

Efficiency of an Educational Robotic Computer-mediated Training Program for Developing Students' Creative Thinking Skills: An Experimental Study

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Abstract

This research aimed at detecting the efficiency of a computerized training program based on programming the educational roboticists to develop creative thinking skills for the eighth grade basic education students at Manba'a El-Hekma School in Dhofar Governorate. Also, it investigates the nature of the proposed program, the efficiency of the program, and the significance differences between the two groups. The researcher used the experimental curriculum with the two groups; controlled and experimental to achieve the aims of the research and to test its hypotheses. The sample of the research consisted of 30 Students during the first term of the school year 2018/2019 and they were selected intentionally. Each group included 15 students. The experimental group students were trained to program the educational robotics using the computerized training program. Torrance test of creative thinking was applied before and after on the two groups, in addition to an evaluation card to the projects of the Students. The results showed that there are differences with statistical indication on the level of 0.5 between the two averages of the degrees of the experimental and the controlled groups, before and after the application of the creative thinking test and in the evaluation card of the Students' projects in the experimental group. By implication the research recommended to merge the techniques of the educational robotics and the artificial intelligence in teaching and education and training for provide the female teachers on using that technology and encouraging them to employ it in the process of teaching, using the electronic program prepared in this study.

keywords: Computer-mediated Training Program, Creative Thinking Skills, Educational Robotic

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1.1 Introduction

The interest in developing the educational systems is considered the starting point for the progress of countries in different fields. There is doubt that the revolution of information and technology, the multiplicity of knowledge channel, the great increase in population and the need to find distinguished qualified specialists led to a change in the concept of knowledge in general and called for the necessity of concerning about inserting the technology in the process of education and using it to improve the operations of education and learning. Many technological innovations related to the field of education appeared, among of which is the artificial intelligence represented in the modern programmable technological equipment's which are called: Educational Robotics.

Robotics is considered one of the developments in the field of artificial intelligence technology that achieved a wide spread in the educational media in the world. The teachers noticed how the robotics could achieve in education by broadcasting energy in the students' souls and by making the classroom an educational environment characterized by a high level of interaction, in addition to working as members in one team and developing their thinking skills by learning depending on solving problems. (El-Khaledy, 2011).

There are several studies performed in the field of educational robotics that insured its importance as a technological educational tool as mentioned in Eguchi's study (Eguchi, 2014). Those studies aimed at displaying the importance of merging the educational robotics to be a technological educational tool in the curricula of the general education, how they could help the students to get prepared for the future as mentioned in Pazstor et al (Pazstor, Pap-Szigeti & Torok, 2010). The last study aimed at checking the efficiency of using the robotics as a model for teaching programming based on the educational constructional methods instead of the behavioral ones. The results of those studies proved that using robotics contributed in developing the motives of learning and in the formation of positive tendencies for learning. Cooper's et al (Cooper, Keating, Harwin & Dautenhahn, 2000) study reflected the views focused on the benefits of robotics in schools and universities for the students for what they possess of great educational possibilities on all levels.

Sultanate of Oman seeks for investing those skills and mental abilities for the learners in all the stages by forming educational programs that develop those skills and mental abilities. Among those abilities are the skills of creative thinking as the development that appeared in the last two decades in the field of education insured the concentration on the learner to learn by himself through the activities, experimenting, researches and questionnaire. The interest was directed to the necessity of providing new curricula and styles in education that achieves the ability of self-learning and working among a team by the learner to get the objectives drawn by the students themselves with the assistance of the teacher.

Through this, the current study seeks for concentrating on the robotics programs that can contribute in developing the abilities and skills of creative thinking for the students in the basic eighth grade. Training the students on modern technology, specially the field of programming robotics and studying its efficiency on their creative and scientific skills, are considered a method to be pursued in developing the school subjects in the educational process on the Sultanate of Oman.

