British journal of Education

Vol.2, No.4,pp.17-30, September 2014

Published by European Centre for Research Training and Development UK (www.eajournals.org)

EFFECTIVENESS OF IT-ENABLED INSTRUCTIONAL PACKAGE (ITEIP) ON SCIENCE ACHIEVEMENT OF X CLASS STUDENTS IN RELATION TO THEIR GENDER

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ABSTRACT: *Today's world is empowered by information technology. There is nothing which is untouched with the use of technology. Education sector is also not an exception. There are lots of innovations of science that we are using in the field of education today for its betterment and Multimedia is one of them (Gupta & Chirag, 2014). In this context, an attempt has been made to see the effectiveness of IT-Enabled instructional package (ITEIP) on the science achievement among tenth class students in relation to their gender. This is an experimental study with 2x2 factorial design. 140 students of tenth standard selected through multi-stage random sampling technique were taken as a sample for the study out of which 70 students were taught through ITEIP formed Experimental group (E); and 70 students were taught through conventional method of teaching formed Control group(C).The investigators applied self-developed Achievement test in Science (Biology) to assess the achievement of the subjects. Lesson plans, and Formative tests were developed for the strategy ITEIP to carry out the teaching and learning process in all the two groups for eight weeks only. At the end of the experiment, achievement test in Science (Biology) was given to the subjects. Data were analyzed by using ANOVA and t-test to determine the performance by comparing the mean scores of all the groups. Data analysis revealed that students taught through ITEIP showed significant improvement in their achievement in science than the students taught through Conventional Method. Further, boys and girls students taught through IT-Enabled Instructional Package performed better than their counterparts. Furthermore, ITEIP appeared favorable for both boys and girls students but girls students benefitted more when they taught through ITEIP strategy. In conclusion, this study had proven that teaching through IT-Enabled Instructional Package enhances students' achievement in Science (Biology).*

KEYWORDS*:* IT-Enabled Instructional Package (ITEIP), Science Achievement

INTRODUCTION

Education is an engine for the growth and progress of any society. It is a powerful tool for social change, social mobility. It is a continuous process which transfers the morals, values; of our culture to the next generation (Yashpal, 2011). Education in general is undergoing rapid transition from

the traditional teacher dominated teaching to the more self motivated mode, constructivism. It has become a complex process with time because of complex nature of modern industrial civilization and explosion of knowledge due to scientific discoveries of inventions. In order to understand the progressive nature of society and to meet the challenges of time and educational aspirations of society, there is a need for effective system of education in the country. It has contributed to the destiny of societies in all phases of development (Bala, 1995). The quality of education we provide to our children depends to a large extent upon the quality of teachers we inject into the education system, which in turn depends on the quality of teachers` preparations through emergence of innovative tools. Preparing students to be successful in an innovation based economy is a function of empowering educators to teach 21st century content in a 21st context using 21st century tools (Marurizio,2004). Smart education is therefore a paradigm shift from teacher centered education to learner centered education whereas the child is empowered to create knowledge and develop competencies and ability for lifelong learning (Gupta & Lata, 2012). Various range of technologies including computers, computer work stations, display facilities, hardware, software, recording and processing system for sound, still and moving pictures, graphic calculator and wide range of communication facilities present in world. An important progress in computer technology and software has been realized in recent years. Use of computer in education as well as the infusion of Multimedia in teaching learning has altered considerably the instructional strategies in our educational institutions. The traditional teacher-centered method of teaching used for decades in our educational system has been modified and enhanced. The demand of new technologies and the global environment cannot be satisfied with the only source of classroom instructions, with its inherent classroom limitations. The students can do self learning using enormous potentials of internet and proving them with several online exercises. Given the importance of IT in interactive learning, it is most important that the teacher must be educated and trained more thoroughly about IT, its importance and how it can be infused in teaching. One word of caution though is that the undoubted tremendous potential of IT be harnessed in wise and conscious way (Varinder, Monica & Parul, 2011).

