

Creativity: A New Era in Educational Technology

Prof. Dr. Enver Tahir RIZA
Dokuz Eylul University
Buca Faculty of Education
Buca-İZMİR

1. Introduction

The research into effectiveness of educational technology mostly concentrates on the achievement and attitudes of students. Not all the research are achieving the expected high records when effectiveness of educational technology is compared with traditional teaching methods. These types of research usually deal with one type of technology for a short time usage. The effectiveness depends on the factors such as the technology used, for which purpose, how long, by whom, how and for the benefit of whom. These factors are all important and have to be considered in the evaluation of the research. On the other hand, achieving equal effects of technology with traditional methods is itself a success for the other characteristics revealed in using technology. Among these characteristics of technology availability of being used as individualized method, creating the possibility of repeating as much as it is needed until learning is occurred. The technology can also be used independently by students whenever and wherever they want and as long as they want to use their time perfectly.

The field of creativity is not paid enough attention in educational technology. This situation depends on different reasons. The field of creativity has not been studied in detail. The area is complex and requires a lot of work. This field is also new in psychology itself. The researchers have concentrated on this field only for the last two decades. Educational technology being a field of application for psychology has to begin this type of research sooner or later. Now is the time to start this type of research in the field of educational technology because of the vital importance of creativity in different aspects of life.

2. What is Creativity?

In the area of creativity many terms are used. The important ones are discovery, innovation and invention. **Creativity** as being a product includes a very fast enlightenment in mind bearing ideas related to a problem solving, a topic for an article, a plan for research, a work in literature or fine arts, a new theory, unknown technique or method.

This enlightenment may be enough for solving the problem or it may need another enlightenment. When this type of enlightenment happens, it causes the abolishment of some restrictions or frames of thinking and removing the ideas imposed on a person for some time. Thus, creativity includes exiting from what is already known. It is a step toward what it is unknown or designing a new line of thinking, giving different alternatives for the problem, discovering something that can lead to other things, finding a relationship among the ideas or formulating a new original idea.

Discovery is finding something new, it may be a place, an inn, a technique, a method, an aid, an apparatus, a theory which is previously unknown to the specialists working in the same area. Thus, discovery is much broader than invention. Just like the discovery of America, a new era has started. This may be an unknown new cave or forest or an archeological place on our earth or discovering a planet or a star in the space. This work requires bravery and sacrifice, in addition to a lot of courage, use of initiative, great responsibility, high motivation, embarking adventures and risks. These characteristics all are included in creativity.

Innovation is the modernization something in order to meet new needs of human being. It needs modifications in order to achieve novelty.

Invention is transferring creative abstract ideas into concrete things, products or services. Invention is finding something new or producing something originating from the needs and fulfilling these needs. Though the needs are the pre-requirements of invention. Therefore, the ideas are transferred into something useful in fulfilling the needs of human being. In all these cases creativity is essential and without creativity no discoveries, innovations or inventions can be achieved.

3. What Should Be Considered in Creativity

Many elements should be taken into account when creativity is investigated. They may be investigated

independently or in relation with one another. These elements are as follows:

a. Cumulative Knowledge

Someone with enough knowledge of an area is not necessarily creative. The knowledge is still the basis of creativity. Knowledge itself does not guarantee creativity. However, it is a requirement because it forms the foundation that creative work is based on. Knowledge broadens the individual's horizon. It is important to benefit from other people's experiences. It is important because it stimulates human brain for new ideas. It can be developed for further new works. It prevents or at least limits the waste of efforts, time and money. It enables researchers to avoid repeating what others have already done or discovering what others already discovered.

Technology enables everyone to reach the knowledge easily wherever it is. It offers new and rich ones from the first resources.

b. Communicative Skills

People do not do their work just for themselves. The value of work emerges in communicating them to other people. This situation makes one happy. A person feels happy when he or she shares his or her thoughts with others. Ideas, senses and productions have to be transferred to others or they will fade sooner or later. Communicating knowledge to other people is very important from the view point of creativity and it entails using spoken or written words in a suitable manner. Technology can play a very important role in all these areas.

c. Analysis

Analyzing something means dividing a whole to its elements for the purpose of understanding or teaching and learning. Analysis is important from the view point of creativity in order that some other elements can be added, eliminated or modified by others.