1.2 The problem of the research

For keeping up with the developments with the age, teachers and learners need to train the necessary skills to get in the modern fields of technology in the which computer became a basic pillar and an important key of which. Many previous studies such as Abd El-Galil (2013), Hemdan (2012) and Chang (2009) confirmed that the students' need to train on the skills of educational robotics and the importance of increasing the training opportunities in this field, teaching the robotics became one of the necessary requirements to build minds which are able to catch the track of the developed countries, schools have to keep up and encourage using technology in education and to be concerned to enter motivating and encouraging educational styles in developing the skills of creative thinking for the students.

The researcher performed a survey by distributing a questionnaire for (20) twenty female teachers of information technology in the schools of Dhofar Governorate to know the obstacles that confront the Students in programming the robotics. A percentage of 60% of female teachers indicated that the Students could not program the educational robotics. A percentage of 80% indicated that the educational robotics are not available to include all the students when all the female teachers confirmed that the Students wanted to train to program robotics because that would strengthen their positive learning motives and to increase their achievements in the field of education.

The problem of the research is summarized in the following questions:

- 1-What is the computerized training program based on programming the educational robotics in developing the skills of creative thinking for the Students in the basic eighth grade?
- 2-What is the efficiency of computerized training program based on programming the educational robotics in developing the skills of creative thinking for the Students in the basic eighth grade?
- 3-What is the efficiency of computerized training program based on programming the educational robotics in producing creative projects based on programming the robotics for the Students in the basic eighth grade?

1.3 Hypotheses

- 1-There are differences with statistical indication on the level of (0.05) between the two averages of degrees, of the Students in the experimental group and the degrees of the Students in the controlled group in the test of creative thinking, for the benefit of the experimental group.
- 2-There are differences with statistical indication on the level of (0.05) between the two averages of degrees of the Students in the experimental group and the degrees of the Students in the controlled group in the evaluation card of the product of the creative projects which are based on programming the robotics, for the benefit of the experimental group.

1.4 The objectives

The research aimed at the following:

- 1-Designing a computerized training program based on programming the educational robotics to develop the creative thinking for the Students in the eighth grade of basic education.

- 2-Knowing the extent of efficiency of applying the computerized training program in developing the ability of creative thinking for the Students in the eighth grade of basic education.
- 3-Discovering the efficiency of the computerized training program based on programming the educational robotics producing creative projects based on programming the robotics for the Students in the eighth grade of basic education.

1.5 Significance

The importance of the research is represented in the following:

1. Directing the sight of those who teach information technology to the importance of using the computerized training programs in developing the skills of creative thinking for the students.
2. Presenting a computerized training program supplied with all the multimedia that benefit the specialist in information technology by employing him\her in training the students to install and program the educational robotics.
3. The card of evaluating the product used in this research to measure the skills of the students in other school grades concerned with producing creative projects based on programming the robotics.
4. The importance of the research is based on the importance of robotics because of the variety of its jobs in the current era, its applications prevailed in the different fields of life in general. That requires condensing the scientific and technological tracks to keep up with all the innovations in this field.

1.6 Research limits

- 1-A sample of the Students in the basic eighth grade in Manba'a El-Hekma School, Dhofar Governorate.
- 2-The second unit concerning the Robotics in the Information Technology in the basic eighth grade for the school year 2018/2019.
- 3-The skills of creative thinking skills of fluency, flexibility and originality from which the researcher aim at studying the extent of providing those factors in the works of the Students of the experimental group after having the computerized training program
- 4-The school term of 2018/2019.

1.7 Research Items

The computerized training program:

The computerized training program is considered a plan for a number of educational situations and aspects of organized activity intentionally to achieve an aim or a group of aims, in addition to considering that the content of any educational objective is to create an intended change in the cognitive, skilled or emotional aspects for a group of individuals. The program includes all the integrated educational experience done by the learner whether with or without the teacher through a period or a certain educational stage. (Abd El-Aaty, 2001).

