The utilization of information and communication technology and its effectiveness in learning empirical science among fourth-grade elementary school students

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Abstract

The research aimed to explore the necessity for the utilization of information and communication technology and its effectiveness in learning empirical science among fourth-grade elementary school students and it has also drawn a comparison with the traditional method. The research sample comprised 184 fourth graders under the program of descriptive assessment who were randomly selected and assigned into the experimental and control groups. First, both groups underwent the traditional method and then, the pre-test was administered. The experimental group used new technology at home for reviewing and revising the lessons while the control group reviewed the lessons using the traditional method. The results of post-test and its comparison with the pre-test scores indicated that, the experimental group scored higher on learning as compared to the control group. Moreover, the increasing scores of the experimental group obtained a higher mean as compared to the control group. The statistical analysis indicated that, the value of F was significant for the experimental and control group in the post-test at the level of .0001.

Keywords: Information and communication technology, learning-teaching process, active learning, descriptive assessment.

1. Introduction

The rapid and fast-paced evolution of information and communication has drastically changed the form of life and each day new aspects of progression and development emerge in the realm of information and communication technology. Information technology is defined as the knowledge and its implication in the methods of production, process, transmission and distribution of data and information (Karami Pour, 2003). Research data and the experience of leading and industrialized countries indicate that, the need for effective implication of information and communication technology in education and learning requires the educational staff specifically teachers to be familiar with innovative approaches in education and learning and also planning in order to benefit the opportunities that are provided by this technology (Zamani, 2007).

The cultural and social foundations in which the ICT sources are perceived and utilized by teachers exert significant effect on personal and occupational development. Our society has perceived the effect of ICT in social, personal, economic and educational aspect and ICT has emerged under the titles of informational society and factual culture. In this process, access to the knowledge of ICT can go beyond the traditions and open new horizons before our eyes (Reis Dana, 2002).

In the current era, the development of innovative technologies has influenced the realm of education owing to the fact that, information technology requires the educational systems to change from the process of traditional learning and teaching in which the knowledge is directly transferred to the learner to the conversion of data and benefiting it to grow socially and personally. This important issue can't be achievable unless the acquired skills can turn into occupational ability of human sources in career and occupational realms.

Here, the main issue is to express the new assigned duties of the teachers and scientific explanation of these duties. This article attempts to shed light onto the reasons of teachers' role change in relation with applying the computerin education that reminds us that teachers should reconsider their role and guide their students instead of preaching. Moreover, families should regard this phenomenon in continuing this path and providing their children with the technology

as the complementary part of school education. The present article has also evaluated the reasons of implementing the new technologies in the classroom and the effectiveness of utilizing the computer in education. McCormick & Scrimshaw (2001) assert that, the issue of education is far more crucial than technology and its main focus is on the quality of gaining and broadening the experience and learning.

Introducing the beneficial changes of technology in the realm of communication and information is one of the axes of change in the 21st century. The educational organizations' staff emphasize that, one can evolve the process of teaching and learning through employing the new informational tools and adequate capabilities suitable for the innovations (Sanger & Willson, 1997).

In the current era, with regard to the increasing growth of technologies, media and cultural evolutions, we have faced momentous and revolutionary changes in the realm of science and technology. Students of the 21st century are confronted with higher levels of unpredictable changes as compared to the 20th century. Preceding schools attempted to educate people who were successful in learning the lessons and could start the motor of the society; however, the present schools should educate students who are innovative and have the required skills to live in the digital age (Russle, 2010). The students in the digital age are discovering their surrounding world, a world that shapes their original and independent thoughts. Therefore, if the education aims to educate innovative students, it should try to provide for the cooperation of students in the world of computer (Zamani, 2007). We're bound to open the window of the classroom toward the light form the science so that the students, teachers and society can derive and enjoy the benefits of such light.

The first form of extensive classroom was in a distance learning type as a correspondencecourse. Isa Ebrahim Nezhad (2006) considers distance learning as the product of industrial era and the industrialized form of education and contends that, the process of growth and evolution of this system has tangible and historical relevance to the stages of industry. Pithman (1840) taught stenography subject lesson using correspondence (Bravoo, 2003, p. 50). United Kingdom Open University UKOU was established as the first educational institution in the world to employ the distance learning method and rarely emphasizes on written subjects. Moreover, Indira Gandhi

National Open University inIndia has integrated the implication of publication, audiovisual tapes, radio and television broadcasting and conference technologies (Sanger, 2001). The first attempts of teachers to implement the computer in traditional classroom was through giving speech and learning experience related to the teacher's teaching which was carried out in other educational settings was presented or utilized as the assignment for more consideration (Sutherland, 2000).