LITERATURE/ THEORETICAL PLANNING

In the realm of science education, there has been a strong link between computer and science**.** Various studies have shown that ICT is also a significant factor in enhancing achievement level of students. Kiboss (2004) found that the use of the CMS programme to augment conventional biology teaching has major implication for secondary biology instruction in this area. Cepni & Kose (2006) showed that using CAIM in teaching photosynthesis topic was very effective for students to reach comprehension and application level of cognitive domain. Ponraj & Sivakumar (2010) revealed that teaching the zoology by using CAI is more effective than conventional strategy. Serin (2011) investigated that there is statistically significant increase in the achievement and problem solving skills of the students in the experimental group that received the Computer based Science &Technology instruction. Chaudhari (2013**)** concluded that CAI can be used as the supplementary tool by the teachers to overcome the problems of Science like lack of visualization and it may minimize constraint of education. Bindal & Sharma (2013) revealed that a teacher is expected to know successful integration of ICT into his/her subject area to make learning

meaningful and its integration in teaching and learning is being perceived as a necessity and is growing exponentially. Gupta & Chirag (2014**)** found that Multimedia Teaching Package (MMTP) is helpful in enhancing the achievement of students. Ada, Faith & Victoria (2012) examined that students taught using (CAI) package performed significantly better than their counterparts taught using the conventional method of instruction. Research exploring the use of technology in science classrooms clearly indicates that the use of technology has positive influence on the wide variety of student learning outcomes including understanding of science and development of scientific reasoning skills (Schroeder, Scott, Tolson, Huang, Lee & Songer, 2007). These studies proved that ICT could be a potent tool in teaching-learning process of Science. Also appropriate educational technologies have the potential to make the science concepts more accessible through visualization and multiple representations and students can be engaged in more powerful scientific activities and they are able to perform investigation that would not be possible without the use of technology. Although a number of empirical studies have been conducted on multimedia packages, a very few have been conducted in classrooms of India. So, the purpose of the present study is to help bridge this gap in this research literature by investigating the effect of ITEIP on achievement in science among tenth class students in relation to Gender.

Objectives of the Study

The study asserts to meet the following objectives:

1. To compare the mean achievement scores in science of Experimental and Control group (E & C) of tenth class students to be taught through IT-Enabled Instructional Package (ITEIP) and conventional method teaching before experimental treatment.
2. To compare the mean achievement scores in science of boys of Experimental and Control group (BE & BC); and girls of Experimental and Control group (GE & GC) to be taught through IT-Enabled Instructional Package(ITEIP) and conventional method of teaching before experimental treatment.
3. To study the effect of treatment and gender on achievement in Science of tenth class students after experimental treatment.
4. To study the interaction effect of treatment and gender on achievement in Science of tenth class students after experimental treatment.
5. To study the effect of treatment and gender on mean gain achievement scores in Science of tenth class students after experimental treatment.
6. To study the interaction effect of treatment and gender on mean gain achievement scores in Science of tenth class students after experimental treatment.

Design of the Study

The present study is an experimental study with 2x2 factorial design. Achievement of students in Science was treated as dependent variable while instructional treatment (ITEIP) and gender were treated as independent variables in this study. Instructional treatment was studied at two levels namely experimental group (E) which was taught Science through IT-Enabled Instructional Package (ITEIP), and control group (C) which was taught Science through conventional method.

Sample

Initially a sample of 160 students was taken through random sampling and after administration of Socio- Economic Status Scale and intelligence test, only 140 students of middle strata and moderate intelligence were taken for the study. All the 140 students were equally divided and formed experimental group (E) and control group (C).

Tools used

Following tools were used for the purpose of collecting data related to different variables covered in the study:

A Standardized Tests

a) General Intelligence test (GIT) by S. M. Mohsin to measure the intelligence of students.

b) Socio-Economic Status Scale Questionnaire (SESSQ) by Kalia & Sahu to measure the socio-economic level of students.

B Self Developed Tools

a) IT-Enabled instructional package in science developed by investigators themselves was used. The package was developed by using software such as Adobe Photoshop, Adobe Sound Booth, and Swish 2.0.

b) Science Achievement Test developed by investigators themselves was used to measure the achievement of students in Science. The test consists of 70 items with a reliability of 0.90 and high content validity.

Procedure for Data Collection

The whole experiment was conducted in the three phases which is shown in the tabular form.

Table-1: Schematic Procedure of the Experiment

Phase	Experimental Group	Control Group
Pre-Test Phase	Measurement of 1. Intelligence 2. SES 3. Achievement in science	Measurement of 1. Intelligence 2. SES 3. Achievement in science
Treatment Phase	Teaching science through ITEIP for 6 weeks	Teaching science through Conventional Method for 6 weeks
Post-Test Phase	Measurement of Achievement in science	Measurement of Achievement in science

Statistical Techniques Used

1. Descriptive statistics such as mean and S.D. were worked out on the scores of achievement
2. Two way Analysis of variance (ANOVA) with 2x2 factorial design was employed to study the main effects and interactional effects of independent variables (treatments and gender) on dependent variable (Science Achievement) supplemented by t-test. To test the assumption of homogeneity of variance for ANOVA, Hartley's test was employed.