The program is identified by the researchers as: The bold lines for a group of educational lessons of installing and programming the robotics for the Students in the basic eighth grade in Manba'a El-Hekma School, Dhofar Governorate under the educational objectives of the skills of

programming the robotics. Those objectives are characterized with comprehension and integration and using the training educational methods supported with technology of multimedia with the variety of educational activities. in Manba'a El-Hekma School, Dhofar Governorate.

The educational Robotics:

It is procedurally identified as a group of pieces of installation and connecting, motors, sensors and assistant software produced from Lego Company (EV3 Education) that will be taught in the curriculum of information technology for the basic eighth grade in the schools of basic education in Dhofar Governorate.

Creative Thinking:

Yassin (2008) identified "Creativity" as: The mental, spiritual, impulsive and social processes that lead to the solutions, ideas, technical form and theories or the new products".

It is procedurally identified as " the ability of the Students, in the eighth basic grade in Manba'a El-Hekma School for basic education in Dhofar Governorate, to know the importance of the robotics in confronting the situations and to solve problems in a nonesuch method.

2. Literature Review

The theoretical framework deals with the educational robotics and the importance of its usage in education in addition to the creative thinking concerning its related concepts and skills.

2.1 The educational Robotics

Robotics is considered one of the most important developments in the field of artificial intelligence, that achieved a wide spread in the educational media in the world. Educational robotics provides unlimited capacities. Teachers noticed how the computer and its attachments like the robotics in education lead to broadcasting the energy in the students' souls and to make the classroom an educational environment characterized with a high level of interaction and to contribute in developing their skills of thinking by learning depending on solving problems (El-Khaledy, 2011).

2.1.1 Identifying the science of Robotics

Concerning the definition of Robotics Institute of America in 1979, it is "A programmable manipulator and multi-tasks tool, it is designed for transferring materials, spare parts, tools and specialized equipment's through a group of programmed movements to perform a variable group of tasks" (Garwan, 2014, p. 150).

The Japanese Union of Industrial Robotics based a definition of robotics which provides that: "It is a machine for all purposes provided with a Memory Device and limbs which are able to rotate and to replace the human factor by automatic performance of motions" (Abd El-Wahed 1996, p. 102).

Ghonemi (2001) adds a definition of the Association of Robotics Industries that identified the robotics as: "It is an automated mediator that can be re-programmed, it is a device with multiple functions and can be used in moving subjects or to perform other specialized works.

2.1.2 The practical applications of robotics

Robotics is used in different fields like entertainment, heavy industries, scientific discoveries and medicine for what it is characterized with of the ability to perform hard and dangerous tasks, which are boring for the human, with a high degree of accuracy and noticed speed. The design and shape of robotics are various according to the purpose for which it was designed.

Wajner & Compton (2016) says that education based on creativity is the one which leads the students to find and follow the motive of cognitive discovering which develops by time, to create more depth and feeling of objective. That can Generates motivation and passion for learning. To achieve the ambition of creativity in education, there have to new methods such as the skills of robotics and the skills of the twenty-first century such as skills of communication, planning, and teamwork. Teaching robotics for the students can stimulate them for scientific research, creativity, and invention. (Robotics Arabic Magazine, 2015, p. 39).

2.1.3 The importance of using robotics in education

Robotics is considered one of the modern fields that spread in the educational media. Robotics science provides the encouraging environment which is based on self-learning, handwork and merging sciences and learning with experiment, and to present the creative solutions for problem. So, teaching the robotics and including it in the students' curricula became one of the priorities of the modern school which keep up with technology and encourage for it, the schools which are keen to insert methods and motivating methods of education for the students (Garwan, 2014).

Therefore, using the robotics in the educational process has many benefits and characteristics (Yassin, 2008, p. 217), some of which are encouraging for cooperative learning and working among a team, motivating the skills of handwork and developing it, developing the skills of thinking (creative and critical) and promoting the skills of solving problems, to achieve the integration between sciences, to train the students to organize and manage time. To connect learning with the practical life, to achieve the concept of interesting learning and to train the students on invention and creativity.

