

**EFFECT OF IT-ENABLED INSTRUCTIONAL PACKAGE (ITEIP) ON
ACHIEVEMENT IN SCIENCE AMONG X CLASS STUDENTS: AN
EXPERIMENTAL STUDY**

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ABSTRACT

Learning through ICTs is more effective as they provide opportunities for using multiple technologies (Video, Computer, Telecommunication, etc.), thereby providing visualization aids in the internationalization and understanding of difficult concepts and processes. This gives opportunities for providing links between theory and practice (Gupta & Lata, 2014) [7]. The present study establishes the effectiveness of IT-Enabled Instructional Package (ITEIP) by comparing the achievement scores of tenth class students of two groups (i.e. experimental and control) by teaching the selected content of Science syllabus prescribed by CBSE board. The students of experimental group were taught by using ITEIP and the students of control group were taught through conventional method. The academic achievement has been treated as the dependent variable whereas ITEIP and gender constituted the independent variables for the study. The study employed was experimental in nature for the purpose of investigation. Multi-stage stratified random sampling technique was used to select the sample of 140 tenth class students studying in Gohana city of Sonipat district (Haryana). The design of the study comprised of three stages. The first phase has involved pre-testing of all the students of two groups on the basis of Achievement Test in Science (Self-developed), Socio-Economic Status Scale developed by Kalia & Sahoo and General Intelligence Test developed by Mohisin. The second stage consists of experimental treatment of six weeks. The experimental treatment was consisted of teaching Science

(Biology) to class X with IT-Enabled Instructional Package (developed by the investigators themselves) to experimental group and through conventional method to control group. During the third stage i.e. post-test stage, the students of both the groups were post-tested on achievement in Science (Biology) just after the treatment so as to determine the effect of treatment. The results of analysis revealed that group of students taught Science through ITEIP showed significantly higher mean achievement scores than the group of students taught through the traditional method. It was also found that boys & girls of experimental group, when analyzed separately, performed better than boys and girls of control group respectively. The study also revealed certain educational implications for the school authorities, planners & administrators, teachers and students for enhancing the academic achievement of school students. The findings clearly suggest that teaching Science with the help of ITEIP to school students is very effective.

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

Introduction

“The illiterate of the 21st century”, according to futurist Alvin Tofler, “will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn. There is a rapid shift of educational technologies, so as to shape the structure of the system of education across the globe. Information and Communication technology (ICT), with in a very short time, has become an important part of Teaching-learning process that can transfer the present isolated, teacher-centred and book-centred learning environment into a student centred environment (Gupta & Chirag,2011)[5]. 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 (Gupta & Lata, 2014) [8]. In the emerging Indian society, knowledge creation, exchange, networking, and maximum utilization have become most vital for the advancement of nature. We need to make the system of education more innovative and futuristic; knowledge and information sharing serve as a major resource of bringing innovative trends in teacher education programs. In the last years, the so called ‘digital revolution’ brought the computers

into the classroom in order to support and enhance pedagogical practices. Technologies available in classroom today range from simple tool based applications to internet based multimedia, e-mail communication, blogs, wikis and podcasts. Research into the use of technology in classrooms demonstrates that technology plays a critical role in student learning (Russel, Lucas, & McRobbie, 2003) [24]. Some of the large scale studies have shown the significant increase in achievement scores of students using technology as a learning tool (e.g., Lei & Zhao, 2007) [14]. Schroeder et al. (2007) [25] showed the positive influence of the use of instructional technologies on student learning. The authors found that the most effective teaching strategy on student learning is “enhanced context strategies” such as making the content relevant to students’ everyday life experiences. As the authors suggested, real world experiences can be easily brought to students through technology since the technology facilitates authentic science activities in the classroom. For example, project-based science curricula that include learning technologies provide an opportunity for students to engage in inquiry (Hug, Krajcik, & Marx, 2005) [10]. Students design and conduct inquiry projects using various learning technologies such as handheld personal computing devices and digital measurement instruments.