RESULTS AND DISCUSSION

In order to examine the effects of instructional strategy ITEIP on the science achievement among the tenth graders in relation to gender, two way analysis of variance (ANOVA) was employed. Groups were made to find out the interaction effect. The subjects were given different designations and groups were also made to find out the interaction effect.

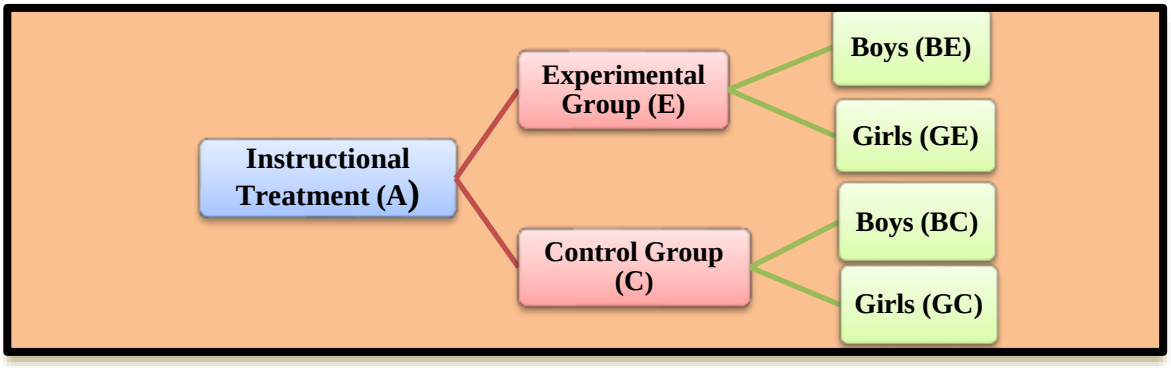

Fig .1: Cells for the Interaction Effects of Treatment and Gender

BE vs. GE: Boys of Experimental Group vs Girls of Experimental Group
BC vs. GC: Boys of Control Group vs Girls of Control Group
BE vs. BC: Boys of Experimental Group vs Boys of Control Group
GE vs. GC: Girls of Experimental Group vs Girls of Control Group

Comparison of Achievement Scores of Experimental (E) and Control (C) Group in Science (Before Experimental treatment)

Table-2: 't'- values for Achievement Scores of Experimental and Control Group in Science (Before Experimental Treatment)

Group	N	Mean	S.D.	't'-values
Experimental	70	40.52	6.72	1.12**(NS)**
Control	70	33.24	8.48	
Experimental Group (Boys)	35	43.25	5.96	1.83**(NS)**
Control Group (Boys)	35	33.77	10.35	
Experimental Group (Girls)	35	37.8	6.49	0.13 **(NS)**
Control Group (Girls)	35	32.71	6.19	

NS: Not significant

The results displayed in table 2 reveals that there was no significant difference in the achievement level of students of both the groups (experimental and control; boys of experimental and control group; & girls of experimental and control group on the criteria of achievement score in science. So it is evident vide Table- 2 that initially all subjects performed similarly.

Effect of Instructional Treatment and Gender on Achievement in Science (After Experimental Treatment)

After giving experimental treatment, the two groups were again administrated Science achievement test. The scores were treated as post-test scores and subjected to two way ANOVA with 2x2 factorial design which is reported in Table-3.

Table-3: Summary of Two-Way ANOVA for Mean Achievement Scores of students in Science with respect to Instructional treatment and Gender

Sources of Variation	Df	SS	MS	F-Value
Treatment (A)	1	5696.07	5696.07	81.22**
Gender (B)	1	1125.78	1125.78	16.05**
Treatment x Gender(AxB)	1	532.35	532.35	7.59**
Between Cells	3	7354.2		
Within Subjects	136	9538.63	70.13	
Total	139	16892.83		

** **Significant at 0.01 level**

Main Effects of Instructional Treatment (A) on Achievement in Science of Students in relation to their Gender (B)

Treatment (A)

On perusal of the Table-3 it is evident that F- ratio 81.22 for main effect of instructional treatment on post test mean achievement scores in science is found significant at 0.01 level of significance leading to the inference that experimental treatment yielded difference in science achievement scores of school students. The result has been supported by the findings of Suman (2009) who investigated that E-content improves achievement in science significantly higher in comparison to Conventional strategy. In order to investigate further, the 't'-value was computed and has been given in Table-4.

