

Effect Of Computer Assisted Instruction On The Achievement And Retention Of Students

*Sunita Rani and ** Dr. Babita Chaudhary

**Research Scholar, Department of Education, SunRise University, Alwar, Rajasthan (India)
* Assistant Professor, Department of Education, SunRise University, Alwar, Rajasthan (India)
Email: Srsunita1237@gmail.com

Abstract: Students turn into passive information receptors of knowledge and information. In order to end this lack of teaching related to non-constructivist approaches, some empirical studies have revealed innovative and student-centered approaches that promote the acquisition of skills among students (Nganyadi, 2021). Nowadays, many studies in the published literature indicate that there is a strong relationship between the use of computers and students' acquisition in teaching and learning processes (Altun & Alev, 2007). Computer technologies are an integral part of modern science and science education. The use of computers in science can be divided into five categories: symbolic manipulation, data collection, simulation, numerical analysis, analysis and visualization (Gold & Tobochnick, 1996). The ICT-based learning activities include making presentations using laptops/computers, making observational videos, search for learning resources through the internet, send emails and business productivity software such as text editor and spreadsheet, enterprise software, data storage and security, network security and others (Ashrafi & Murtaza, 2008; Van Laar et al., 2017).

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Introduction:

Today, science and technology are developing rapidly. Against this, traditional education approaches in which the teacher gives a lot of lectures while the students listen, record and memorize (Tosun & Yildiz, 2015; Haryadi & Pujiastuti, 2020) are insufficient in raising individuals and developing their skills. In addition, science education should prepare students for the ever-increasing competition between countries and enable them to keep up with the conditions of the 21st century with higher achievement standards. The rapid development of information technology and the use of computers and internet in education have led to a paradigm shift in various fields, including the development of learning methods (Siahaan et al., 2017; Saputri, 2021; Yildiz, 2021).

Computers have advanced greatly since their first commercial use in the 1960s. They have developed from expensive, cumbersome devices to powerful but affordable tools used in modern life for both professional and leisure activities. Their use in education has increased dramatically in recent years and now computers and related technologies are in most schools all over the world. Advances in technology are inevitably reflected in educational systems. In most developed countries education has been penetrated by Information Technologies (IT). Many teachers use computers and new technologies while teaching and many textbooks have included new

technologies (Hicks & Holden, 2007). Most educators and researchers try to use these new technologies, and this integration has changed the nature, concepts and methods of work in each subject (Custer, 2000). For example, in mathematics, teaching and learning have changed with the use of technology (Hoyles & Lagrange, 2010, p. 494).

With the development of technology and knowledge, there is a shift in the learning environment from print to digital. Therefore, it is necessary to take advantage of the opportunities provided by the use of information and communication technology (ICT) through the learning process (Hırça & Şimşek, 2013). Traditional Instruction (TI) refers the use of traditional teacher-centered methods and standard tools of mathematics in the classroom such as rulers, pencils, and paper to teach mathematics content. In the case of traditional methods in mathematics teaching, teachers usually provide instruction of mathematics concepts by using abstract examples and words. This way of teaching, which needs highly cognitive skills to assimilate the taught subject puts a lot of pressure on students leading them to lose their self-confidence which lowers their capacity for learning. Most mathematics content in primary education in North Cyprus is provided in a traditional manner. Lecturing and questioning are the most common teaching methods in most mathematics classrooms (Pesen, Odabaşı, & Bindar, 2000). Thus students encounter

many difficulties in acquiring what is taught, and more importantly, this causes them to memorize most mathematical concepts without understanding (Cankoy & Tut, 2002). Although some innovative approaches were incorporated into the school curricula with the publication of a new “North Cyprus Education System” booklet in 2005, currently, traditional teaching techniques, such as lecturing, are commonly used in North Cyprus (Ministry of National Education and Culture, 2005). Similar to North Cyprus, students in Hong Kong mostly receive traditional instruction. In a study in Hong Kong, Mok, Johnson, Cheung, and Lee (2000) suggested the use of technology, such as graphics calculators, to eliminate problems in secondary school algebra where major

teaching activities are conventional in style and do not provide sufficient opportunities for students to develop conceptual understanding. However, there has been no such scientific study in North Cyprus to investigate the integration of computers in education.

