



## The Relationship between the Use of Information and Communication Technology with Critical Thinking and Creative Thinking among High School Students

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### Abstract

The purpose of this study was to investigate the relationship between the use of information and communication technology on critical thinking and creative thinking of high school students. The research method was descriptive correlation. The statistical population of the present study were all the students of the high school in Isfahan city in Iran, and they were 50707 people, Based on the Morgan and Krejci sample size formula, 382 individuals were randomly selected for research. The research tools include the Ritex standard critical thinking questionnaire (2003) with validity (0.67) and reliability (0.71) and Torrance creativity standard questionnaire with validity ( $r = 0.66$ ) and reliability (0.78) and friendship information and communication technology standard questionnaire (2016) with face and content validity and reliability (0.75). In the inferential analysis of the research, first, the normality of the distribution of scores was checked by the Kolmogorov-Smirnov test, and statistical regression tests were also used. Statistical operations were performed in the environment of SPSS V. 25. The results of the present study showed that the use of information and communication technology has a significant relationship on critical thinking and creative thinking and their components, in the high school students of Isfahan. Based on this, it is suggested that the elements of the educational system use information and communication technology in an effective and principled manner in order to solve problems and develop high-level thinking skills.

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**Keywords:** Information and Communication Technology, Critical Thinking, Creative Thinking, Thinking Skills.

### Introduction

The educational systems is obliged to create the necessary competences for providing prosperity and happiness in children and teenagers through the provision of information and communication technology. In the educational system, all the talents of people in various fields, including the thinking styles and attitudes of students, should be developed in a balanced and coordinated manner. Official and common programs in schools mainly emphasize on cultivating memory and using the mental powers of students, and the

development of various aspects, especially students' thinking, is not given serious attention. Now, to compensate for these issues in education, information and communication technology is a vehicle that allows the expression of a wide range of information, thoughts, concepts and messages.

Information technology has been developed in order to expand the capabilities of human thought, thinking. Information technology is considered to be one of the most dynamic and controversial fields of science and technology due to its transformability and great influence on the development of thinking, economic, social, national security, globalization and adjustment of traditional information problems. It is important to pay attention to this point that in today's world and with the situation that has arisen as a result of the movement towards the global village, other traditional methods of knowledge transfer through text, sheets, exercises and the like cannot attract the attention of young people who are saturated in the world to turn the media to himself (Abdoli Sejzi et al., 2013).

It seems that the main elements of the educational systems, especially the teachers, should be exposed to educational developments in accordance with the developments of today's world and find more awareness of the capabilities of new technologies, and in parallel, strategies should be designed to introduce new technologies into classrooms and educational environments, lead to better thinking and attitude. And in practice, the role of the teacher as a source of power that is monopolized by information will disappear. And his/her role should be changed from the publisher of information to the role of facilitating the process of obtaining information. Parallel to the changes that occur in the elements of the educational system as a result of the introduction of information technology, the changes at the school level are also significant. In this regard, seven basic changes can be mentioned: 1. Change in the attitude of people inside the school 2. Change in the philosophy and styles of learning and pedagogy 3. Change in the formulation of plans and policies 4. Change in the facilities and information sources 5. Change in the professional abilities of the school staff, especially teachers 6. Change in the level of community participation 7. Change in evaluation method (Naghim, 2010).

Information and communication technology is a means of storing, processing and presenting information electronically based on a number of media (Emamverdi et al., 2013). Today, information and communication technologies have become productive tools in higher education and should improve themselves quickly. Otherwise they will lose their users. The use of technology in education is one of the important aspects of the development of information and communication technology as a huge transformation in the social, professional and educational life of the 21st century, which has opened a new horizon for educational institutions such as schools and universities, these changes show that education by nature, the duties and functions of education have changed and the use of information technology and multimedia has become an integral part of the education system.

Today, knowledge management in computer information systems has been given considerable attention. Organization and management of knowledge, followed by management of information and educational resources, and is particularly important in the e-learning environment (Adibi et al., 2004). Many sources and researches have shown that the application of information and communication technology has played an essential role in improving and promoting thinking skills. One of the most obvious approaches is to pay attention to thinking. Experts believe that the first goal of education and training should be to cultivate thoughtful people with an "exploring mind" (Shabani, 2003).