Table-4: 't'-value for the Mean Achievement Scores in Science of Experimental and Control Group

Group	N	Mean	S.D	't'- value
Experimental Group	70	50.44	9.58	4.72**
Control Group	70	37.65	8.32	

****Significant at 0.01 level**

Table-4 illustrates that students of experimental group have higher achievement in science than the students of control group. The findings that students taught through ITEIP achieved higher score than those instructed through traditional methods are in tune with conclusions drawn by

various researches abroad as well as in India. The findings are supported by (Gupta & Chirag, 2013 & Sharma,2012) who found that experimental group students showed significant improvement in their achievement as comparison to the control group students. It further revealed that the boys as well as girls of experimental group when compared with those of control group separately were benefited by multimedia teaching package in terms of their achievement. Findings are also in tune with the findings of Oguz Serin (2011) revealed that there is statistically significant increase in the achievement and problem solving skills of the students in the experimental group that received the Computer - Based Science & Technology instruction. Steve (2010) determined the effects of interactive multimedia simulations and virtual dissection software on depth of learning among students participating in biology and chemistry laboratories. The results indicated that participants changed their depth of learning after completing simulation and virtual dissection software. Liao (2007), Kiboss (2004) investigated that CAI is more effective than traditional instruction (TI). The mean differences between the experimental group and the true control group were statistically significant in favor of the treatment group. Shim, Park & Kim (2003) examined that VRT Simulations allow comfortable interaction with computers and increase the interest of students and their understanding of scientific concepts and phenomena. Stark, Gray and Payne (2000) found that ICT improved motivations, enhanced learning and teaching, improved communication and access to information, and improved efficiency and feelings of independence. Hence learning through computers helped in achieving better than the control group. So it can be safely concluded that teaching through ITEIP is more effective than conventional method of teaching in raising the achievement level of students in Science (Biology).

Gender (B)

It can be inferred from the Table-3 that F-ratio (16.05) for main effect of gender on achievement in science is significant at 0.01 level of significance which indicates that gender have a significant main effect on science achievement of school students. In order to investigate further, the 't'-value was computed and has been given in Table-5.

Table-5: 't' value for Achievement Scores of Boys and Girls in Science

Group	N	Mean	S.D.	't'-value
Boys	70	46.9	12.23	0.20**(NS)**
Girls	70	41.2	8.83	

NS: Not Significant

Table- 5 depicts that boys and girls learning through IT-Enabled Instructional Package (ITEIP) are almost similar in their performance. In the context of mean scores, it can be revealed that boys group performed better than girls group after being exposed to experimental treatments.

Interaction Effect (Treatment X Gender)

The F-value (Table-3) for the interaction between treatment and gender for post-test achievement scores is 7.59 which is highly significant at 0.01 level leading to the inference that two variables interact with each other. To investigate further, the't'-values were computed (table-6). Mean scores

of different groups have been presented graphically in fig.2. The interaction effect of treatment and gender on achievement in science for the Experimental and Control group has also been presented in the form of line graph in Fig.3 which shows a significant interaction effect of instructional treatment and gender on achievement in science of tenth class students.

Table-6: 't'-values for the Mean Achievement Scores in Science Achievement of Students for different groups of Treatment(A) × Gender (B)

Group	N		Mean		S.D.		't'- values
BE vs GE	35	35	55.25	45.62	7.87	8.76	8.13**
BC vs GC	35	35	38.54	36.77	9.89	6.41	0.37(NS)
BE vs BC	35	35	55.25	38.54	7.87	9.89	6.29**
GE vs GC	35	35	45.62	36.77	8.76	6.41	9.46**

** Significant at 0.01 level NS: Not Significant

The results displayed in the Table-6 revealed that 't'-values are found to be highly significant. in case of BE vs GE; BE vs BC; & GE vs GC which lead to the inference that the strategy implemented has positive learning outcomes.