2.2 Creative Thinking

Al-Jaji (2011) mentions that educational and psychiatric studies in the field of creation and creative thinking are among the most important achievements in education. He identified creativity as the production which is distinguished with the biggest extent of intellectual fluency, flexibility, spontaneity, originality and far-reaching implications as a response for a problem or an exciting situation.

Hanora (1997, p. 54) also defines creativity as a production for something new for the individual, the society or the culture. That creative production is characterized with rarity, relevance and support. That means the parts of the solution of the result are completely correct and the individual is able to create forms of new shapes rather than improving and developing that he/she performs for the previous forms and shapes.

2.2.1 The concept of Creative Thinking

El-Dreny (1991, p. 24), El-Laḡani and El- Gaml (1996, p. 60) agree that the inventor is distinguished with a group of characteristics represented in the spontaneous behavior, originality in production, flexibility in response, curiosity with open thinking, feeling with freedom that carries risk and independence in thinking. They pointed out that Torrance defined creative thinking as an operation in which the individual became sensitive to problems and aspects of lack of the experiences of knowledge, deficient principles and lack of harmony and so on. So, he\she identifies the difficulty, searches for solutions, introduce suggestions and formulates hypotheses for the contradictions, examine and re-examine those hypotheses, prepare for them and re-examine them and finally presents his/her results concerning that matter.

Othman & Bakr (2002, p. 37) referred to that creative thinking helps the teachers to produce a great number of ideas which are represented in new and various choices or alternatives that enable them to solve the problem.

2.2.2 The components of the ability to creative thinking

This kind of thinking includes three abilities on which the researcher agreed on. They are fluency, flexibility and originality and that was confirmed by KairAllah (1990, p. 47). Each component of them is identified in the following:

Fluency:

Eisa (1993) defines Fluency as: " The ability to produce the biggest possible number of alternative ideas and responses from the stored information in the memory" (p. 22), of symbols, shapes, and words which are represented in some special conditions through a certain period of time. The sub-factors of fluency are represented in the following:

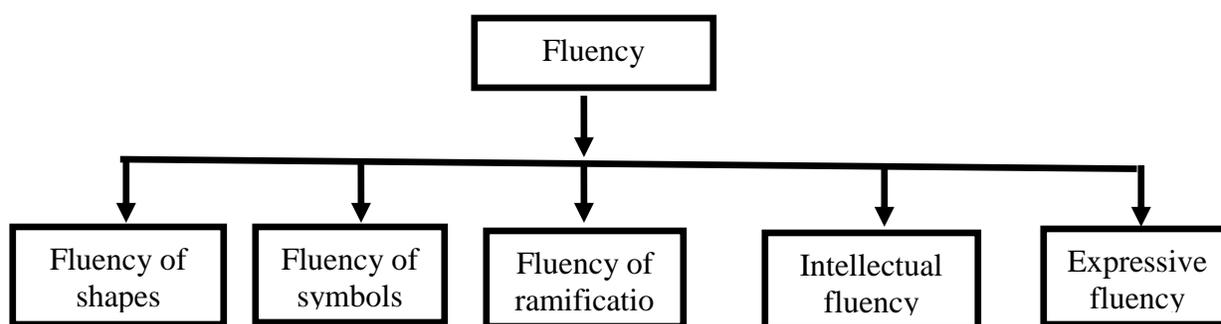


Figure 1. shows the sub-factors of fluency (El-Zayat, 1995)

Flexibility:

Kenany (2000, p. 99) believes that flexibility is the thing by which an individual can change his mental situation and change his thinking direction through which he can see various things and situations. Soliman, Abu-Hatab (1998,) referred that Torrance identifies the students with flexibility as those when plans or methods of whom fail, they come quickly with a different entrance and they use several plans or different entrances to solve the problem. So, flexibility is the ability to produce suitable responses for a certain problem or an exciting situation, it is

distinguished with diversity and non-stereotyping, as much as the increase in the unique response, as much the flexibility increases.

