COMPUTER SIMULATED INSTRUCTION AND ACHIEVEMENTS OF HIGHER SECONDARY SCHOOL STUDENTS IN PHYSICS

[1]DR.KHUDA BAKHSH, [2]DR.MUHAMMAD SHABBIR, [3]DR.SHUMAILA FAROOQI, [4]DR.GHULAM AHMAD

[1]Associate Professor, Department of Education
Government College University, Faisalabad, Pakistan
[2]Assistant Professor, Department of Education
Government College University, Faisalabad, Pakistan
[3]Assistant Professor, Department of Education
Government College University, Faisalabad, Pakistan
[4]Assistant Professor, Department of Arabic
Government College University, Faisalabad, Pakistan

ABSTRACT

The study was designed to see the role of Computer Simulated Instruction towards the academic achievements of Physics students enrolled in government Higher Secondary Schools in Punjab. It was an experimental study having the pretest and post test results. We hypothesized that Simulation instructional strategy is more effective than conventional lecture method especially for the teaching of Physics. A thirty items Test having Multiple Choice Questions from the syllabus of Solid State Physics was administered to the students. Treatment was given for two weeks. It was found the Simulation techniques assisted by computer and the teacher is more effective than conventional lecture method to teach the Physics students. It was recommended to apply and ensure the computer simulated instructions throughout the Government Higher Secondary Schools in Punjab.

***Keywords**: Government, Simulation, Computer, Instruction, Physics, Higher Secondary School*

INTRODUCTION

Simulation is a structured set of circumstances which mirror real life situations. It is the act of stimulating the behavior of a situation or a process by the use of a suitably analogous phenomenon. Simulation is a teaching technique in which the behavior is not controlled and participants can bring their own experience, knowledge, and skills to the situation and consequently enrich the learning process, change the academic setting to a real life situation, and provide an effective and efficient language learning experience. Simulation can also be considered as a problem-solving activity to which learners bring their own distinct opinions, feelings, and personalities.

Science and Technology Education form the foundation for sustainable national development by protecting human societies from ignorance, illiteracy, disease and poverty (Babajide, 2021) .The teaching of science starts from the nursery through primary to secondary and tertiary institutions. Thus, science education is meant to expose the learners to scientific nature (facts, principles and concepts), processes, attitudes and then equip learners with skills of professional scientists. The objectives of the science curriculum as provided in the National Policy on Education include; adequate laboratory and field skills in science, meaningful and relevant knowledge, ability to apply scientific knowledge to everyday life. The knowledge acquired from the elementary stage is the basis for some courses such as Engineering, Biochemistry, Microbiology, Zoology, Botany and Environmental Sciences (Javid,2013; Andelore,2020; Tao,2018).

Science curriculum has developed a package of computer simulation and multimedia teaching, an indication that science and technology has gone beyond their conventional approach into the use of simulation teaching for schools and colleges. Teachers play vital a role in the implementation of the curriculum; their responsibility is to ensure that science students achieve national goals. Incidentally, the learners have their peculiar characteristics which may manifest special learning needs. Learners expect that the materials and method of instruction should be easily transferable to the real world (Babajide, 2018; Gunstone,2022). Thus, the task of the teacher includes, among others, to provide the materials and experiences to aid learning and meet the learner's expectations. Basically, computer simulation simplifies instruction and makes it real. It emphasizes the use of computers for educational purposes, which have become increasingly common. The development has shifted

education from mere acquisition of declarative knowledge and skills to the application of conceptual and integrated knowledge so that science students are better able to apply their knowledge to a friendly, expansive, novel situation in which learners must perform. The application of dynamic visualization such as simulation is potentially well suited for learning contents and is not easily affordable in normal classroom settings. The use of computer simulation for instruction in such circumstance appropriate (Akram,2017).

Physics has been found to be the bedrock of scientific and technological development worldwide both in developed and developing countries. It is quite obvious that students cannot actually apply what they don't understand; knowing for instance from Bloom's taxonomy of learning that comprehension precedes application, hence there is need for proper comprehension of physics concepts before they can be applied (Ozkal,2018).

One of the ways of solving the problem of the abstract nature of science is the application of Information and Communication Technology (ICT). Physics is one of the first areas where the possibilities that computers may offer the employment of new teaching methods are explored. A variety of computer applications have been developed and used in teaching Physics, such as spread sheets (Dory, 2001), computer-based laboratories and simulations (Andaloro,2021), exploratory environments, multimedia and intelligent tutors (Pena,2022). There are numerous ICT applications that are meant to stimulate students' active engagement and offer the opportunity to work under conditions that are extremely difficult, costly or time-consuming to be created in the classroom or even the physics laboratory. The use of such ICT applications has developed a new research in Physics , since it radically changed the framework under which Physics teaching is being understood and implemented (Umoke,2021).

Among the various ICT applications, computer simulations are of special importance in Physics teaching and learning. Simulations offer new educational environments, which aim to enhance teachers' instructional potentialities and to facilitate students' active engagement. Simulations provide a bridge between students' prior knowledge and the learning of new concepts, thus helping students to develop scientific understanding through an active reformulation of their misconceptions.

Today a wide variety of educational software is available for teachers and students helping them to present and model physical phenomena and processes, or solve Physics problems. Computer simulations have been successfully applied from high school to University Physics teaching . They have been used to diagnose and remedy alternative conceptions of quantum Physics and confront alternative students' conceptions in mechanics. A recent study showed that simulations were equally effective to micro-computer based laboratories in facilitating the comprehension of concepts involving the free fall of objects. Other studies focus on the effects of the use of computer simulations on students' conceptual understanding . An interesting finding is that, even after computer-supported Physics instruction, students conserve most difficulties and vacillate between alternative and scientific conceptions from one context to another. It is on this premises that this study investigated the effect of computer simulated instruction on the achievement of higher secondary school students in Physics.