Nafisi (2004) in an article entitled "requirements, conditions and foundations for the implication of information technology in educational organization of Iran based on the findings of international studies" authors that, with regard to the condition of Iran, it seems that, the total orientation of educational organization is educational reforms to educate individuals who have the required abilities in the informationera. Hence, information technology can be at the service of such strategy and provide for the effective foundation of learning and teaching activities.

Studies and research indicate that, many students and young individuals may attend the school with pleasant feelings to be familiar with ICT so that, their curiosity is awakened and aroused (Sutherland et al, 2000; Sanger et al, 1997; Becta, 2001). Sanger has described the differences between children's experience at school and their broader experience in implementing the communication technologies as obstruction of cultural climate and has also emphasized on the necessity of fresh assessment and evolution of structures and systems of education. He asserts that, children's use of ICT at home should be exploratory along with timely cooperation with family members. In such a state, the ICT at home becomes purposeful.

Mehr Mohammadi (2005) authors that, the traditional role of teacher as the source of knowledge has changed into the learning guide. Teachers should make use of different strategies of learning to be able to respond to individuals' differences in learning, integrate the technology with educational curriculum, introduce good and comprehensive lesson subjects and involve the students in the process of learning. Moreover, the studies by Nasiri (1999), Khezr Lou (2000) and Yazdchi (2002) have studied the importance of implementing the information and communication technology in education and have come to similar conclusions. All these studies demonstrate that, employing information technology and educational media result in the

improvement of teaching and learning process and play a significant role in the enhancement of students' quality of learning.

2. The theoretical foundation of ICT implication in education

The most important theories which have produced significant effect on the process of learning are generally those that have aimed the issue of interaction in children's learning, the interaction with the surrounding world through physical communication and activities and interaction with others through communication and language (Loveless, 2002).

Piaget asserts that, logical structure of children's thought is shaped through acting. He states that, the practical structure of the child has been limited in the primary stages of learning and is different from adults' thinking from a qualitative point of view. As the child gains more experience, s/he may need more complex models and samples to explain what occurs around him/her to be able to interpret them. These structures are gradually reformed to be adapted with the environment. Children can shape the specific adaptive principles and styles from symbolic and abstract structures through mutual interactions, playing and action in the world and confronting with new circumstances.

Another structural theory of learning considers knowledge as the result of action and reaction, comparison, simulation, adaption and adjustment both in the concrete and abstract world. The real situation can be simulated for children through the possibilities of informational and communicational technologies, so that, they can test out their issues in virtual world with real conditions. The process of education can have higher quality using trial and error method.

The information technology makes the education of anything possible for anyone, anywhere and anytime. With the expansion of electronic education and education of new virtual opportunities for family causes the maintenance of local culture and using the beneficial experience of others. This educational system has many benefits including:

Teaching everyone at any place and anytime regardless of the race and age limitation

Decreasing the physical costs associated with the educational building

Instant access to resources and information at any time

The possibility for collective working and bilateral discussions

The availability of on-line educational resources and lessons on a regular and integrated basis that is more appropriate than the traditional educational method

Access to others' learning experiences

Balance and steadiness of the contents of lessons

Selection of the desired educational modules based on the individual's abilities and competence

Updating all the desirable textbooks and contents and the facilitation of this process

Possibility of evaluation and assessment of creative education

Possibility of broadening and storing the experience (Jalali, 2003, p. 28-30)

3. **Method and materials**

The present research employed a semi-experimental method with pre-test and post-test design. The utilization of information and communication technology and the traditional method were compared in learning empirical science among fourth-grade elementary school students. The research population included all the fourth-grade students under the program of descriptive assessment in Alborz Province (1st, 2nd and 3rd boroughs and Taleghan region) in the school year of 2012-2013 (184 individuals) out of which, a sample of 45 individuals were randomly selected from among 8 schools. Finally, 21 and 24 students were assigned to the control and experimental group, respectively. Descriptive and inferential statistics including frequency, standard deviation, percentage, standard deviation error and one-way variance analysis were employed by SPSS-10 to compare the obtained scores of students in the experimental and control groups.

The data gathering tool was a teacher-made Empirical ScienceAchievement Questionnaire that was used to evaluate the students in the experimental and control groups. The items of this test were designed based on the educational goals of science in the fourth grade of elementary school. This test had a total of 35 items including 29 multiple-choice items and 6 short-answer

questions. The validity of the questionnaire was determined using faced validity. The test was given to some of the experienced fourth-grade teachers and educational groups' leaders and it was altered in accordance to their opinions. The reliability of Empirical Science Achievement Questionnaire was obtained to be %81.

Table 1- distribution of the subjects in the experimental and control groups

Groups	Number of subjects	percent
Experimental group	92	50
Control group	92	50
Total	184	100

Prior to the experiment, each of the groups learned the empirical science by one of the traditional methods including making speech, asking and answering and group discussion. The scores of all the students were recorded by a test one week subsequent to the end of teaching.