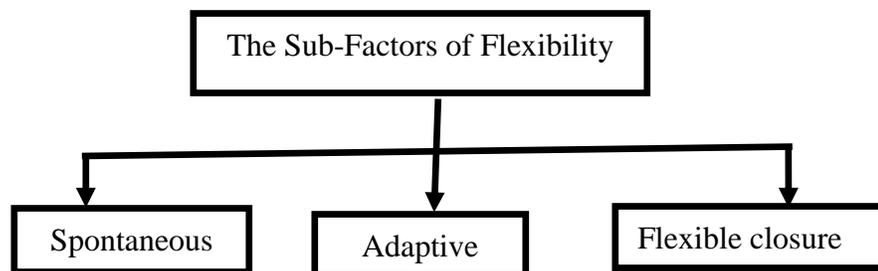


Figure 2. shows the sub-factors of flexibility

Originality:

KairAllah (1990) referred that Torrance identifies the students with originality as " Those who can get away from the familiar and common things, who have the ability to realize the relationships between things, who can think about ideas and different solutions from what others can think about. Originality is the ability to produce original responses, which are repeated a few in the group to which the individual belongs. As few the thought is, the bigger the degree of its originality is (p. 43).

2.2.4 The stages of creative thinking

Abd El-Salam (2000) and Ahmed (2000) agreed that the process of creativity passes four consequent stages:

- Preparation Stage: This stage represents the stage of preparatory phase for creativity, through which information concerning the problem is collected, understood and represented, the relationships between then and its related articles of the problem are analyzed to elements to search for the possibility of employing the available information for solving it.
- Incubation Stage: This stage represents the incubation of thoughts, information related to the problem when the individual leaves the problem for a period may be long or short, and surprisingly the solution appears. That is called the unexpected solution. This stage requires the serious intellectual work which includes examining and organizing the ideas, information and experiences. Here, a kind of sentimental predisposition happens as a result of decreasing pressure on the short-term memory. This stage is sometimes called preparing information.
- Illumination stage: This stage represents reaching the peak of the creative process. It is sometimes called the creative insistence or the stage of enlightenment. Information and experiences seem as if they were spontaneously organized without planning. Everything was ambiguous or unclear becomes obvious. In this stage, a lot of interferences, that hinder the individuals' progress for solution, vanish. So, ideas converge and the solution jumps to the individuals' realization and awareness. Researchers find that the stage of inspiration is similar to the process of wasted searching for a forgotten name, and after a period of neglecting, it rises surprisingly to the mind.
- Verification Stage: This stage represents special importance in the creative process as it is related to the judgment of the correct result and its being sound by performing some experimental tests

for the thoughts and new responses under the test of reality. This stage is considered the experimental application of the results of the precognitive stage.

2.3 The previous studies:

Many studies confirmed that changing the methods of teaching using new methods can lead to developing the creative thinking and increasing the academic achievement, among the used methods in this research is the electronic training program based on programming the robotics from the new methods confirmed by a lot of studies and researches. Through teaching by those methods, there is an interaction between Students and they perform their work efficiently. That was proved by many researches.

Eguchi's study (2014) shows the importance of merging the educational robotics to be a technological, educational tool in the academic curricula in general learning, at explaining the methods of helping the students to prepare for the future by applying STEM orientation. The study reached that merging the programs and projects which uses STEM through teaching robotics in education to develop the mathematical thinking and in learning the geometric skills, symbolization and all the necessary knowledge and skills for the students to become successful staff of workforce in the future. Also, the study proved that educational robotics are considered the tools of the technological education – all in one – they encourage the students for success in the future. The research recommended that academic curricula should teach robotics integrally at schools.

