

# Effectiveness of Computer Simulation in Teaching Physics in ODL

Iqbal Shah\*

Waseem Ahmed\*\*

## Abstract

This study was an experimental design research. Its aim was to evaluate the effectiveness of simulation in teaching of Physics at higher secondary school level. The main objective of the study was to explore the effect of simulation method of teaching Physics on academic achievement of students. Achievements were compared, taught by simulation method and conventional lecture method.

The sample comprises of forty students. Two groups of twenty students each were formed. One group was taught by computer simulation method and the other by conventional lecture method. The content of the teaching material was selected from the curriculum of Physics class XI, published by Punjab Textbook Board Lahore, Pakistan. The achievement tests were used as a tool of the research.

The findings of the research were, that the academic achievements of the students were significantly high through computer simulation method as compared to the group of students studied through conventional lecture method. It was recommended and suggested that computer simulation method may be applied in the schools and colleges for effective learning in the subject of Physics.

**Keywords:** Computer aided instruction, Simulation method, Conventional lecture method and Overhead Multimedia Projector.

---

\* Assistant Professor, Allama Iqbal Open University, Islamabad.

\*\* Research Scholar

## **Introduction**

The conventional lecture method of teaching has now been transformed with the advent of the computer technology. A number of new teaching methods are being introduced in field of science teaching. These methods are of course improved with the passage of time. Contemporary students not only need to understand the subject fundamentals but also advanced learning. To lead these students to acquire the skills will demand drastic overhaul in teaching methods in the classrooms. Modern teaching methods play a pivotal role in improving learning. The age of blackboard and notice boards are in the transition phase. Teachers, therefore, should use new and advanced teaching methods. Modern classes are equipped with new teaching techniques such as interactive whiteboards, overhead multimedia projectors, computer simulation, computer models, animations and educational software etc.

Simulation is the hypothetical representation of some real thing or system or process. Computer simulation is an endeavor to model a real or imaginary state on a computer system for the purpose of getting insight into functionality of the system. On changing variables, predictions can be made about the characteristics and behavior of the system. Computer simulation is becoming a useful part of modeling many natural systems in sciences like Physics, Chemistry, Biology and Social sciences as well as in Engineering to gain insight into the operation of the system.

Computer simulation and animations are outstanding tools for teaching of science courses. Animations demonstrate step-wise sequences of numbers, images and diagrams to exemplify intricate conceptions or theories. Simulation on the other hand is imitations of systems. The person adds or alters certain parameters and the software will highlight the response or changes. The conclusion is that simulation or animation has been constructed for teaching and learning. These are handy tools for teacher, used for assessment and facilitate in classroom and laboratories.

## **Materials and Methodology**

Materials used for computer simulation instructional method were, Computer, software of the simulation, multimedia projector.

Materials used for the conventional lecture method were white board, writing marker.

The study was a pretest-posttest design or experimental research. All science students of higher secondary school level in Islamabad city constituted the population of the study. Forty students of grade xi were taken as a sample. These students were further divided into two groups; Experimental group 'A' and Control group 'B'.

A pre-test was constructed and administered on the sample, on the bases of the result of this test students were divided into equally two groups as mentioned above.

Each group was consisted of 20 students. The group 'A' was instructed by computer simulation method, while group 'B' was instructed by the conventional lecture method. Three topics were selected from the curriculum of the xi level Physics.

The duration of the teaching was three weeks for each group. After a week a post-test was developed and administered on both group.

## Data Analysis and Interpretation

The analysis was done with the help of MS Excel. Data was tabulated and analyzed in terms of mean scores and t-test was used to compare the academic achievement of both groups.

Table 1  
Academic achievement of group A and B in the Pre-test

Group	N	Average	Stand. Dev.	t-value
A	20	12	3.36	0.28
B	20	11.7		

Table 1 shows that t-value 0.28 is less than the critical value at significance level 0.05 is 2.02 with degree of freedom  $df=3$ . There was no significant difference between the mean academic scores of both groups in the pre-test. Hence there is no difference of academic achievement of both experimental and control groups in pre-test.