The growth and development of students' intellectual skills has always been an important issue in education, in such a way that educational experts have expressed great concern about the students' inability to think critically and creatively. It is a global need for people to improve their critical and creative thinking so that they can provide targeted services and education to the people of society. A teacher-directed class cannot guide the development of critical and creative thinking. Due to the fact that in our educational system, the retention and transfer of information is the dominant form of education, and based on this, the content and methods of teaching and evaluation are formed, fundamental problems can be seen in the field of critical and creative thinking education. Today, most employers complain about the quality of the educational system and state that young people do not have the necessary skills to do work after graduating from institutes and universities, and the evidence shows that our educational system is losing its efficiency (Abbasi, 2001).

In new era, information and communication technology is one of the most effective components that have affected various aspects of the individual and social life of humans and caused changes in lifestyles.

Educational system is not unaffected by these changes. Both the growth and expansion of this field of human knowledge owes to the educational system and the educational system benefits from this technology. The old teaching methods certainly do not respond to the changing educational needs in new age; therefore, one of the efforts of educational organizations should be related to information and communication technology and its application in the curriculum (Kazemi, 2018).

If information and communication technology is integrated in the current educational processes, it can play an effective role in educational environments and provide the country's education by creating suitable conditions for economic and cultural prosperity (Adibi et al., 2004). The use of information and communication technology in education is the foundation for motivation, learning, experience and innovation. Therefore, its application in education is an undeniable necessity. Information and communication technology has a significant effect on learning, which includes changing the role of learners and teachers, more participation of students with peers, increasing the use of resources outside of textbooks, and developing and improving the skills of designing and presenting materials.

Information and communication technology in education helps to promote the quality of education, which is done by increasing the motivation of learners to learn using multimedia software that integrates text, sound and moving images. These softwares can create an authentic theme and, by involving the student in the learning process, facilitate the learning of basic skills and concepts that are the basis of higher-level thinking skills and creativity. The most basic use of computers for education is to master skills through reinforcement and repetition of lesson content. By creating fundamental changes in traditional concepts, information and communication technology can eliminate the inefficiencies of the education space and bring fundamental changes in the education of memory enhancement, interest in learning, speed of transfer and stability and deepening of learning, creating the power of reasoning and creativity, and finally created changing the attitude of students and creating a positive attitude in them.

The main mission and goal of education is to educate and train people who can think and not be satisfied with the results of other people's thinking; that is, cultivating people who are willing to investigate and not those who simply accept what is said (Abdoli Sejzi et al., 2013). Critical education focuses on wisdom, criticism and change as valuable educational goals. This point of view tries to discover the real social conditions of education, therefore it needs critical thought. For critical education, the critical analysis of social conflicts, in which education is involved, is considered an important starting point.

Based on the importance of critical thinking in development and based on the weakness of traditional education in cultivating this type of thinking, today education experts agree that critical thinking should not only be one of the goals of education but also an integral part of education at any stage. Because critical thinking is thinking that creates the best solution in humans by using analysis, evaluation, selection and application, which is what the world needs today. This research can help designers, authors of textbooks, planners, teachers, students and school administrators. Considering the importance and necessity that was raised, the current research entitled "The effect of the use of information and communication technology on the thinking styles among high school students" in order to strengthen the creative and critical thinking of students with the use of information and communication technology.

## **Research Background**

In the research conducted by Beigzadeh et al. (2018) regarding the use of information and communication technology and the cultivation of creative thinking with entrepreneurial motivation in students, they concluded that the use of information and communication technology can increase creativity. And the entrepreneurship of students is effective. Also Taghipoorhoveizi (2018), found that there is higher academic self-efficacy in smart schools. Also, there is an interaction between the attitude towards information and communication technology and the improvement of the teaching-learning process.

Shabooni and Nohi (2016) in their study indicate that the use of the team teaching method is more effective in increasing students' learning, communication and critical thinking skills and that the level of students' satisfaction with the teaching method presented is higher in comparison with the lecture method. This finding emphasized the desire of students for active and cooperative learning in comparison with passive and one-

sided traditional methods. Team training has an effective role in improving the level of critical thinking and academic progress of students in the courses presented in comparison with the usual lecture methods.