The study of Pazstor, Pap-Szigeti and Torok (2010) aimed at verifying the efficiency of using robotics as a model of teaching programming based on the constructional educational styles instead of the behavioral ones. The study applied the experimental curriculum on a group of the students in the Faculty of Programming. On comparing the results of the experimental group and the control group, the results showed that using robotics contributed in developing the motives of education and in formulating of positive attitudes that influence more achievements in programming.

Goh & Aris's (2007) study confirms at describing its lessons, concerning the design of robotics in education that appeared through the students' experiments in building and programming robotics, and in noticing some considerations that contribute in designing efficient robotics for the student. It was also noticed how the design of robotics can be interesting, funny, activating and motivating. A group of conclusions were reached by notices and interviews with six of the participating students. The researcher reached a group of results, the most important of which is the necessity of joining the students to build robotics which copy real problems. So, the students should directly confront and practice the reality, however immediate feedback of the success or failure of their thought, should be provided immediately from the students who are distinguished with high individual experiences and capacities. Those students should be distributed on the work groups to benefit from their experience and to exchange the ideas among the teams of work. They should give more space to express their thoughts. At the end, the students should reach a correspondence for the whole team. The study also proved that robotics is an excellent tool for teaching science and geometry for all the ages. In spite of that, practical training on robotics is still in its first stages in the field of art and pedagogy. So, the research recommended the need to make a map for the future of the professional in using technology for the generations of the future.

3. Research Methodology and procedures:

3.1 The research method in the study:

The study used the experimental curriculum to discuss the efficiency of the computerized training program which is based on programming the educational robotics in developing the skills of creative thinking for the students in the basic eighth grade. The study used the experimental design known as: the design with pre and post measurement for two groups one of which is control group (Khater, 2001).

3.2 The sample of the research:

The sample of the research consisted of the Students in the eighth basic grade at Manba'a El-Hekma School for basic education in Dhofar Governorate. The sample was selected intentionally in the academic year 2018/2019, they are 30 Students and they were divided into two groups: experimental with 15 students and control group with 15 students,

3.3 Tools of the study:

3.3.1 Building the computerized training program:

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The program aimed at the using the default three dimension environment of the robotics to build different models of the robotics, programming the robots to get information from the sensors for performing certain functions, employing the mathematical processes and the available properties in EV3 program of programming the robots.

The description of the program: The program started with a preliminary introduction about the consequent developments in the field of education and the traits of this era, the students need for the educational robotics as one of the technological innovations and its importance for the students in the light of accelerating developments. The general aims of the program were identified for the recommended program, then the content of the program was included: installing the model robots using Lego Digital Designer, sensors and multiple tasks and wires of data, the training program was designed using the multimedia technology with its different elements that were used through one of Google sites. The tools used for e-learning were identified and described and sextant goes of education and learning used, in explaining the lessons of the program, were identified. Those sextant goes represented in the preliminary accompanied with the innovative educational multimedia, discussion, brain-storming, self-learning, practical presentation and learning with discovering, practical model and training tasks. Then enriching activities were identified for each lesson aiming at enriching the Students' knowledge about the lessons of the program.

- The procedures of the program: After the researcher prepared the required educational materials for teaching the program and they prepared the necessary tools for evaluating the Students, then they prepared designing a forum on the internet aiming at deepening the content of the program related to programming the educational robotics and communicating the Students with each other in an interactive environment about the subjects of the content easily, with the possibility to get the feedback with its different shapes anytime and the possibility to add links of outside websites to be reached directly by the Students and designing an educational website by the tool of Google sites on the internet aiming at teaching the Students the content of the program related with robotics programming, the training materials were uploaded on the following website: <https://sites.google.com/site/in4ev3/>. Figure 3 shows the educational website.



Figure 3. the educational website of training on the programming the educational robotics.

