

The effects of the Information & Communication Technology (ICT) on growing creative minds in high schools

Mohammad reza ghaznavi

Master of education technology ,sistan and baluchestan ,iran

Aleme keikha(corresponding author)

Master of Education Management ,University of zabol, Iran,p.o.box:98615/538

Hasan keikha

Master of management ,sistan and baluchestan ,iran

Abstract

This research's purpose was set to study the effects of the Information & Communication Technology (ICT) on growing creative minds and four elements of the creativity which are mobility, initiative, resilience and expansion in one of Kalaleh city's high schools. Through this study, a comparative-based method is used including two experimental groups: the experiment group and the control group. The whole population of the students that have been studying in the third grade in Kalaleh's high schools has been 308 individuals in the academic year 1389-90. The sampling method in this study was the "Simple Cluster" and 38 students from "Shahid Beshkufe" high school as control group and 30 students from Doctor Hesabi high school as experiment group -all male and third grade students- were selected as samples for this research. The data have been gathered using two methods: the library method and Torrance's visual creativity test. The data are analyzed in two levels of descriptive (average calculation, variance, and deviation from mean) and deductive (the T test for calculating the difference between the averages of the experiment and control group). The major results of this study were that firstly using the ICT for the third-grade students has been effective on growing creative thinking with initiative and expansion but it has had no effects on the growth of their mobility and resilience. In brief, using ICT helps the third-grade students to have creative minds.

Key words: Information and Communication technology, Creative thinking, high school

Introduction

The 21th century is the age of knowledge and information revolution; it means changing the industrial community into informative community, and today the wealthiest countries and human communities are those who have more knowledge and information and certainly ICT will be the leader of teaching and training in the future (Nowrouzi & others, 1387 AHS, P10).

Information & communication technology (ICT) has passed the face to face contacts (Video Contacts), and by the means of changing the way information are processed and saved, has revolutionized the functions of the organizations and totally whole society, and also has affected the awareness of people and has made an informative society (Niyaz Azari, 1381 AHS, P 338).

When ICT entered to the education and course scheduling aspects, course management was completely affected by it and now is performed by the research-based and student-based manners. Now it is not a responsibility of teachers to pile up and transmit the information; they have different responsibilities and must be skilled in different subjects. The closed, limited and focused patterns of educational resources and traditional learning become open, unfocused and unlimited and free from time and place and will have strategic results for the education and learning system. Course textbooks adopted from ICT have multi-dimension and active essences and their designers have process-based performance not content-based one. In traditional attitude to this matter, a teacher-based performance is the principle and basic rule of human training. But in the modern attitude, this principle has been shifted to the students and is founded on it (Mohammadi, 1381 AHS, P 2).

The fact that those systems which are only dependent to the materials are going to be collapsed and training methods which are based on using mutual values according to the modern communication systems and visual-auditory frames are promoted, is undeniable. Inefficiency of traditional training methods in present age is accepted by the public and the usage of PC-technologies and information to improve training process either qualitatively and quantitatively is inevitable (Yazdchi, 1385 AHS, P 4).

One of the most important needs of the information age is paying attention to the thinking skills. With this significant promotion of the technologies in the contemporary world, especially ICT, it might be considered that teaching and training has to focus on using this technology. But having and using this technology alone in the teaching and training world will not be good enough for today and future needs (Razavi, 1385 AHS, P 41).

The basic affair of the present world is to train thoughtful men. Marshall and Taker (1998) have mentioned it that the continuance of the communities is dependent on people that be able to think, understand, learn and solve the problems in all economic and social dimensions. According to Marshall and Taker, future belongs to those communities that pay attention to the thinking growth and focus on the policies that emphasize on gathering knowledge and skills for all society members not a limited number of them.

Today, the modern communicative-informative technologies have accelerated and deepened social changes to that extent which even has included the most stable field of human-life i.e. the culture and has involved us in the middle of a cultural revolution that John Berry Barlow -one of the theorists of electronic boundaries- considers it as the most serious cultural revolution after fire invention up to know (Mahdavi, 1380 AHS, P 329).

BabaMohammadi and Khalili (1386 AHS) did a research with the title "The creative thinking skills in nursery students of the medical sciences in university of Semnan" and concluded that the grades of B.A students has been exceeding but for juniors has been remained at the same range. The average of B.A students' grades was 12/34 and for juniors it was 11/27.

Fatemi (1383 AHS) did another research titled "Does using computer in teaching mathematics instead of giving lectures increase the creativity of the students?" and the results showed that there was a magnificent difference between the average of the creativity scores of those students that had been taught by computer and those by giving lectures.