Maleki and Sales, (2016) conducted a research on the relationship between the use of information and communication technology and critical thinking among the students of Shahrekord University of Medical Sciences in the academic year of 2014-2015. The results of the research showed that there is a positive and significant correlation between the use of information and communication technology and critical thinking.

Abdi and colleagues (2014), in a research, reached the results that there was a significant correlation between faculty members' metacognitive awareness and high-level thinking training for students. But this feature did not increase with age and teaching experience. The findings showed that metacognitive awareness along with its two main components (metacognitive knowledge and cognitive regulation) can explain high-level thinking education.

Amanzadeh and colleagues (2014), in their research came to the conclusion that education based on the basics of modern educational technologies (education Web-based, computer and mobile learning) has a significant impact on students' life skills, decision making, problem solving, critical thinking and creative thinking. Also, the effect of education based on the basics of modern educational technologies on students' life skills is not different based on gender.

Shoara and Roodbali (2013), in their study about investigating the relationship between knowledge management and the use of information technology in the organization and providing practical solutions to improve knowledge management using IT, have tried to determine the relationship between knowledge management and the use of information technology by electronic industry employees. Their finding showed that there is a significant relationship between knowledge management and the use of information technology.

Soleimanpoor and colleagues (2010), conducted the research about effect of the teaching method based on information and communication technology in creating sustainable learning in the experimental science course of the third year of middle school. In this research, three methods of providing electronic content produced by the teacher, connecting to the Internet and using educational software were used in this research to present the subjects, and the researchers found that the amount of sustainable learning in the teaching method based on information technology is more than the traditional teaching method.

Agh ar Kacooli (2001), in their research showed that information and communication technology has an effect on the critical thinking of female students of the first year of high school in general and in the subscales of analysis, evaluation and inference.

Owi and colleagues (2017), conducted a study on the effectiveness of high-level thinking skills based on the concept of "I think" map on primary school students. The purpose of this study was to identify students' skills in solving high-level thinking mathematical problems by the concept of "I think". The results showed that students had a significant improvement in solving high-level thinking problems, which proves that the concept of "I think" causes students' ability to solve high-level thinking problems. Suprpto (2017), conducted a study and the results showed that the use of problem-based learning strategies was able to improve high-level thinking skills in students and increased their problem-solving skills, teamwork and self-confidence. Lindner and colleagues (2011), in their research found that information technology, organizational factors and cultural factors strongly influence the success of knowledge management.

Solhaug (2009), in a research showed that critical reflection increased in classes by controlling the variables of motivation, self-efficacy, gender, grades and cultural background. Chang (2009), in a research entitled the relationship between critical thinking skills and information literacy of junior teachers in Taiwan, examined the effect of information technology-based curriculum on increasing information literacy. The results showed that there is a positive relationship between critical thinking skills and information literacy. And there is a significance and the effect of curriculum based on information technology on increasing the information literacy of teachers has been moderate. Shanahan (2007) showed that the use of Internet skills helps the development of students' information literacy skills. Combining Internet information literacy and curriculum by providing rich opportunities is the best approach to develop students' Internet information literacy. This helps to develop students' problem-solving skills and high-level thinking skills, which are essential skills for

everyone in the 21st century. Wheeler and colleagues (2002), in a study titled the effect of using online technologies such as the Internet in promoting creative thinking among students in a rural primary school in the west of England showed that the level of creativity in students in computer-based educational environments has increased significantly.

Sringam (2001), in his study under the title of improving the learning outcomes of adult students through the integration of information technology in distance education in Thailand find that computer-based discussions can replace face-to-face discussions, without harming the learning outcomes of students, students develop their critical thinking skills through the integration of information technology in the teaching-learning process. The use of technology does not have a negative effect on students' learning performance, and accepting the integration of information technology in the teaching-learning process improves critical thinking skills in small groups.

## Research Hypotheses

### The Main Hypothesis

There is a significant relationship between the use of information and communication technology in education and critical thinking and creative thinking of high school students.