Vij (2003)[31] found the mean gain score of the group of Pupils taught Science through Computer Managed Instruction was significantly higher in Achievement than the group of Pupils taught Science through traditional method . Ludwig and Daniel (2004)[16] found that multimedia content organized with a slide ware tool can generate productive and stimulating presentations that lead to greater retention, application to new situations, and performance on assessments. Rai (2009)[22] described that the use of Multimedia, not only brings creativity but encompasses all arenas of education through text, graphs, moving images, sound and music with the help of computers. Steve (2010) [30] determined the effect 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. Serin (2011) [26] revealed that there is a statistically significant increase in the achievements and problem solving skills of the students in the experimental group that received the computer-based science and technology instruction. Gupta & Chirag (2013) [6] revealed that multimedia teaching package enhance the achievement of fifth graders in mathematics. Most

of the studies given above revealed that ICT is doing a commendable job in the field of education. But no study has been carried out to assess the effectiveness of ITEIP on achievement in science. Hence, the investigators endeavour to undertake the present study to see the effectiveness of IT-Enabled Instructional Package on the achievement of tenth graders in Science.

Objectives of the Study

The present study is designed to realize 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 and after 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 and after experimental treatment.
- 3 To compare the mean gain achievement scores in science of two groups (E & C) to be taught through IT-Enabled Instructional Package (ITEIP) and conventional method of teaching.
- 4 To compare the mean gain 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.

Variables Involved

a) Independent Variable: For the present study, the independent variables were IT-Enabled Instructional Package (ITEIP) and Gender.

b) Dependent Variable: The dependent variable or the criterion variable used in the current study was Achievement in Science.

c) Intervening Variables: Different intervening variables in the present study are type of school (English medium private schools affiliated to CBSE Board), grade of class (X), subject to be taught (Science), intelligence of students (moderate intelligence) and socio-

economic status (middle SES level) of students, which were controlled up to greatest extent to equate the sample or to form the matched group.

Design of the Study

Method Used: The present study is experimental in nature. Pre-test post-test control group design has been employed in this study.

Population: Class X students studying in English medium private schools (affiliated to CBSE Board) located at Gohana city formed the population of the present study.

Sample: A sample of 140 students from two English medium private schools was selected through multistage random sampling technique.

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 (1990) to measure the intelligence of students.
- b) Socio-Economic Status Scale Questionnaire (SESSQ) by Kalia & Sahu (2010) 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.

Statistical Techniques Employed

Mean, Standard Deviation and t-test were employed to compare the performance of experimental and control groups.

Analysis and Interpretation

In the present study, the data has been analyzed and interpreted in the following manner:

Comparison of Achievement Scores of Experimental and Control Group in Science (Before Experimental Treatment)

This section deals with the comparison of achievement scores in Science of the two groups: experimental group (E), and control group(C) of tenth graders at pre-test phase. The group of students to be taught through IT-Enabled Instructional Package formed Experimental Group (E), and the group of students to be taught through conventional method of teaching formed the control group (C). The focus of this section was to compare the achievement scores in Science among students of the Experimental and Control group of tenth class students to be taught through IT-Enabled Instructional Package and conventional method respectively. Further in this section, the experimental and control group boys and girls separately were also compared on their achievement scores at pre-test phase respectively. In light of these objectives, pre-test achievement scores were subjected to ‘t-test’. The means, S.D.’s and t-values of different subjects of both the groups (E & C) at pre-test phase have been presented in table 1. These mean scores are further being presented graphically in Fig. 1.