4. Results and findings

The table below shows the mean and standard deviation of the scores in the experimental and control groups in the pre-test and also the mean and standard deviation of the scores of learning of both groups in the post-test.

Table 2- mean, standard deviation and standard error of experimental and control groups in the pre-test and post-test

test	group	n	mean	Standard deviation	Standard error
Pre-test	experimental	92	9.33	22.57	.26
	control	92	8.79	2.63	.27
	total	184	9.06	2.61	.19
Post-test	experimental	92	13.94	2.48	.25
	control	92	12.09	2.84	.29

	total	184	12.97	2.83	.30

As observed in the table above, the experimental group has higher mean as compared to the control group. The significance or insignificance of the difference has been demonstrated in table 3.

Table 3- mean, standard deviation, and standard error of groups in the pre-test and post-test

Type of test	Source of variance	Sum of squares	df	MS	F	Level of sig.
pretest	Between-group	13.58	1	13.58	2.005	.159
	Within-group	1233.64	182	6.77		
	total	1247.21	183			
Post-test	Between-group	172.19	1	172.196	24.113	.0001
	Within group	1299.71	182	7.141		
	total	1471.91	183			

As observed in the table above, the value of F is not significant for the experimental and control groups at the significance level of .05 (df=1, F=2.005). However, the value of F is significant in the post-test at the significance level of .0001 (P>.0001, F=1, F=24.113). For more precise evaluation, mean and standard deviation of the scores have been presented in the table below.

Table 4- comparison of the experimental and control groups in increasing scores

groups	N	mean	Standard deviation	valuet	df	Level of sig.

experimental	92	4.60	3.53			
control	92	3.21	3.55	2.66	182	.008

The experimental and control groups were compared in increasing scores in the table above, the mean of the increasing scores in the experimental group is higher than the control groups. Statistical analyses indicated that, this difference is significant (t=2.66, df=182, P>.008). The results of analysis in these tables indicate the higher effectiveness of the experimental groups (using ICT) as compared to the control groups (traditional) in increasing the learning.

5. Discussion and conclusion

From what was discussed, the importance of information and communication technology can be perceived in the life of human being. Many countries utilize modern educational tools and advanced sciences and technologies in their reformed educational curriculum and adopt new definition of the role of teacher and student, resetting the goals and modifying the pedagogical methods by equipping the schools with the computers and its connection to the net. This technology has changed the role of the teacher and s/he is not considered as the sole resource of knowledge and information but a guide and responsible to help students acquire new information and enhance their skills for interpreting and solving the problems. The paramount and growing need among the societies can't be fulfilled by the continuance of traditional methods and learning based on the fact that, information and communication technology has paved the way for the innovative methods of teaching and education.

Research on the effectiveness of educational programs using ICT in the quality education indicates that, its educationaleffectiveness is higher than traditional classes. The results of the present research are not in line with the results of the research by Russell (2010). He claims that, there is no significant difference between the scores of students who use ICT-based educational courses as compared to those who undergo traditional methods. The results are in harmony with the results of the research by Khezr Lou (2000), Nasiri (1999), Yazd Chi (2002) and Mehr Mohammadi (2005). These studies indicated that, the utilization of ICT as the instructor in combination with traditional education results in higher increase of learning in basic skills and

they learn faster and show higher levels of memory activity. If they work with the computer, they may get encouraged to learn better.

According to Mehr Mohammadi, the traditional role of teacher as the data sources has change into the learning guide and nowadays,teachers should employ different methods of teaching to be able to respond to the individual differences in learning, integrate the technology with educational curriculum to make it more interesting and involve the students in meaningful learning. On the other hand, according to Loveless (2002), the utilization of ICT, aims the issue of interaction in children's learning, interaction with the surrounding world through physical activities and interacting with others through communication and language to expand the learning of students. What is certain is that, the processes have accelerated in the recent 15 years and have turned into a new global economy that is strengthened by the technology, fueled by the information and driven by knowledge. The present process goes toward the decrease of inaccurate information and access to the credible and authoritative information is on the rise; therefore, schools should promote the culture of education for learning such as acquiring skills and knowledge that leads to constant education during the life of individual. According to Alvin Toffler, the illiterate individuals in the 21st century are not those who are not able to read and write but those who can't learn and teach.

Moreover, Sanger (1997) suggests that, children's use of ICT should be exploratory with timely cooperation of the family members, so that, the utilization of ICT at home becomes a purposeful action. The differences between individual experiences at school and their broader experience in benefiting the communication technologies necessitate a fresh reevaluation and evolution of structure and educational systems.

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