female groups. However the Male Group is assumed to be

effective than Female group when mean scores of Male is 4.0732 and that of Female is 3.5428. Therefore it was concluded that Male outperformed the Female on interest score

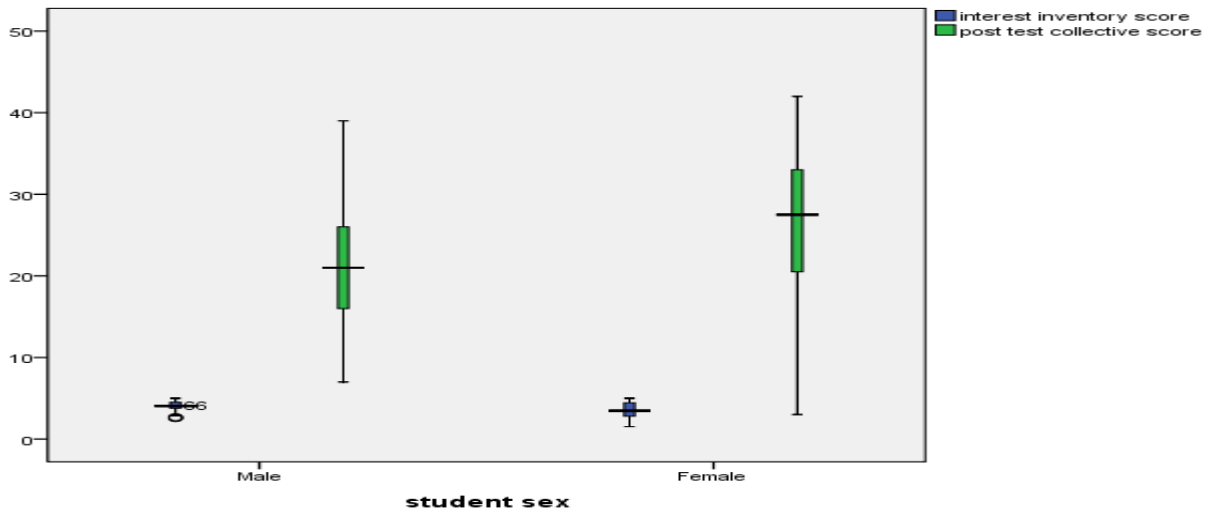


Fig 3: Showing the Mean academic achievement and Interest Inventory Score of the male and female groups

FINDINGS

Null Hypothesis 1

The data analysis shows that the experimental group performed significantly better than the control group on the post-test. Therefore the null hypothesis, H_01 stating no significant difference between the CAI and traditional lecture method on the student's achievement in physics is rejected at the 0.05 level of significance (See table 1)

Null Hypothesis 2

The data analysis shows that the experimental group out-performed the control group on the interest inventory. Therefore the null hypothesis H_02 stating no significant difference between the CAI and traditional lecture method on the student's interest is rejected (See table 2)

Null Hypothesis 3

The data analysis shows that the Female group performed significantly better than the Male group on the post-test. Therefore the null hypothesis, H_03 stating no significant difference between the Male and Female on the student's achievement in physics is rejected at the 0.05 level of significance (See table 3)

Null Hypothesis 4

The data analysis shows that the Male group out-performed the Female group on the interest inventory. Therefore the null hypothesis H_04 stating no significant difference between the Male and Female on the student's interest in physics is rejected (See table 4)

Discussions

The present study was undertaken to determine the effects of CAI on the academic achievement and Interest of Students in Physics. Numerous studies have been conducted on the effects of CAI on the academic achievement. The researchers compared the CAI with different other methods of teaching. The majority of the studies conducted across different grade levels and in different subject areas concluded that CAI method is better than the other traditional methods. However some studies disagree with the dominant effect of CAI over the other methods.

The findings of the present study indicate that experimental group which was taught through CAI method performed significantly better than the control group which was taught through traditional lecture method on academic achievement. There is a great deal of evidence regarding the effectiveness of CAI in physics. The results of the present study are supported by many studies which were conducted to check the effectiveness of CAI in physics such as (Altin (2002), Kara & Kahraman (2008), Kara (2008), Bayrak (2008) , Sotayo (2008) , Knezek (2008), Kocakaya (2010) , Azar & Sengulec (2011) , Bakac et al., (2011) , (Pondhe, 2011) , and Kayri et al., (2012)). However few studies disagree with the results of the present study on academic achievement such as studies of Huxford (1999), and Spradlin (2009). The reason is that the direct comparison of the current study can't be made with these studies for many reasons including the way CAI was implemented, the difference of teachers, wide variety of student ages, and the different sample sizes.

The second part of the discussion regarding the interest of two groups in two different methods of teaching shows that in the present study CAI group performed

significantly better than the lecture group on interest inventory. According to (Khirwadkar & Pushpanadhan, 2005) the CAI is not only found effective to increase the academic achievement but also arouse student interest and make attitude positive towards the teaching and learning process. There are few studies on the interest in two methods of teaching. The results of the present study are supported by the studies in different subject areas and different grade levels such as (Achor et al., (2010), Saka (2011), Wang (2011), and (Wang et al., 2012)).

CONCLUSIONS

The students who were taught through CAI method outperformed those who were taught through Traditional Lecture method on academic achievement (post-test). That is to say, the mean post-test scores of both the groups were different and data analysis shows that CAI (experimental) group performed significantly better than the traditional lecture (Control) group on the academic achievement (See table 2).

The data analysis shows that CAI (experimental) group performed significantly better than the traditional lecture (Control) group on the interest score (See table 3). Therefore it was concluded that CAI method of teaching was better than the traditional lecture method in maintaining the interest of students in physics at the secondary level.

The gender differences show that Female outperformed the male on the academic achievement whereas Male performed better than the female on interest.

Recommendations

This research found that CAI method of teaching is better than the traditional one in enhancing the academic achievement and interest of the students, therefore proper planning, inspection and support should be

provided by the government for the successful utilization of computers for instructional purpose. Suitable software should be made available at the local levels that cover the contents in different subjects. The present study found that CAI method is better than traditional methods in the subject of physics therefore studies can be conducted in other science subjects such as chemistry and biology and in different other areas like mathematics and languages.

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