Table 1: 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

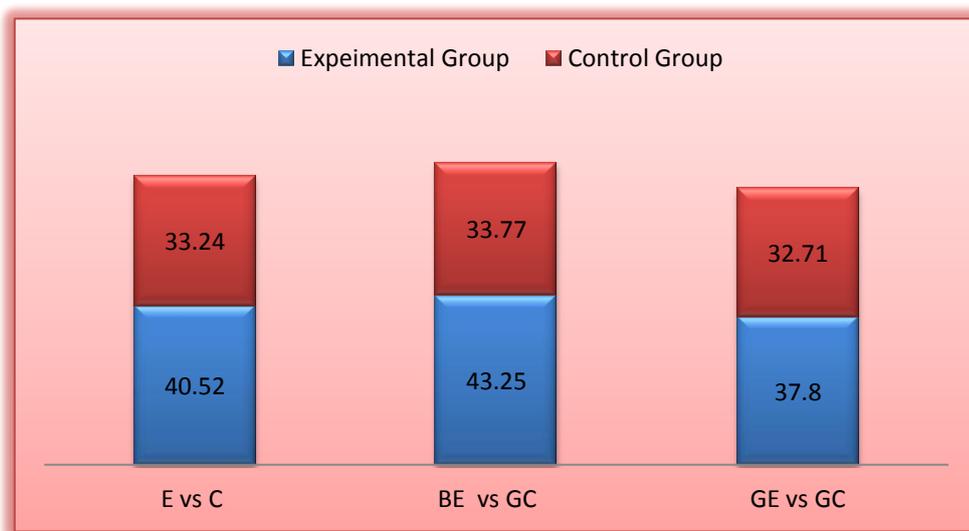


Fig. 1: Mean scores of Experimental Group and Control Group in Science (Before Experimental Treatment)

The results displayed in table 1 reveals that the t-values 1.13, 1.83 & 0.13 of pre-test scores of total students of experimental and control group, boys of experimental group and control group & girls of experimental group and control group respectively are not found significant. It may therefore be concluded that there was no significant difference in the achievement level of total students of both the groups (experimental and control), boys of experimental and control group & girls of experimental and control group before conducting experiment.

Comparison of Achievement Scores of Experimental and Control Group in Science (After Experimental Treatment)

The focus of this section was to compare the achievement scores of two groups (E & C) of students to be taught through IT-Enabled Instructional Package and traditional method after experimental treatment. Further in this section, the experimental and control group boys and girls were also compared on their achievement scores at post-test phase level respectively. These mean scores are further being presented graphically in fig. 2.

Table 2: t-values for Achievement Scores of Experimental and Control Group (After Experimental Treatment)

| Group | N | Mean | S.D. | t-values |
|---------------------------|----|-------|------|----------|
| Experimental | 70 | 50.44 | 9.58 | 4.72** |
| Control | 70 | 37.65 | 8.32 | |
| Experimental Group (Boys) | 35 | 55.25 | 7.87 | 6.29** |
| Control Group (Boys) | 35 | 38.54 | 9.89 | |

| | | | | |
|-----------------------------------|----|-------|------|--------|
| Experimental Group (Girls) | 35 | 45.62 | 8.76 | 9.46** |
| Control Group (Girls) | 35 | 36.77 | 6.41 | |

**** - Significant at 0.01 level**

The perusal of table 2 shows the t-value 4.72 for both the groups was found to be significant at 0.01 level of significance. In the context of mean scores, it can be revealed that students of experimental group have higher achievement in science than the students of control group. So it can be safely concluded that ITEIP helps in enhancing the achievement of students in mathematics in comparison to the traditional method of teaching. Apart from the aforementioned obtained results when boys of experimental group and control group were compared for their achievement, it was found that mean achievement score of experimental group boys is higher than that of control group. Also the t-value 6.29 for the mean scores of both the groups is significant at 0.01 level of significance. Hence it can be inferred that ITEIP has enhanced the achievement level of boys of experimental group in science. From the table 2, it is further elucidated that the mean achievement scores of experimental group girls (45.62) is significantly higher than the mean achievement score of control group girls (36.77). The t-value 9.46 for post-test scores of experimental and control group of girls is found significant at 0.01 level of significance. Therefore it can be concluded that the girls of experimental group have performed better than the girls 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) [5] 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. Ada, Faith & Victoria (2012) [1] indicated that students taught using (CAI) package performed significantly better than their counterparts taught using the conventional method of instruction. Liao (2007) [15] Cepni & Kose (2006)[3], Singh (2005)[28] & Kiboss (2004)[12] suggests 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 favour of the treatment group. Shim, Park & Kim (2003) [27] examined that VRT Simulations allow comfortable interaction with computers and increase the interest of students and their understanding of scientific concepts

and phenomena. Balasubramanian and Meera (2002) [2] also revealed that CAI in Drill and Practice is more effective than the Tutorial and Simulation mode in teaching Biology. Stark, Gray and Payne (2000) [29] 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).