### Sub Hypotheses

- 1- There is a significant relationship between the use of information and communication technology in education and critical thinking of high school students.
- 2- There is a significant relationship between the use of information and communication technology in education and creative thinking of high school students.

## Research Method

The research method in this study was descriptive correlation. Description because its purpose is objective, real, orderly description and characteristics of a situation or an issue. Also, the research method is correlational because its purpose is to investigate the relationship between the variables in the research. In other words, in this research, since the researcher investigate the relationship between information and communication technology and critical thinking and creative thinking, the research is correlation.

## Population and Sampling Procedure

The statistical population of the present study were all the students of the high school in Isfahan in Iran, and they were 50707 people, Based on the Morgan and Kerjcie sample size table, 382 individuals were randomly selected for research.

## Data Collection Instruments

The research tools include the Ritex standard critical thinking questionnaire (2003) with validity (0.76) and reliability (0.78) and Torrance creativity standard questionnaire with validity ( $r = 0.79$ ) and reliability (0.85) and Dusti information and communication technology standard questionnaire (2016) with content validity and reliability (0.87).

## Findings

**Table 1: Kolmogorov Smirnov Test Results**

Instrument	Z	Sig	Data Distribution
Creativity Questionnaire	0.362	0.205	Normal
Critical thinking Questionnaire	1.498	0.89	Normal
Information Technology Questionnaire	10.201	0.108	Normal

Kolmogorov Smirnov test was used to check the normality of data distribution. According to this test, the data distribution is normal when the value or significance level is greater than the critical number at the 0.05 level. According to Table 1, the test results show that the data distribution of the changes is normal. As a result, it is possible to use parametric tests and parametric tests were used to check the significance of the hypotheses.

## Inferential statistics

### The Main Hypothesis

There is a significant relationship between the use of information and communication technology in education and critical thinking and creative thinking of high school students.

Pearson's correlation test was used to measure this hypothesis, the results of which are reported in Table 2.

**Table 2: Pearson correlation coefficient results to test the main hypothesis**

Variables	Apply Information and communication Technology		
	correlation coefficient	Sig	N
Critical Thinking	0.820	0.001	382
Creative Thinking	0.737	0.001	382

\*\* Correlation is significant at the 0.05 level.

According to the Pearson correlation coefficient test and the results presented in Table 2, it can be seen that there is a significant relationship between the use of information and communication technology in education and students' thinking styles. That is, there is a significant relationship between critical thinking and creative thinking towards the use of information and communication technology ( $r=0.820, 0.737$ ). Therefore, the main hypothesis that there is a significant relationship between the use of information and communication technology in education and students' thinking styles is confirmed.

### First Sub Hypothesis

There is a significant relationship between the use of information and communication technology in education and critical thinking of high school students.

**Table 3: Summary statistics of the regression model**

Model	Correlation Coefficient R	coefficient of determination R <sup>2</sup>	adjusted coefficient of determination	standard deviation error
1	0.820	0.672	0,667	0.687

**Table 4: ANOVA test results for predicting students' critical thinking based on the use of information and communication technology**

	sum of squared	degrees of freedom	mean squared	F	significance level Sig
Regression	194.2	4	48,55	115,60	0.001
Remainder	158.965	378	0,420		
Total	353,165	382			

**Table 5: results of simple regression test Model**

Model		B	Error Standard Deviation	Beta	T	Sig
	Fixed	1.398	0.468		13,035	0,001
1	Critical thinking	0,485	0,074	0,661	12,356	0,001
2	Creativity	0,722	0,097	0,511	13,448	0,001
3	Growth	0532	0,086	0,312	9,392	0,001
4	Commitment	0,644	0,122	0,420	10,077	0,001

As can be seen in Table 3, the correlation coefficient of the use of information and communication technology and critical thinking of students and their components is 0.820 and the coefficient of determination, i.e. the percentage of the criterion variable variance that is explained by the predictor variables, is equal to 0,661. Therefore, students' critical thinking predicts 65.1% of the variable of using information and communication technology. Also, the creativity component predicts 51.1%, the growth component 31.2% and the commitment component 42% of the use of information and communication technology variable. Also, the regression equation is significant with  $F = 103.226$  and a significance level of 0.001, which is smaller than 0.05.