- An e-mail was created and the Students were informed with it, aiming at communicating with teacher to solve any problem they may confront on the period of application and to send any links of websites and files that represent a number of enriching activities related to the content, the e-mail is: Web2_2010@hotmail.com
- The Students were prepared for studying the program by explaining its idea and that continuing in studying it as desired by each student. That means joining the experiment of the program is not obligatory but it is optional. The students were directed to study the program by themselves on the internet, and they were followed up weekly by the efficiency in the content proficiency and verifying that the Students are in good pace in studying the program by asking some questions related to the program aiming at supervising the Students' following up of studying the program. The Students continued in studying the program by themselves for eight weeks.

3.3.1.1 The validity of the program:

After finishing the preparation of the program, the researcher presented the program for a group of specialists in the field of information technology, curricula, methods of teaching and education technology.

3.3.1.2 Evaluating the program:

After finishing the process of arbitrating, the program was applied on the sample of the research, then the final form was applied for the tools of measurement to verify that the program achieved its previously set objective. Those tools represented in Torrance Pictorial Test of Creative Thinking (B) to measure the skills of creative thinking for the Students and the evaluation card of the product for measuring the skills of the Students in the basic eighth grade in producing creative projects based on programming the robotics.

3.3.2 Preparing the evaluation card:

To prepare the evaluation card, some studies and researches concerned with that aspect, were reviewed. That card was prepared according to the procedural following steps:

-The aim of the card: It aimed at measuring the skills of the Students in the basic eighth grade in producing creative projects based on programming the robotics.

-Primary Formulating the items of the card: Based on the theoretical framework of the research, researches and previous studies that used the evaluation cards, the items of the evaluation card were primarily formulated in a way that the following considerations were taken: the statement is short and clear, the statement declare the required content easily and the main parameters of the card reached the items of (14) skills.

-After finishing the card, the researcher presented the card for a group of specialists in the field of curricula and methods of teaching and in the field of education technology and in the field of psychology to verify its validity. The arbitrators confirmed its validity.

- The card was applied for the achievements and costs of the Students in the basic eighth grade which are based on the educational robotics,

- Data were collected and treated statistically.

3.3.3 Torrance Test of creative thinking:

The aim of the test: Measuring the skills of creative thinking (Fluency, Flexibility and Originality), through which the researcher aimed at studying f providing those factors in the works of the Students in the experimental group after performing the computerized training program.

-The sources of the measurement: The researcher used Torrance Test of Creative Thinking of the modal pictures (B) codified on the Yemeni (El-Heity, 2008).

- The measurement was reviewed by a group of specialists in Curricula and Methods of Teaching and Education Technology to confirm its validity and to express their opinions concerning their suitability for the members of the sample and the extent of measuring for what it was prepared for.
- The test was applied primarily on the sample of the Students in the basic eighth grade in Manba'a El-Hekma School in the first term of the academic year 2018/2019. After fifteen years of re-applying, the coefficient of correlation between the two applications using SPSS program, so the value of correlation was 0.82 which is a high value that indicates the reliability of the test.
- After calculating the stability and the validity of the test, it was applied on the members of the sample in the first term of the academic year 2018/2019.
- Data was collected and treated statistically.
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4. Results & Discussion

4.1 The results related to research question one:

What is the computerized training program based on programming the educational robotics in developing the skills of creative thinking for the Students in the basic eighth grade?

The research depended on the theoretical framework of the study, on the results of the previous studies, and researches in the field. The program included the general aims: a) using the default three- dimensional environment of the robotics in building the models of the different robotics, b) programming the robotics to get information from the sensors for performing certain functions,

and c) employing the mathematical processes and the availability characteristics in EV3 program to program the robots. The units of the recommended training program: The first training unit: installing the model robots using Lego Digital Designer, The second training unit: Sensors and the third training unit: the variety of tasks and wires of information. The training program was designed by using the technology of multimedia with its different elements that were used through one of the Web 2 tools (Google sites). Teaching and learning strategies: They were used to explain the lessons of the program. They are represented in the preliminary lecture accompanied by the innovative educational multimedia, discussion, brainstorming, self-learning, practical presentation, learning by discovery, practical model and training tasks. The enrichment activities: Those activities were identified for each training unit aiming at enriching the Students' knowledge about the lesson of the program.