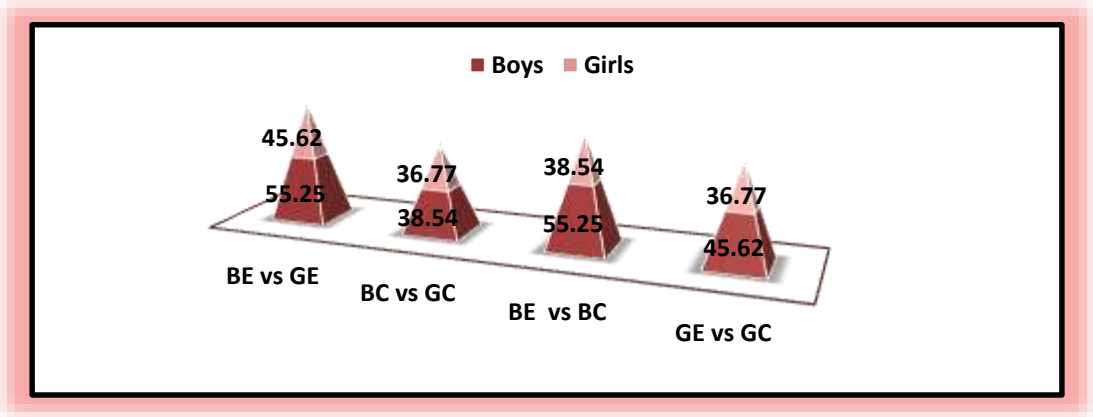

Fig. 2: Mean Scores for Interaction Effect of Instructional Treatment and Gender on Achievement in Science of Students

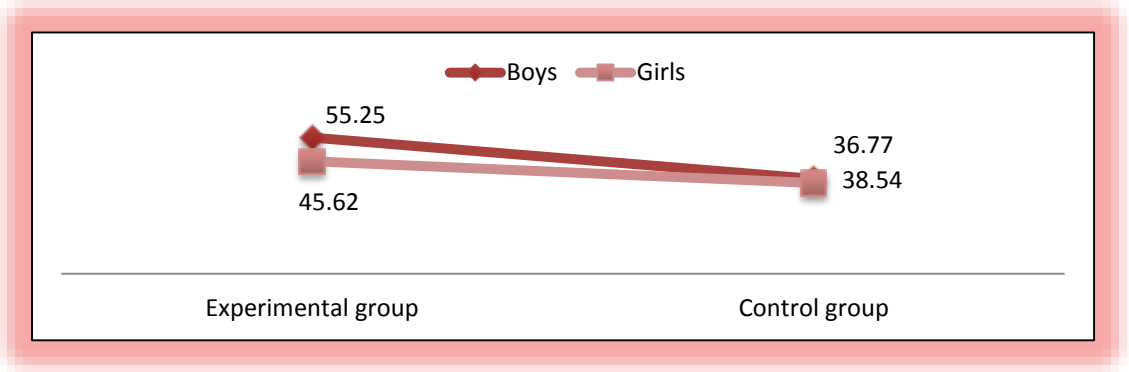

Fig.3: The Interaction Effect of Treatment (A) ×Gender (B) on Achievement in Science of Students

Effect of Treatment and Gender on Mean Gain Achievement in Science (After Experimental Treatment in Terms of Gain Achievement Scores)

The mean gain achievement scores in Science were subjected to two way Analysis of Variance with 2x2 factorial design, the **s**ummary of which has been presented in Table-7.

Table-7: Summary of 2x2 ANOVA for Mean Gain Achievement Scores in Science

Sources of Variation	**Df**	**SS**	**MS**	**F**
Treatment (A)	1	1058.75	1058.75	121.00**
Gender (B)	1	208.87	208.87	23.8**
Treatment x Gender(AxB)	1	104.58	104.58	11.95**
Between Cells	3	1372.20		
Within Subjects	136	1191.03	8.75	
Total	139	2563.23		

** **Significant at 0.01 level**

Main Effect

Treatment (A)

On glance of the Table-7 it is revealed that F- raito 121.00 for main effect of instructional treatment on mean gain achievement scores in science is significant at 0.01 level of significance leading to the inference that experimental treatment has a significant effect on mean gain achievement scores in science of school students. In order to investigate further, the't'-value was computed which has been given in Table-8.

Table-8: 't'-value for the Mean Gain Achievement Scores in Science of Experimental and Control Group

Group	**N**	**Mean**	**S.D**	**'t'- value**
Experimental Group	70	9.91	4.29	
Control Group	70	4.41	1.83	3.95**

****Significant at 0.01 level**

A close inspection of Table-8 exhibits that the subjects exposed to IT-Enabled instructional Package (ITEIP) of teaching achieved significantly higher mean gain level of achievement in comparison to conventional method. It can be concluded that teaching through IT-Enabled Instructional Package (ITEIP) is more effective than Conventional method of teaching in raising the achievement of students in Science. The result is in consonance with the findings of other researchers. Panda and Chaudhary (2000), Vij (2003) found that computer assisted teaching method was superior to lecture method in terms of gain achievement scores. Ponraj & Sivakumar (2010), Phillip, Jacksin & Dave (2011), Ada, Faith & Victoria (2012), Gupta & Chirag (2013)

findings also revealed that students taught using CAI performed better than the control group in terms of gain in achievement. The results of the studies indicated higher achievement & positive attitude with CAI treatment group. The results are also in contradiction with the findings of Jothiokani & Thiagarajan (2004) who determined that the mean gain scores of the control group were significantly greater than that of experimental group in all six units with reference to the objectives and their level of achievement in both the years 1999-2000 and 2001-02. It was concluded that the conventional method is more effective and efficient than CAI method.