METHODOLOGY

The study adopted a pre-test post-test quasi-experimental research design involving two groups; students in the control group were taught with traditional teaching method and the experimental groups were exposed to the Physics simulated instruction. The population of the study consisted of Higher Secondary School students in Punjab.

One hundred students (50+50) participated in the study. They were randomly assigned to control and the experimental groups. The Physics Achievement Test having 30 items of multiple choice options drawn from the syllabus of Solid State Physics was administered. . The simulated instruction was designed with several animations for proper comprehension. One -way Analysis of Variance (ANOVA) was used to test for the effects of Computer Simulated Instruction on achievement of students in physics.

RESULTS

The results were presented on the basis of the research hypothesis which guided the study.

H: There is significant effect of treatment on achievement of Higher Secondary School Students especially in the subject of Physics.

Table 1: ANOVA for Computer Stimulation group and Control group.

Sum of squares	Mean Square	F	significance
699.14			
699.14	318.65	0.02*	
23.00			
722.14			

0.02* is less than 0.05

Table 1 reveals that there is significant effect of treatment on the achievement of students. The use of computer simulated instructions account for the significant effect of the treatment on the achievement of students.

Table 2: Descriptive Statistic for Experimental and Control groups

Group	N	Mean	Standard Deviation
Experimental group	50	14.12	1.68
Control Group	50	9.89	1.92

Table 2 showed that students in the experimental group that were exposed to Computer simulation performed better than those in the control group (14.12 > 9.89). This implies that computer simulation enhances better achievement in physics. Consequently, the hypothesis which states that there is significant difference in the achievement mean scores of students in Physics before and after treatment was accepted.

The effect of Computer Simulated Instruction on Students' Achievement in Physics is significant, because computer simulated instruction perform different functions such as helping students to develop their understanding about phenomena and physical laws, develop an understanding of the relationships between physical concepts, variables and phenomena. Computer simulation also employs a variety of representations i. e pictures, animations, graphs, vectors, and numerical data display. This help the students to understand the underlying concepts, relations and processes in Physics and also retains the knowledge that they have acquired through constructive simulation. This is opposite to what happened in the control group where the teacher was solely in control of the classroom activities and the students were the recipients of information. This information can easily be lost from the students memories after a time leading to poor achievement in Physics.

CONCLUSION AND RECOMMENDATIONS

This study has shown that students' achievement in Physics is enhanced through their exposure to computer simulated instruction. It is, therefore, suggested that the government should supply enough electronic materials to schools because without these materials, computer simulation cannot be effectively implemented. The government should also organize continuous seminars and training for the in-service teachers on the effective design and implementation of computer simulated instruction. Secondary schools should be provided with standby generators in case of power failure. The government should make adequate resources for the implementation of computer simulated instruction readily available in schools. The teachers should be well grounded in the use of computer. It is the basis for the implementation. If the teacher cannot make use of the computer, then it

will be very difficult to design and implement computer simulated instruction. State and Federal Governments should encourage and sponsor in-service training for science teachers on the application of simulation. Most importantly the government should beef up computer literacy programs for both students and teachers because simulation utilizes computer programs to a large extent. Government should equip all schools with necessary facilities (laboratories, computers and accessories).for the bold application of simulated instruction enabling the students to do better with due interest and utmost pleasure.

References

[1] Adeyemo, S (2010). Impact of Information and Communication Technology (ICT) on teaching and learning of Physics. *Journal of Educational Research and Technology*

[2] Akinsola, M.K. and Animasahun, I.A. (2007). The effect of simulation-games environment on students'achievement in and attitudes to Mathematics in secondary schools. *The Turkish online journal of Educational Technology*

[3] Akram,S. (2017). The Effect of Simulation on Middle School Students' Perceptions of Classroom Activities and their Foreign Language Achievement: A Mixed-Methods Approach,

[4] International Electronic Journal of Elementary Education

[5] Andeloro,G(2020). A Computer-based learning Environment in the field of Newtonian physics

[6] Babajide, V.F.T (2021).Enhancing Cognitive Achievement in Physics:The impacts of Practical Activities.Education & Science Journal of Policy Review& Curriculum Development

[7] Babajide, V.F.T(2018).The Relative Effects of Two Instructional Strategies on Secondary School Students' Achievement in Physics, *International Journal of Applied Psychology and Human Performance*

[8] Gunstone, R.F(2022).Children' Science :A decade of Developments in Constructivist views of Science Teaching and Learning .*The Australian Science Teachers' Journal*

[9] Javid, C. (2013). An investigation of effectiveness of simulation in developing oral skills: A case study. *European Scientific Journal*

[10] Ozkal, K., Tekkaya, C., Cakiroglu, J., & Sungur, S. (2018). A conceptual model of relationships among constructivist learning environment perceptions, epistemological beliefs, and learning approaches. *Learning and Individual Differences*

[11] Pena,C.M & Alessi,S.M(2022).Promoting a Quantitative understanding of Physics .*Journal of computer in Mathematics and Science Teaching*

[12] Tao,P.K(2018). Confronting Students 'Alternative Conceptions in Mechanics with the force and motion in micro world. Athar Publishers , germany

[13] Umoke, J. C. and Nwafor, C.C. (2021). Effects of instructional simulation on secondary school students'achievement in Biology. Journal of Education and Practice