Computer Simulation Software in Science Education

PhET, which is a simulation developed by the University of Colorado, is one of the most common easy to use software in science education. PhET simulations designed to demonstrate the basics teaching physics, biology and chemistry for the benefit of classroom learning or individual learning (Perkins et al., 2006; Daskan & Yildiz, 2020).



Figure 1: A screen of parabolic motion at PhET simulation

PhET simulation that can be accessed easily and free of charge by students not to burden students financially helps students to acquire the relationship between real-life and underlying knowledge (Haryadi & Pujiastuti, 2020) and provides feedback to students in the creative workplace (Perkins et al., 2006). Algodoo educational software is very suitable for teaching and learning physics in a computer-based learning environment. The ability of this software is that it is able to visualize physical phenomena in a similar way to real situations. Algodoo shows scientific interactions in a more interesting way with virtual remarkable animations.

The Algodoo educational software presents a fun and motivating learning environment for students creating an interaction between drawing and physics courses. With Algodoo, students can test physical theories and laws or their own hypotheses to learn by

doing in a computer environment. Students can also design their own physics-based games by taking into account gravity, friction force, and even the friction coefficient of air (Hırça & Bayrak, 2013; Cayvaz & Akçay, 2018).

Educational Aspect of Computer Simulations

In elaborating constructivists' ideas, Elliott et al. (2000) stated that constructivism is a learning approach that argues that individuals actively build their own knowledge and that reality is determined by the student's experiences. Svein Sjoberg defines the basic ideas of the constructivist learning approach, as the knowledge is not passively received from outside, but actively constructed by the learner (Sjoberg 2007). Simulations can provide a more complex and realistic learning environment than other educational strategies. They can also make complex science concepts more simple and understandable. Therefore, Perkins et al.

(2006) and Sjoberg (2007) asserted that science simulations also support constructivist approaches. Finkelstein et al. (2006) indicated that when reviewed based on the Dale's Cone of Experience, science simulations such as PhET simulation is included in the most concrete level, where 90% of students will be actively involved in learning activities to observe, conduct experiments, and conclude the data obtained. The use of virtual laboratories in online learning still leaves some problems. Saputri (2021) stated several problems arise in the implementation of virtual laboratories which are lack of students' ability to perform practical procedures, students' lack of understanding of the error method and low skills of students' science processes are problems that arise during the implementation of online applications. On the other hand, Siswanto et al. (2018) emphasized that

it is important that the simulations used in the studies are developed by researchers under the supervision of education experts in order to adapt to the learning activities performed by the students. Haryadi and Pujiastuti (2020) conducted research to determine the presence or absence of a significant effect of the use of PhET simulation media on the learning achievements of the basic energy material in the life system. The results of the study show that learning using PhET software simulations is 37% better than traditional learning. It can be concluded that PhET software simulation can improve students' science process skills. However, Saputri (2021) stated that mastery of student science process skills is low during the implementation of online learning with virtual laboratories.

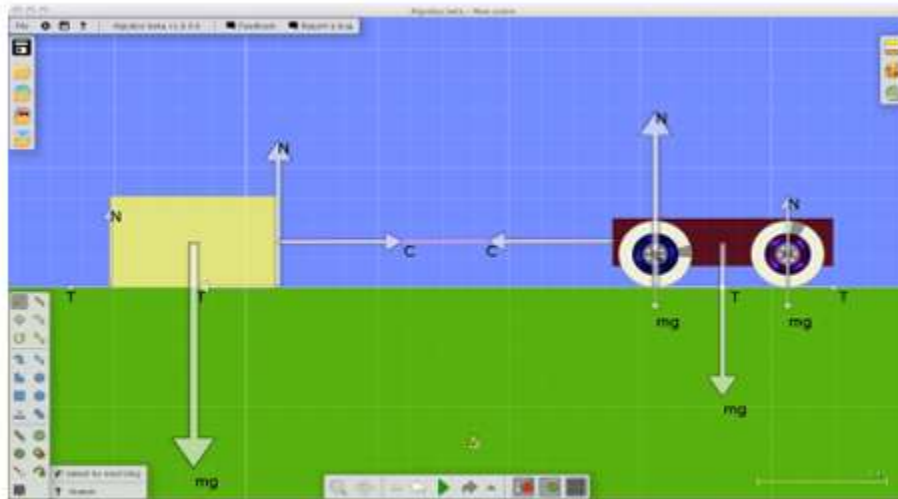


Figure 2: A screen of Newton Laws at Algodoo simulation

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