(Commitment) 0.644 + (Growth) + 0.532 (Creativity) + 0.722 (Critical Thinking) 0.485 + 1.398 = Y' (Information and Communication Technology)

## Second Sub Hypothesis

There is a significant relationship between the use of information and communication technology in education and creative thinking of high school students?

**Table 6. Summary statistics of the regression model**

Model	Correlation Coefficient R	coefficient of determination R <sup>2</sup>	adjusted coefficient of determination	standard deviation error
1	0.522	0.272	0,265	0.211

**Table 7: Results of ANOVA test for predicting students' creative thinking based on the application of information and communication technology**

	sum of squared	degrees of freedom	mean squared	F	significance level Sig
Regression	163,536	5	32,707	109,38	0.001
Remainder	112.875	377	0,299		
Total	276,411	382			

**Table 8: Simple regression test results**

Model		B	Error Standard Deviation	Beta	T	Sig
	Fixed	1.428	0.457		11,491	0,001
1	Creative Thinking	0,728	0,114	0,272	9,536	0,001
2	Fluidity	0,336	0,081	0,233	11,247	0,001
3	Flexibility	0,167	0,136	0,432	9,741	0,001
4	Initiative	0,621	0,136	0,263	9,603	0,001
5	Extension	0,423	0,183	0,197	9,381	0,001

As seen in Table 6, the correlation coefficient of the use of information and communication technology and creative thinking of students and their components is 0.522 and the coefficient of determination, i.e. the percentage of the variance of the criterion variable explained by the predictor variables, is equal to 0,272. Therefore, the variable of students' creative thinking predicts 27.2% of the variable of using information and communication technology. Also, fluidity component predicts 23.3%, flexibility component 43.2%, initiative component 26.3% and extension component 19.7% of the variable of information and communication technology application. Also, the regression equation is significant with F=109.38 and a significance level of 0.001, which is smaller than 0.05.

(Extension) 0.423 + (Initiative) + 0.621 (Flexibility) + 0.167 (Fluidity) + 0.336 (Creative Thinking) 0.728 + 1.428 = Y' (Information and Communication Technology).

## Conclusion

The results of the present study showed that there is a significant relationship between the use of information and communication technology in education and students' thinking styles. That is, there is a significant relationship between critical thinking and creative thinking towards the use of information and communication technology ( $r=0.820, 0.737$ ). Therefore, the main hypothesis that there is a significant relationship between the use of information and communication technology in education and students' thinking styles is confirmed. This result is in agreement with the results of Abdoli seji et al., (2013) and Taghi Porhawizi et al. (2013), Beigzadeh et al. (2009) and Wheeler et al. (2002) and, Tawakoli et al. (2014). The importance of developing thinking in educational systems and the necessity of providing opportunities and facilities for it, is the result of countless research studies that have received more attention today. Then, one of the effective factors in establishing opportunities and facilities for cultivating the mind and attitude and expanding the thinking platform is today's modern technologies, which in different ways can be used for optimal use in enriching the teaching-learning factors at the disposal of the teacher and the learner.

Also the results of the present study showed that the use of information and communication technology has a significant relationship with students' critical thinking. This result is consistent with the results of Shaboni and Nouhi (2015), Maleki and Tahal (2015), Amanzadeh Beneh et al. (2013), Gerji Karsami (2015), Agh Arkakli et al. (2015). In a research entitled the relationship between the use of information and communication technology and critical thinking, Maliki and Tahir (2015) found that there is a positive and significant correlation between the use of information and communication technology and critical thinking. Amanzadeh

and colleagues (2013) in a research, concluded that education based on the basics of modern educational technologies (web-based education, computer and mobile learning) has a significant impact on students' life skills, decision making, problem solving, critical thinking and creative thinking. In explaining this result, it can be said that information and communication technology as a new approach, in the complementary role of the educational system, improving the quality of teaching, diversifying teaching methods, empowering students, providing continuous and automatic training, shortening the training time, shortening the course Education works by paying attention to individual talents, individualizing education and dealing with the problems of collective education.