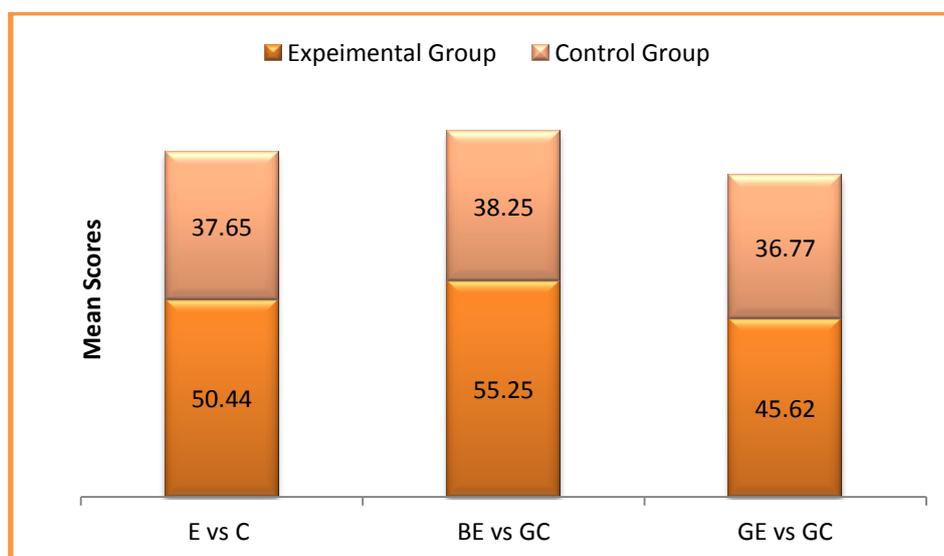


Fig.2: Mean Scores of Experimental Group and Control Group (After Experiment)

Comparison of Mean Gain Achievement Scores in Science (After Experimental Treatment)

In this section comparison of mean gain achievement scores of two groups (E & C) of students to be taught through ITEIP and traditional method has been done. The mean gain achievement scores in science of two groups (E & C) at post-test phase are also presented graphically in the form of bar diagram in Fig. 3.

Table 3: Mean Gain Achievement Scores of Experimental and Control Group (After Experimental Treatment)

| Group | N | Mean | S.D. | t-values |
|---------------------------|----|------|------|----------|
| Experimental | 70 | 9.91 | 4.29 | 3.95** |
| Control | 70 | 4.41 | 1.83 | |
| Experimental Group (Boys) | 35 | 12 | 4.23 | 4.80** |
| Control Group (Boys) | 35 | 4.77 | 4.77 | |

| | | | | |
|-----------------------------------|----|------|------|--------|
| Experimental Group (Girls) | 35 | 7.82 | 3.24 | 8.14** |
| Control Group (Girls) | 35 | 4.05 | 1.25 | |

**** - Significant at 0.01 level**

The perusal of table 3 indicates that the mean gain achievement score of experimental group (9.91) is higher than the control group (4.41). The t-value 3.95 of mean gain achievement scores is found significant at 0.01 level. It supports that subjects exposed to ITEIP achieved significantly higher mean gain level of achievement in comparison to conventional teaching method. It can be concluded that teaching through ITEIP is more effective than conventional teaching method in raising the achievement of students in Science. Furthermore, results summarized in table 3 illustrate that after the comparison of boys of experimental and control group, it was found that mean gain achievement scores of experimental group boys (12) is higher than of control group boys (4.77). Also the t-value 4.80 for both the groups is found significant at 0.01 level. The results displayed in the table 3 further revealed that when girls of experimental and control group were compared on mean gain achievement score it was found that mean gain achievement score of experimental group girls (7.82) is higher than that of control group girls (4.05). Also the t-value 8.14 of mean gain achievement scores was found significant. So, it can be clearly stated that the boys and girls exposed to ITEIP achieved significantly higher level of achievement in comparison to conventional teaching method.