Jahani (1379 AHS) has analyzed the growth of creative thinking in teenagers with study-based performance through his essay. This program had been made by Mathew Lipmann for the "Teaching philosophy to the children" institution. The results showed teaching by the scenario method helps growing creativity skill in teenagers and moreover presenting the educational plans using scenario with the research method more than scenario method alone provides possibility for the growth and promotion of creativity skill. Later this theory was accepted by the Crenel's measure.

Using "the California Critical Thinking Skills' Test", Quidamo (2007) carried out an experiment to determine whether the writing has totally significant effects on the critical thinking skills and studying its core which consists of exploring, analyzing, evaluating and deduction or not and concluded that writing has no clear and significant effects on it.

Anthony (2004) did another research titled "Creativity, Imagination and Digital technologies". The results of this research have shown that using computerized capabilities helps growing creative thinking in students.

Dodecyl and Middleton (1999) did a research titled "Designing lessons for the behaviors of thinking" and through it have analyzed the importance of behaviors as an important part of thinking and also have suggested three principles to design lessons for increasing creativity: A) growing the creativity needs time and students should be given enough time for learning the behaviors of thinking within their schedule. B) Students need to risk through the learning process and should be given the chance for possible mistakes. C) Having reflective thinking while educational designing which means to teach the students to see things from different points of views and solving the problems.

Peter & Norn Fascione and Jean Carlo (1995) did a research in the California University which was titled "Studying the relations between the behaviors of thinking and thinking ability". They came to know that if students were put in real, complex and exciting situations and during their education look for the reasons and the evidences and explore and analyze the data and information and think about the justifications to solve their own problems (super acknowledgement), certainly their ability to think creatively will be improved.

According to above-mentioned studies and researches, this study's aim is to analyze the effects of the Information and Communication Technology (ICT) on growing creative thinking in students of Kalaleh city. Hypotheses experimented during this study are followings:

- 1- Using ICT helps growing the mobility of the students
- 2- Using ICT helps growing the initiative ability of the students
- 3- Using ICT helps growing resilience ability of the students
- 4- Using ICT helps growing expansion ability of the students

Method and Materials

According to the aim and hypotheses of this research, it has been carried out by the comparative method with two experimental groups –the experiment group and the control group. All male students of Kalaleh city who were studying in the third grade of the high school during 1389-90 AHS were elected as the statistical community of the experiment. 68 individuals were elected as the samples this way: 38 students from Shahid Beshkufe High school as the control group and 30 students from Doctor Hesabi High school as the experiment group.

To gather the required information for this research, two methods are used: The library method (using library resources, theses, magazines and validate & relevant e-magazines) and the standardized visual creativity test of Torrance. This test includes 112 signs which are categorized in three sections of verbal, visual and written. Torrance defined the creativity as a combination of following four elements: mobility (ability to produce many ideas), initiative (ability to produce unusual and new ideas), resilience (ability to use different approaches) and expansion (ability to mind every little detail). According to the results printed in the standardized creativity test

of Torrance guidebook, the permanence amount of this test for a sample of 50 students of 10th region in Tehran has been estimated to be 80%.

To analyze the research data, two statistical approaches have been used: Descriptive and deductive. Through descriptive analyzing of the statistic features such as charts, frequency distribution table, calculating the average, variance and standard deviation have been used. And through deductive analyzes for calculating the average of experiment group's scores in every test with control group, for demonstrating the meaningfulness of the results, the independent T test has been used for calculating the difference between the averages of control group and experiment group.

Results

Tables of descriptive measure: Table 1-1 the Descriptive measurement of the scores taken from the Torrance's test by the students from Beshkufe high school

The measure	Frequency	Average	Variance	Minimum	Maximum
Mobility	38	17.4	51.76	7	33
Resilience	38	12.3	20.27	6	28
Initiative	38	22.2	12.045	2	53
Expansion	38	54.71	586.12	5	85
Creativity	38	22.61	21.04	12.3	54.71

Table 2-1 1 the Descriptive measurement of the scores taken from the Torrance's test by the students from Doctor Hesabi high school

The measure	Frequency	Average	Variance	Minimum	Maximum
Mobility	30	17.2	34.3	6	26
Resilience	30	11.53	12.6	5	17
Initiative	30	29.6	130.36	10	54
Expansion	30	63.6	782.2	19	148
Creativity	30	30.5	33.08	11.53	63.73

The first hypothesis of the research: using ICT helps growing mobility skill of students

Table 3-1 the independent T test, comparing the average of the scores of the control group and the experiment group in terms of "Mobility"

	average	variance	Deviation from mean	T score	Table's T score	Degrees of freedom
Beshkufe	17.4	51.76	5%	0.123	1.67	66
Dr. Hesabi	17.2	34.3				

As you can see here, above table shows that the experiment group with the average of 17.2 and the control group with the average of 17.4 nearly have had the same performance and there is no significant difference between their scores.