Gender (B)

It can be revealed from the Table-7 that F-ratio (23.8) for main effect of gender on mean gain achievement in science is significant at 0.01 level of significance which indicates that gender has a significant main effect on mean gain achievement scores in science of tenth class students. In order to investigate further, the 't'-value was employed and has been given in Table-9.

Table-9: 't'-value for Mean Gain Achievement Scores in Science of Boys and Girls

Group	N	Mean	S.D.	't'-value
Boys	70	8.38	4.95	0.66**(NS)**
Girls	70	5.94	3.09	

NS: Not Significant

A perusal of Table-9 indicates that no significant difference was found in the mean gain scores of science achievement between boys and girls. However, in the context of mean scores, it can be revealed that boys group has gained higher than girls group after being exposed to experimental treatments.

Interaction Effect

The F-value vide Table-7 for the interaction between treatment and gender for mean gain achievement scores is 11.95 which is significant at 0.01 level, leading to the inference that two variables interact with each other. It means the strategy put into practice has increased the achievement level of students.

Table-10

't'-values for the Mean Gain Achievement Scores in Science of Different Combination Groups for Treatment × Gender

Group	N		Mean		S.D.		't'- value
BE vs GE	35	35	12	7.82	4.23	3.24	2.87**
BC vs GC	35	35	4.77	4.05	2.23	1.25	0.10(NS)
BE vs BC	35	35	12	4.77	4.23	4.77	4.80**
GE vs GC	35	35	7.82	4.05	3.24	1.25	8.14**

** **Significant at 0.01 level** **NS: Not Significant**

It can be inferred from table-10 that't'-values for difference between mean gain achievement scores of the subjects of the three groups (BE vs GE; BE vs BC; & GE vs GC) are found to be significant. Mean scores of different groups have been presented graphically in fig.4. The interaction effect of treatment and gender on mean gain achievement scores for experimental and control group have also been presented in the form of line graph in Fig. 5

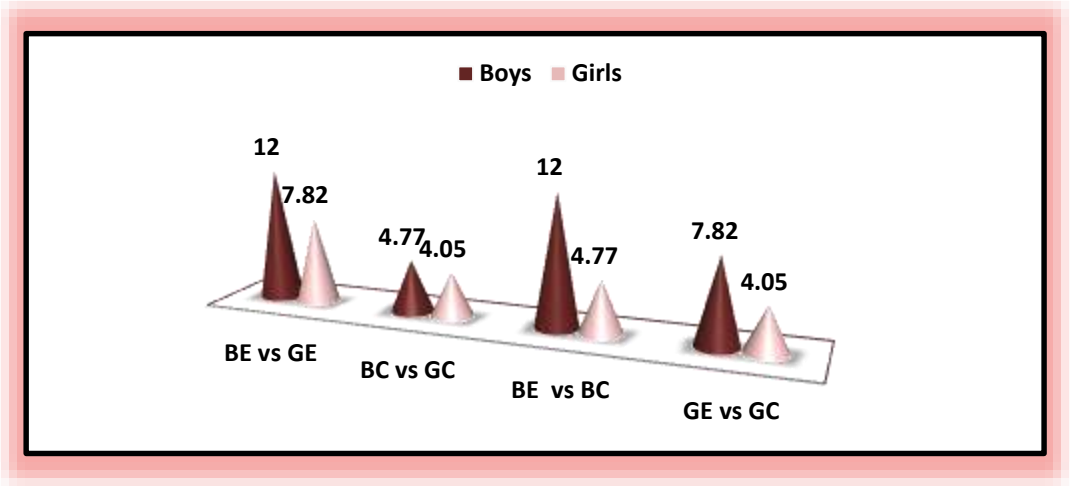

Fig.4: Mean Gain Achievement Scores for Interaction Effect of Instructional Treatment and Gender on Mean Gain Achievement in Science (Biology)