The result is in consonance with the findings of other researchers as Rose and Stella (1992)[23], Kumar (1998)[13], Panda and Chaudhary (2000)[18], Vij (2003)[31] found that computer assisted teaching method was wuperior to lecture method in terms of gain achievement scores. The results are also in contradiction with the findings of Jothiokani and Thiagarajan (2004)[11] 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. Patil (2006)[19] found that there is significant difference between the gains in achievement in terms of scores in pre-test and post-test of the pupil-teachers from pre to post-test. Nimavathi and Gnanadevan (2008) [17], Ponraj & Sivakumar (2010)[21], Phillip, Jacksin & Dave (2011)[20], Ada, Faith & Victoria (2012)[1] 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.

Findings of the Study

- No significant difference was found in the achievement level of total students; boys; and girls of experimental and control before conducting experiment. It leads to the conclusion that there was no difference in the achievement scores of two groups (E & C) i.e. initially experimental group and control group were similar in their performance.
- Significant difference was found in experimental and control group after conducting experiment. It discloses the fact that students of experimental group have higher achievement in science than the students of control group. It can therefore be inferred that students who were taught science through ITEIP show significant improvement in their achievement than the students who received instructions through conventional method of teaching.
- The post-test achievement scores in science of boys of experimental group and control group of fifth graders differ significantly in favor of experimental group boys. This implies that boys who were taught science through ITEIP show significant improvement in their achievement than the boys who received instructions through conventional method of teaching.
- The post test achievement scores of girls of experimental group was found significantly higher than the post test achievement scores of control group. This leads to inference that the girls who were taught through ITEIP show significant improvement in their achievement in science than the girls who received instructions through conventional method.
- The mean gain achievement scores in science of experimental group and control group of tenth graders differ significantly in favor of experimental group. It implies that students who are taught science through IT-Enabled instructional package show significant improvement in their achievement than the students who received instructions through traditional method of teaching.
- After the comparison of boys of experimental and control group in terms of mean gain achievement scores, it was found that boys of both the groups differ significantly in favor of experimental group boys. It can be concluded that ITEIP is more effective than conventional method of teaching in raising the achievement of boys in science.

- When girls of experimental and control group were compared on mean gain achievement score it was found that mean gain achievement score of experimental group girls is higher than that of control group girls. This entails that the girls exposed to ITEIP benefited more in their achievement in comparison to the girls exposed to conventional method of teaching.

Educational Implications

The present study has a wide range of implementation in the field of education. Some of the implications are given below:

- **For Schools:** School organization should be considered technology as a useful tool so that teachers can successfully integrate technology into their teaching. IT-Enabled instructional package if find a permanent place in school time table can be proved as a boon in today's overcrowded classrooms. Apart from this information technology course should be given due place in the curriculum.
- **For Planners:** 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.
- **For Administrators:** The administration should allow enough flexibility for teachers to make decisions regarding the use of technology in the classroom instruction. The administrators might allow teachers time to design lesson plans that incorporate technology and should also provide them high-quality professional development.
- **For Teacher Educators:** Finally, teacher education programs would motivate teachers on adopting technology use in their classroom when teaching. For this purpose teachers should be provided opportunities to explore and practice with various technology tools in technology courses. More practice and self exploration might help them increase their comfort level with the technology tools.
- **For Teachers:** This study implies that having access to the technology outside the school seems impact teachers' technology integration efforts. Teachers used technology in their personal lives. It is easier for them to use some of those tools in their classroom since they do not need to spend extra time to learn about those tools for classroom instruction.

- **For Students:** 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.

Conclusion

The quality education helps to empowering the nation in all aspects by providing new thoughts and the ways of implementation of various technologies. There are number of effective teaching & learning methodologies in practice. Technology is the most effective way to increase the student's knowledge (Gupta & Lata, 2015)[9]. IT-Enabled Instructional Package (ITEIP) with its variety in the presentation of content helps learners in concentration, better understanding, and long retention of information which is not possible otherwise. The learners can get opportunity to work on any live project with learners and experts from other countries. The current study has a wide range of applications in the field of education. With the help of IT-Enabled Instructional Package, the teacher would be able to devote more time to the task of helping students for which they are trained. Moreover, the students will also enjoy their course of study with motivation and encouragement. Thus, when students taught through ICT, they feel more involved in studies which help significantly in enhancing their achievement level. To conclude, it is assumed that the present study will help to open the door to a new and different venue to check the effectiveness of teaching through ITEIP on academic achievement of school students.

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