Students who go through the learning process in new conditions and by using software, the Internet and the world of multimedia education have wider and higher information, and due to the variety of resources and educational content they have, they have more ability to choose. Also, information technology is an intermediary that provides the possibility of expressing a wide range of information, ideas, concepts and messages and has been developed in order to expand the capabilities of human thought. Having the ability of information technology to store, sort and retrieve large amounts of information provides students with various sources of information databases. By using the internet and compact discs, students can access various sources of information that are not necessarily available in regular classrooms or libraries, and in general, information technology with interactive features, storage and the ability to manipulate and present information in various forms of facilities. It provides a potential for active and experiential learning and improving students' critical thinking. Students can draw and present their views and ideas by searching, exploring, making connections between familiar and new scientific topics and summarizing information collected from various sources.

Finally the results of the present study showed that the application of information and communication technology has a significant effect on the creative thinking of students. The results of the present research are in consistent with the results of Abdoli Sejj et al. (2013), Beigzadeh et al. (2017), Amanzadeh and colleagues (2013), Wheeler et al. (2002), (Kraft, 2005), (Ebrahimzadeh, 2016), the results showed that information and communication technology has a significant effect on cultivating creative thinking. Amanzadeh Beneh and colleagues (2013) in a research entitled the effect of education based on the basics of modern educational technologies on the life skills of students of universities in Mazandaran province, concluded that education based on the basics of modern educational technologies (web-based education, computer and mobile learning) has a significant impact on students' life skills, decision making, problem solving, critical thinking and creative thinking. Abdoli Sejj (2013) in his research showed the effectiveness of using information and communication technology in education in creativity in general and in one element of it, i.e. innovation. Wheeler et al. (2002) in their research showed that the level of creativity in students in computer-based educational environments has increased significantly. . Creative thinking is a necessary feature of life in the 21st century; because the world is constantly changing. Creative thinking is a way to go beyond what has been done in the past and reach achievements, solutions and ideas for the present and future. The power of creative thinking and creation enables a person to discover various choices and as a result, get out of the dead ends that he encounters in life. The power of creative thinking allows a person to get out of the closed circle of his limited experiences and look beyond experiences; In this way, a person's life becomes flexible and he looks at phenomena from all sides. On the other hand, as we know, with the development of technological tools and facilities in various fields, significant progress has been made in the field of designing learning and educational environments. The development of these tools and technologies has led to the strengthening of face-to-face learning environments on the one hand and the formation of electronic and integrated learning environments on the other hand. The capabilities and potential of information technology on the one hand, as well as the increase in research and design knowledge in educational technology on the other hand, have caused a change in the approach of educational environments to learning and multimedia, intelligent, virtual and similar learning environments based on information technology are to be formed. Learning environments based on information and communication technology were formed in the direction of transitioning societies from industrial to knowledge in order to provide the mechanism of this evolution by cultivating thinking, creative and digital-based human forces. (McCarthy, Eberheim, Sijano and Sharma, 2006). Information and communication technology, both in terms of potential ability and in terms of demand for it in the ways we show and use it behaviorally and intellectually in the social world, has an increasing role in fostering creativity and high-level thinking skills. (Kraft, 2005). For example, the research of Imamvirdi, Ghahrani and Imamvirdi (2013) showed that all the components of creativity (fluidity, flexibility, expansion and innovation) have a significant relationship with the information technology system. However, in general, information technology includes the collection, selection, processing, storage and application of information in the desired fields and their transmission



through multimedia computers, so that the result is the design, selection of educational materials (lessons) and management of the teaching-learning process in the form of a network of learners. , teachers, experts, educational designers and computer technologists, and the type of information technology educational space is dynamic, real-time, collaborative and creative (Abdoli-Sejzi, 2013). The expansion of information technology and the use of new tools and concepts, provides the expansion of information and easy and low-cost access for students, including students and teachers, in a continuous manner, and enables the rapid exchange of information, new ideas, and cultural interactions. Makes. Undoubtedly, students will enjoy better educational, economic and social opportunities when they have access to computers and information technologies (Jokar and Yaripour, 2018). On the other hand, the information and communication technology revolution has led to the flourishing of educational, economic and cultural movements and a new world is emerging. And in the new millennium, communication technology has rapidly invaded the world, and has affected many aspects of human life.

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