4.2 The results related to research question two:

What is the efficiency of the computerized training program which is based on programming the educational robotics in developing the skills of creative thinking for the Students in the basic eighth grade?

Table 1. *The differences between the two averages of the pre and post measurement in the test of creative thinking*

Type of application	N	M	STDEV	T- test	Significance level
Pre	15	20.17	5.32	10.61	Significant to level 0.001
Post	15	49.75	6.73		

The result in table 1 refers to the efficiency of the computerized training program in developing the skills of creative thinking for the Students in the basic eighth grade. The first hypothesis is achieved because there are differences with statistical indication on the level of 0.05 between the two averages of the degrees of the Students in the experimental group and the degrees of the Students in the control group in the test of creative thinking for the benefit of the experimental group. Perhaps that points out the clear formulation of the training units and its suitability for the status of the students, in addition to the continuity of reaching the educational units. So, the student can get the information he/she wants whenever the time is suitable for him/her.

Those results correspond to the results of Khairy's study (2005) which showed that the learning environment through the internet which helped the students to gain information and in the success of learning using the internet asynchronously. In addition to using the internet in designing the curricula and the Strategies of presenting them and it proved its success in increasing the motivation of the learners.

4.3 The results related to research question three:

What is the efficiency of the computerized training program which is based on programming the educational robotics in producing creative projects based on programming the robotics for the Students in the basic eighth grade?

Table 2. *Significance of (t) between experimental and control groups in the evaluation card of the product in producing the creative projects based on programming the robotics.*

Groups	N	M	STDEV	T- Test	Significance level
Control	15	12.4	4.19	7.76	Significant to level 0.005
Experimental	15	21.6	4.78		

The result in table 2 refers to the efficiency of the computerized training program based on programming the educational robotics to produce creative projects which are based on programming the robotics for the Students in the basic eighth grade. The second hypothesis is achieved because there are differences with statistical indication on the level of 0.05 between the two averages of the degrees of the Students in the experimental group and the degrees of the Students in the control group in the card of evaluating the creative projects based on programming the robotics for the benefit of the experimental group. Those differences can be returned to the following reasons:

- The variety of stimuli, introduced for the Students in the education situations which are related to those subjects, is considered an important factor for achieving the efficiency and speed of learning.
- Building education in the learner's memory is influenced by collecting a number of interactive multimedia such as using the technology of multimedia. Using the element of the technology of multimedia is useful for the creativity of training presentations that require showing the learners movement and presenting several synchronous stimuli together.

That can create synchronization in the interaction of the learner's senses. This result is aligned with the previous studies and researches such as Amer's study (2001).

Conclusion

This research aimed at detecting the efficiency of a computerized training program based on programming the educational roboticists to develop the skills of creative thinking for the Students in the eighth grade of the basic education. The researcher used the experimental curriculum with the two groups; controlled and experimental to achieve the aims of the research and to test its hypotheses. The sample of the research consisted of 30 Students during the first term of the school year 2018/2019 and they were selected intentionally. Each group included 15 Students who were trained to program the educational robotics using the computerized training program. Torrance test of creative thinking was applied before and after on the two groups, in addition to an evaluation card of the product for the projects of the Students.

The results showed that there are differences with statistical indication on the level of 0.5 between the two averages of the degrees of the experimental and the controlled groups, between the measurements before and after the application of the creative thinking test and in the evaluation card of the product of the Students' projects for the benefit of the experimental groups. Also, there are differences with statistical indication between the measurements before and after for the benefit of the experimental group.

The research recommended to merge the techniques of the educational robotics and the artificial intelligence in teaching and education, in the training of the female teachers on using that technology and encouraging them to employ it in the process of teaching, and to adopt the training electronic program prepared in this study to be included in the non-class activities in the schools of basic education (5 - 10) to develop the skills of creative thinking for the Students.

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