The deductive discussion on the first hypothesis:

According to the details of the table 3-1, the average score of the students of Beshkufe high school was 17.4 with the variance of 51.76 and for Dr. Hesabi high school's students it was 17.2 with the variance of 34.3. Since the calculated T for the degrees of freedom of 66 was 0.123 and is not larger than table's T score (1.67) in the 5% safety level, it can be concluded that the difference between two groups with the safety index of 95% is senseless, so using ICT has no effects on growing the mobility skill of the students.

The second hypothesis of the research: using ICT helps growing initiative skill in students

Table 4-1, the independent T test, comparing the averages of scores of the experiment and control groups in initiative skill

	Average	Variance	Deviation from mean	T score	Table's T score	Degrees of freedom
Beshkufe	22.2	120.45	5%	2.71	1.67	66
Dr. Hesabi	29.6	130.36				

As you can see the table shows that there is a basic difference between the scores of experiment group with the average of 29.6 and the scores of the control group with the average of 22.2; and this difference is meaningful.

The deductive discussion on the second hypothesis:

According to the results shown in table 4-1, the average of the students of the Beshkufe high school was 22.2 with the variance of 120.45 and for the students of the Dr. Hesabi high school they were 29.6 and 130.36. Since the calculated T with the degrees of freedom=66 was 2.71, it is larger than the table's T (1.67) in the safety level of 5%. So, it can be concluded that the difference between the two groups with the safety index of 95% is meaningful, so using ICT helps growing initiative skill in students.

The third hypothesis of the research: Using ICT helps growing the resilience ability in students

Table 5-1, the independent T test, comparing the average of the scores of experiment and control group in the resilience ability

	Average	Variance	Deviation from mean	T score	Table's T score	Degrees of freedom
Beshkufe	12.13	20.27	5%	-0.6	1.67	66
Dr. Hesabi	11.53	12.6				

As you can see clearly, the details within the table show that the experiment group with the average of 11.53 and the control group with the average of 12.13 nearly have had the same performance and there cannot be seen any meaningful difference between them.

The deductive discussion on the third hypothesis:

According to the contained data in the table 5-1, the average score of Beshkufe high school students is 12.13 with the variance of 20.27 and for the students of Dr. Hesabi high school it is 11.53 with the variance of 12.6. Since the calculated T with the degrees of freedom=66 was – 0.6 and it is not larger than the table's T (1.67) in the safety level of 5%, it can be concluded that the difference between the two groups with the safety index of 95% is meaningless, so using ICT has no effects on growing the resilience ability in students.

The fourth hypothesis of the research: Using ICT helps growing the expansion skill in students

Table 6-1 the independent T test, comparing the average scores of the experiment and control groups in expansion skill

	Average	Variance	Deviation from mean	T score	Table's T score	Degrees of freedom
Beshkufe	54.71	586.12	5%	2.39	1.67	66
Dr. Hesabi	63.73	782.2				

As you can see, the results of the table show that there is a significant difference between the scores of the experiment group (63.73) and the control group (54.71) and this difference is meaningful.

The deductive discussion of the fourth hypothesis:

According to the results contained in the table, the average of the scores of the Beshkufe high school is 54.71 with the variance of 586.12 and for the Dr. Hesabi the average is 63.73 with the variance of 782.2. Since the calculated T with the degrees of freedom=66 is 2.39 and it is larger than the table's T (1.67) in safety level of 5%. So it can be concluded that the difference between two scores with the safety index of 95% is meaningful, so using ICT helps growing the expansion skill in students.

The Main hypothesis of the experiment: Using ICT helps growing creative thinking in students

Table 7-1, the independent T test, comparing the average scores of the experiment and control groups in growing creative thinking

	Average	Variance	Deviation from mean	T score	Table's T score	Degrees of freedom
Beshkufe	21.04	21.04	5%	2.94	1.67	66
Dr. Hesabi	30.5	33.08				

As you can see, the results contained within the table show that there is a significant difference between the scores of the experiment group with the average of 30.5 and the control group (21.04) and this difference is meaningful.

The deductive discussion of the main hypothesis:

According to the results of the 7-1, the average of scores for Beshkufe high school is 21.04 with the variance of 21.04, and for Dr. Hesabi high school is 30.05 with the variance of 33.08

. Since the calculated T with the degrees of freedom=66 is 2.94 and it is larger than the table's T (1.67) in 5% safety level, it can be concluded that the difference between two groups with the safety index=95% is meaningful, so using ICT helps growing creative thinking in students.