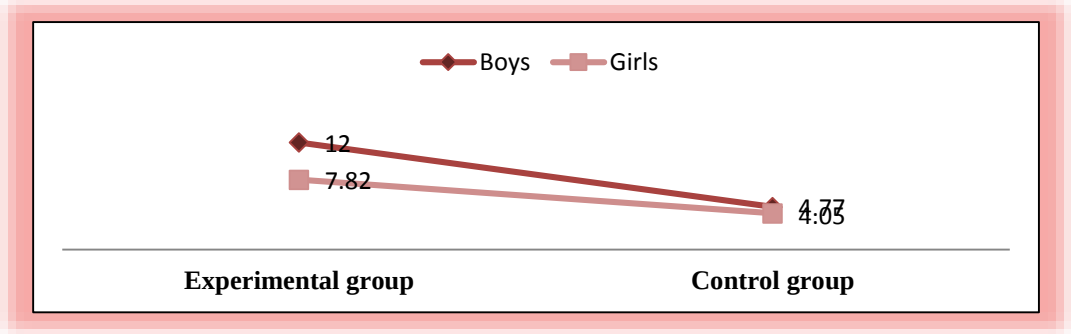

Fig.5: The Interaction Effect between Treatment and Gender on Mean Gain Achievement in Science (Biology)

FINDINGS OF THE STUDY

- Before experimental treatment, no significant difference was found in the science achievement scores of all the groups (E and C) which indicated that initially all subjects performed similarly.
- There was found a significant effect of treatment on mean achievement scores in Science of tenth class students leading to the inference that experimental treatment enhances the performance of school students in their achievement.
- Gender was found to have a significant effect on achievement scores in science of tenth class students.

- There was a significant interaction effect of treatment and Gender on achievement in science of tenth class students leading to the inference that two variables interact with each other.
- Instructional treatment had a significant effect on mean gain achievement scores in Science of tenth class students.
- Gender was found to have a significant effect on mean gain achievement scores in science of students.
- Treatment and Gender had a significant interaction effect on mean gain achievement scores in science of tenth class students leading to the inference that two variables interact with each other. It means the strategy put into practice has increased the achievement level of students in science.

EDUCATIONAL IMPLICATIONS

IT-Enabled instructional package if find a permanent place in school time table can be proved as a boon in today's overcrowded classrooms. School organization should be considered technology as a useful tool so that teachers can successfully integrate technology into their teaching.Potential of IT-Enabled instructional package should be utilized to enhance quality of education at all the levels of education viz. Primary, Secondary and Higher. Government should also establish IT-Enabled instructional package portal in various organisations such as Institutes of Education and Research, Curriculum Wing, Test Book Boards, Curriculum Research and development Centres, and Education University. The administration should allow enough flexibility for teachers to make decisions regarding the use of technology in the classroom instruction, allow them time to design lesson plans and should also provide them high-quality professional development. The use of IT-Enabled instructional package (ITEIP) leads to positive attitude of teachers as well as students towards ICT. Thus, when taught through ITEIP the students feel more involved in studies, which help significantly in raising their achievement level.

CONCLUSION

ICT plays a key role in the modern systems of education. Students find it easier to refer to the internet than searching for information in fact reference books. Modern technologies are improving the students and teachers knowledge and give the innovative techniques. Education is a lifelong process and it should meet the needs of variety of learners. Multimedia will provoke radical changes in the teaching system because it is a woven combination of text graphic art sound animation and video elements. It represents the second wave in educational technology. Development in computers, communication and consumer electronics is compared to the first wave that is technology development in audio, video, and TV media which occurred many decades ago. Today, CD-ROM, Drives, Video Disk Player, Video Data Projectors, Animation Packages, Speech, Music are known as second wave in educational technology. It puts learning into the controls of the learner. It benefits both the students as well as the teachers. Precisely, it can be said that IT-enabled instructional package (ITEIP) provides greater opportunities for the students to learn. It is better than the traditional method of learning. It brings an enhancement in achievement and provides new multisensory learning experiences.

FUTURE RESEARCH

The present study opens up certain avenues for further research which are briefly mentioned below:

- The present study has been carried out only on limited topics of Science syllabus at tenth level; more studies may be conducted involving larger content of the curriculum and different subjects at different grade level.
- Further research can be conducted to explore the effectiveness of IT-Enabled instructional package on disadvantaged groups such as backward, low achievers, mentally retarded and gifted. The study may be replicated on rural, tribal and slum population, where chances of drop outs and failures are high.
- Effectiveness of IT-Enabled instructional package may be studied in relation to other variables, such as group size, creativity, intelligence, economic background, age, cognitive style, personality and classroom environment etc.

REFERENCES

Ada, Faith & Anemelu (2012). Effect of computer-assisted packages on the performance of senior secondary students in mathematics in awka, anambra state, nigeria, *American International Journal of Contemporary Research,* 2 (7), 61-65.