Table 2  
Academic achievement of group A and B in the Post-test

Group	N	Average	Stand Dev.	t-value
A	20	14.8	1.96	0.28
B	20	11.95	3.73	

Table 2 shows that t-value 3.02 is greater than the critical value at significance level 0.05, which is 2.04 with degree of freedom df2. There was a significant difference between the mean academic achievement scores of both groups in the post-test. Hence there is a difference of academic achievement of both groups after computer simulation method used.

Table 3  
Academic achievement of group 'A' in the post-test

Group	N	Average	Std. Dev	t-value
Experimental 'A'	20	2.8	1.38	5.26

Table 3 shows that t-value 5.26 is greater than the critical value at significance level 0.05, which is 2.09, with degree of freedom df2. Therefore there was a significant difference between the mean academic achievement score of group 'A' in the post-test. There was a significant academic achievement of experimental group 'A' in post-test. This is the proof that the academic achievement by the computer simulation method is significant.

Table 4  
Academic achievement of group 'B' in the post-test

Group	N	Average	Std. Dev.	t-value
Control 'B'	20	0.25	0.83	1.35

Table 4 shows that t-value 1.35 is less than the critical value at significant level 0.05, which is 2.00 with degree of freedom df2. There was no significant difference between the mean academic achievement score of group 'B' in the post-test. This proved that the academic achievement by the conventional lecture method in not significant.

## Results

The following results of the study came out after the analysis of the data.

1. The academic achievement by computer simulation method was high as compare to that of conventional lecture method.
2. The academic achievement of experimental group 'A' was significant (table 3).

3. The academic achievement of control group 'B' was not significant (table 4).
4. Comparison of two methods has been shown in table 2. There was a difference between the achievements of the two groups.

The research concluded that computer simulation method proved to be significantly superior to the conventional lecture method. The computer simulation method appeared to be very much effective in Physics teaching and in enhancing the theoretical skills of students.

## **Recommendations**

1. Computer simulation method may be implemented to enhance teaching of Physics.
2. In the teacher training curriculum this concept shall be introduced.
3. All physical and teaching facilities should be provided in schools and colleges, while teaching through this method.
4. The standard and quality of Physics teaching can be improved by applying this method of teaching.

## **Discussion**

This study was designed to find out the effectiveness of computer simulation method of teaching at higher secondary level. The research was conducted for academic achievement in theoretical domains of the Physics students. This was experimental research and academic achievements of two groups were determined for the purpose of effectiveness of the computer simulation. Finding of the study demonstrated that with the help of computer simulation method the gain in academic achievement significantly increased. Therefore it was suggested and recommended that computer simulation method may be applied to enhance teaching excellence.

## References

- Aldrich. (2003). Learning by doing: A comprehensive guide to simulations, computer games and pedagogy in e-learning and other educational experiences, San Francisco. Pfeifer-John Wiley & Sons.
- Bryan, J. (2006). Technology for Physics instruction: Contemporary issues in technology and teacher education, Online serial, 2(6).
- Cekbas, Y., Yakar, H., Yildirim, B., and Savran, A. (2003). The effect of computer assisted Instruction on student. *The Turkish online Journal of Educational Technology*, 4(2).
- Demirel, Q. (2004). Planning and Evaluation in Instruction: Art of Teaching, Pegem Publication.
- Kahraman, O. (2007). Effect of the computer assisted instruction on student's attitude and achievement on the Physics topic of the 7<sup>th</sup> grade science lesson, M.Sc. Thesis, Pamukkale University, Science Institute, Denizli.
- Kara, I., & Yakar, H. (2008). Effects of computer supported education on the success of students on teaching Newton's Laws of Motion. *Worm Applied Sciences*, 1(3). 51-56.
- London, N. (2005). A field of CAI software: A journey through the solar system M.Sc. Thesis, California State University, Dominguez Hills.
- Schutte, J. G. (1996). Virtual teaching in Higher Education: The new intellectual superhighway or just another traffic jam, Retrieved on September 16, 2003, from; <http://www.csum.edu/sociology/virexp.htm>
- Sokolowski, J. A., Banks, C. M. (2009). Principles of Modeling and Simulation, Hoboken, NJ, Willey.
- Stephens, A., Lynn & Clement, John, J. & Nunez Oviedo, Maria, C. (2006). Using expert heuristics for the design of imagery rich mental simulations for the science class, Proceedings of the 2006 Annual Meeting of the National Association for Research in Science Teaching (NARST) San Francisco.