Discussion and Conclusion

Interacting and saving, the information and communication technology is able to manipulate and present the information in different forms and makes it possible to have active and practical learning and creativity. Hence the results of this research are followings:

The first hypothesis

In the first hypothesis, it was supposed that using ICT helps growing mobility skill in students. According to the research's results, there is no significant difference between the average scores of mobility scores of the experiment and control groups and statically there is no meaningful relationship between the ICT and mobility skill of students of control group. Therefore, using ICT has no effects on the mobility skill of the students.

This is the same result of Ghaffari's research but in opposite of Fatemi's who had studied the effects of CAT on creative thinking. To compare the results of this research, the results of Fatemi's research that had studied the effects of teaching by computer instead of giving lectures for mathematics on the creativity of female students studying in the first grade of secondary school in Tehran's 14th region during 1382-83 AHS academic year have been used. The present research is like Fatemi's research from the aspects of theory and dependent variable, but differs in independent variable, because Fatemi has studied two independent variables of CAT and teaching by giving lectures. Also, the information technology is much more than a multimedia teaching of a single course. Fatemi's experiments have been carried out for female community in secondary schools but this one is done for male community in high schools.

The second hypothesis of the research:

The second hypothesis of this research analyzes the effects of using ICT on growing initiative skill in students. According to its results, there a meaningful difference between the averages of initiative scores of experiment group and the control group and statically the meaningful relationship between ICT and initiative skill of students. Hence, using ICT helps growing initiative skill in students.

This result and Fatemi's result are convergent but divergent with Baba Mohammadi and Khalili's results.

The third hypothesis of the research:

The third hypothesis focuses on the effects of using ICT on growing resilience ability in students. According to the concluded results, there is no meaningful difference between the averages of the resilience scores of the experiment and control groups. As a result, using ICT has no effects on growing the resilience ability in students.

These results and Fatemi's results and Anthony's results are convergent.

The fourth hypothesis of the research:

The fourth hypothesis of this research studies the effects of the using ITC on growing expansion ability in students. According to the final results of this research, there is a meaningful difference between the averages of expansion scores of experiment group and the control group and statically there is a meaningful relationship between ICT and expansion ability of students. So, using ICT helps growing expansion ability in students.

These results and Fatemi's & Abd Hagh's results are divergent.

According to author, this difference originates in unsuitable combination of curriculum with ICT; because if ICT is used correctly and basically can affect this aspect of education. Also it may be because of the gender role, since Fatemi's research was carried out within female community but this one is within male community.

The main hypothesis of the research:

The man hypothesis of this research analyzes the effects of ICT on growing creative thinking. According to the results concluded from analyses of data, there is a meaningful difference between the averages of creativity scores of the experiment group and the control group and statically with the safety index of 95% shows that there is a meaningful relationship between the independent variable "Information and communication technology" and dependent variable "creative thinking". As a result, using ICT affects growing creative thinking. The result of this research and what Anthony (2002) has suggested about the effects of ICT on the creative thinking through his essay are convergent. Also, it's completely the same as the result of Fatemi's research that has studied the effects of CAT on creative thinking.

Suggestions

The following suggestions are offered according to the hypotheses of this research and its results:

- Thus ICT has positive effects on growing creativity; it is suggested to increase the number of the computer teaching-based schools.
- Placing teaching the approaches of the information technology units into curriculum alternatively in order to growing creative thinking in students and keeping the required skills in this case.
- Studying why ICT has no effects on two other elements of the creativity: Mobility and Resilience
- The most common problem between students using ICT is being unfamiliar with the English language; so it is suggested to hold English-Learning classes.
- Facilitating, encouraging and creating positive attitude about the "Researching" and it's useful results for principles of schools and the students.
- Reducing the organizational procedures of the research
- Using active and group teaching methods such as asking and answering, discussion and problem solving based on informational and communicational technologies.
- Encouraging students to use ICT for learning.

- Teaching courses using ICT in educational process.
- Asking students to do their own researches alone or by group.
- Evaluation using the ICT facilities.
- Using local networks.
- Showing the researches of the students in exhibitions.
- Providing useful lessons and educational resources via ICT.
- Encouraging students to do their researches using ICT.
- To improve the educational system and training teachers based on new techniques of technology.
- Using one unique procedure in teaching and learning process.
- To visit international exhibitions presenting the up-to-date ICT technologies.
- To visit the schools and other educational institutions that use ICT by the students and teachers.
- To improve of students' skills in using computer and internet in order to receive and process the information.
- To equip schools and other educational institutions using ICT.

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