Bala, Madhu (1995). Classroom Interaction: learning behavior & achievement, Delhi: S.S. Publishers.

Gupta, Madhu & Chirag (2014). Development of multimedia teaching package in mathematics for class v, *Asian Academic Research Journal of Social Sciences & Humanities, 2*(18),176-186.

Gupta, Madhu & Chirag (2013). Effect of multimedia teaching package on achievement of fifth graders in mathematics *The Educand - Journal of Humanities and Social Sciences,* 3 (1), 01-10.

Gupta, Madhu & Lata, Parvesh (2012). Innovative technological approaches in teacher education' published in global evolution, *International Journal of Management and Teacher Education,* 3(1& 11), 27-36.

Jothiokani, N. and Thiagarajan, A.P. (2004). Effectiveness of computer assisted instruction in mathematics among B.Sc. degree students, Ph.D. (Education), Algappa University, *Indian Educational Abstracts,* NCERT, 4(2), 11-12.

Kiboss, J. K. (2004). Effectiveness of a computer-mediated simulation program in school biology on pupils 'learning outcomes in cell theory, *Journal of Science Education and Technology*, 13(2), 207-213.

Liao, Y. K. C. (2007). Effects of computer-assisted instruction on students' achievement in Taiwan' Journal of Computers & Education, 48(2), 216-233.

Maurizio, A. (2004). Teaching And Learning In The 21st Century, www.21stcentury.org.

N.D.Yashpal (2011). Pedagogical aspects of computer assisted instruction, *Techno learn,* 1(1), 137-145.

Panda, S.C. and Chaudhury, J. (2000). Effect of computer assisted learning (cal) in achieving higher cognitive skills, *Journals of All India Association for Educational Research*, 12 (3 & 4), 25-30.

Philip, Jackson & Dave (2011). The effect of computer assisted instruction on students attitude & achievement in matrices & transformations in secondary schools in kenya, *International Journal of Curriculum & Instruction*, 1(1), 53-62.

Ponraj, P. & Sivakumar, R. (2010). Computer assisted instruction in zoology in relation to learners' personality, *EDUTRACKS*, 9(6), 34-37.

Rose, Antony and Stella, V. (1992). Effectiveness of computer assisted instruction with special reference to underachievers, *Ph.D. Education*, Bharathiar University.

Schroeder, C., Scott, T., Tolson , H., Huang , T., & Lee, Y. Songer (2007). A meta-analysis of national research: Effects of teaching strategies on student achievement in science in the United States, *Journal of Research in Science Teaching*, 44(10), 1436-1460.

Serin, Oguz. (2011). The effects of computer based instruction on the achievement & problem solving skills of science & technology students, *The Tourkish Online Journal of Educational Technology (TOJET)*, 10(1), 183-201.

Shim, Park & Kim (2003). Application of virtual reality technology in biology education, *Journal of Biological Education*, 37(2), 71-74.

Stark, R., Simpson, M., Gray, D. and Payne, F. (2000). The impact of information and communication technology initiatives, *Interchange Series. Edinburgh. The Scottish Executive Education Department*, http://www.scotland.gov.uk

Steve, C. (2010). Science laboratory depth of learning: Interactive multimedia simulation and virtual dissection software, *Ph.D, Capella University*.

Suman (2009). Relative effectiveness of e-content strategy and conventional strategy of teaching of science, *Ph.D. Education*, Maharshi Dayanand University, Rohtak.

Varinder, R. Monica,S & Parul, G(2011). Use of information technology for interactive learning. Techno learn,1(1), 123-135.

Vij, Sanjana (2003). A comparative study of the effectiveness of computer assisted instruction (CAI) and computer managed instruction (CMI) on pupil's achievement in science, their self concept and study involvement, *Ph.D. (Education.)*, M.D. University, 2003.

Bindal & Sharma (2013). Impact of ICT on Teaching and Learning. *ZENITH International Journal of Multidisciplinary Research*, 3 (1), 262-271.

Cepni & Kose (2006). The effect of Computer-assisted Instruction Material on 'photosynthesis' topic on student cognitive development, misconception and attitudes. *Indian Educational Abstracts*, 5 (1&2), 28.

Chaudhary, P. (2013). Computer Assisted Instruction (CAI): Development of instructional Strategy for Biology Teaching. *Educationia Confab* ,2(1), 106-116.

Sharma. S.(2012). Effectiveness of two methods of instruction: multimedia and conventional instruction for developing environmental awareness among elementary school children. dissertation abstract, M.D.U Rohtak .