Technology is very useful so as to offer things in small different steps that can be understood easily by people.

d. Perfect Work

Doing perfectly is trying to do something with high care, cleanliness and aesthetic in its appearance. It is trying to do the best of what somebody can do. It includes attempts to produce something with less faults or defects and achieving the exactness as much as possible. This type of work makes one stop and say this is really perfect. It has to be as inclusive, adequate and comprehensive as possible.

Perfect work includes organizing, classifying, and synthesizing. Organizing is arranging dispersed elements and putting them in a proper order to constitute a new whole. This is useful in two ways: The first aspect is useful for it diminishes the striving and endeavoring, extravagancy of time for the investigation of things that are not organized. Creative people put every thing in a regular place so that they can reach it when they want. Files, pictures, articles, books, journals and other works are organized very well. The second aspect is dealing with arrangement and order as the saying goes, "ordered lie is better than unordered truth" not for the purpose of encouraging telling the lies, but emphasizing the important effects of ordering on other people. Arranging an article as introduction, presentation and summary or conclusion is a way of organizing ideas in a proper way. Starting from the known and proceeding toward unknown, from easy to hard and from simple to complex are all useful techniques for organizing ideas which encourage reader to read and increase their motivation. Pointing to references frequently reflects the weakness in writer's knowledge. However, it should not be prohibited.

Classifying is important in reflecting creativity. It is a process of gathering groups of things depending on their characteristics in different classes, categories and families. An important thing in this process is defining the principles of categorization. Mendeleev and his periodical table, Bloom and his objectives, Maslow and his human needs, Dale and his pyramid of experience are some examples of important famous classifications.

Starting from primary school teacher can train his pupils in any subject matter on how to classify things. This training can be achieved in many steps. At the beginning he or she gives his or her pupils ready-made classifications, analyzes it and defines the principles of classification. At the following stage he or she gives them different things, defines the principles and the students do the groupings. At the last stage the students do everything. Classifying things at home, on the road, in the market and in class and, in short, everywhere are very useful training towards this goal.

Synthesizing also reflects the creativity. Synthesizing is on the opposite side of analyzing, but it is more important and more difficult than analyzing. It includes ability of putting a group of elements or parts in a new

pattern. The issue is not just a simple collection of elements. It emphasizes on a perfect interaction among the elements in establishing the new whole. This is the hidden importance of synthesizing on analyzing. The interaction also exists in analyzing, but it is founded by the owner of the idea. The person here identifies the relations and the elements. The difficulty of synthesizing is in discovering these relations and putting ideas in a new form.

By readings in different times one can collect too much knowledge. If these elements are kept in a file and having a look to them from time to time is very important to insight new relations among these elements and form an unknown new whole.

The new whole that constituted may be a story or a poem, picture or sculpture, a piece of music or tune, article or research, book or new invention. The originality of new thing appears in comprehending all aspects of the problem. The idea will be comprehended if it includes further details of all aspects. The organic relations among the aspects of subject is important from the view point of creativity. Depending on these relations every element constitute an important member of the whole and adds something to it and supports its foundations. An importance of an element is valued by the imbalance that may happen when this element is omitted from the whole. If this imbalance does not occur the element is not a vital one. The relation between any two elements and the relation of element to the whole is very important.

e. Development

Developing is changing and improving something which refers here to anything produced by others, it might be related to fine arts or literature, science, philosophy and so on. If someone looks to others' ideas with admiration regarding it as perfect work just for being produced by internationally famous scientists, writers, philosophers or artists he can not add any new thing to them. These feelings of admiration for the gifted people who have unique abilities makes him not dare changing anything related to these people. This also may create some feelings of weakness and inferiority towards himself. This is a real barrier against advancement because everything is still very far from being complete. Human ideas have not reached to be perfect and will not be so whatever sciences, literature, philosophies and fine arts advance. If somebody can remove these obsessive ideas and feelings he will do his best to develop any human work and add something new to the knowledge. So we see the modernists in any science, literature, philosophy and fine arts who try to do something new. Modernizing is developing towards excellency and means more creativity. In any work we have produced we have to ask ourselves: what was our personal participation in this new work.

Others' work can be developed in many ways. It can be developed orally, in writing or by drawing. In order to achieve this objectives variety and different techniques can be used. Making something larger or smaller, adding something, adding other things, subtracting, multiplying, dividing, substituting, combining, changing color and position are some of techniques of developing others' work. Investigating different applications of ideas in the same area or other areas, in the same culture or other cultures are good exercises on development. Developing others' work by summarizing, expressing by students' words orally or in written words are other examples. The pupils should be trained to these exercises starting from kindergarten and first years of primary school. Pupils may be asked to complete sentences, expressions, paragraphs, scripts, stories, symbols, pictures by using their own imagination. This exercise at least clear from fresh minds the fear of touching famous works of scientists, writers and so on.

f. Fluency

Fluency means richness in production, being more than the others, plentiful in quantity, fertilized ideas, a lot of work. Fluency is producing more ideas, answers and alternatives that can be accepted by other specialists in a defined period of time. The student who can give 15 topics for a script is more fluent and creative than the one who can give just 10 topics within the same time. The latter is more fluent and creative than the one who can give just 5 topics for the same script within the same time.

It seems that the inventors, discoverers, scientists produce mostly plentiful work. This is because the inferiority reveals inferiority and creativity reveals creativity. When the heart eyes are opened they can see what others can not see. The quantity in production is important in the way that it effects the quality.

The fluency can be gained by training. Increasing the training increases the fluency. The fluency training should be started from kindergarten and the first years of primary school. The pupils can be tackled by variety and different exercises. Giving topics for scripts is useful exercise in this field. Asking questions on a script, expecting what may happen from existence of some conditions, giving different reasons of some conditions, listing alternatives for any situation, defining familiar things in different ways are all good exercises that develop

fluency of students.

g. Flexibility

Flexibility is a way of looking to things from different points. It means variety in thoughts. It is flexibility in thinking and diversity in doing things. It means also putting ideas, answers and alternatives that have been produced in different species, groups, classes, families, ranks and categories. The ideas, answers and alternatives that are placed in the same species, group, class, family, rank and category reflect just one point. Looking to things just from one point does not include much creativity. In reverse ideas with much categories, species, groups, families, ranks and classes reflect variety, flexibility and creativity.

Thinking like other people is not preferred in creativity. Instead, the differences are important and are always investigated. Therefore, the teacher has to encourage his or her students to think in different ways. For the purpose of flexibility the formalities and regularities have to be changed. Reading different books, journals and newspapers, listening to different broadcastings, seeing different television channels, changing clothes every day, having different meals, going to work in different ways, meeting different people, changing the place of residence, visiting other places, changing properties or organizing them in a different ways, going to cinemas, stadiums, theatres, concerts, fairs, and bookshops, being a member of different scientific or nonscientific organizations, participating in symposiums, conferences, panels and scientific discussions and attending courses in different subjects; at least once a year in a subject that is hated by attendee are all useful examples to overcome regularities and formalities. Using computer and the Internet enables everybody to reach the rich, adequate, newest and best knowledge resources in all aspects of life.

h. Originality

Originality is novelty, innovation in a specific area or producing something new, ingenious and unique. Originality includes individuality, uniqueness, unfamiliarity, oneness and singleness. Originality needs very high cognitive energy, uniqueness in the field, new in the area, great in issue, being perfect in making something, best in the subject, tending to be complete and very faultless. The idea is original when it is an answer to a question, plan for a project or solving a problem that is new and statistically rare. On the other hand the answer is in an opposite direction to familiarized ones. The idea is original if the issue is seen from the different point and reflects unusual thing. It moves from what is known and familiar to unknown and unfamiliar to something which has previously been undiscovered, about which nobody has thought before. It is the best idea, a most suitable solution, an appropriate alternative, a proper answer, a well fitted point of view.

Concerning the originality some ideas are known and others are unknown. Stopping on known ideas and developing them is very good idea. It is known that original ideas are not monopolized in a nation, society, class or a group of people. The original ideas emerged and it is still emerging from each nation, society, class or group of people. But it is unknown to us who will be in the future the owner of those original ideas that direct the world and change the styles of life. There is a very great difference among the people in their original thoughts. The originality of creativity is a hidden capability. The original ideas are not inherited by special people. Everyone can produce original ideas if he or she gets enough training, spends enough time and demonstrate plenty efforts. The time is the capital of creative ideas. However investing the capital does not always guarantee profits. On the other hand without investment there will be no profits. The more time and effort is spent the more creative ideas are expected.

It is unknown when and where, how many and what original ideas that can jump into mind. However it is known that it happens mostly in 3Bs (bathroom, bed and bus). It is also known that original ideas appear very fast as glances then disappear immediately. So if it is not caught quickly it might disappear forever. Thus, it is vital to catch these original ideas before disappearing. In reverse the sorrow does not bring back anything. It is necessary to keep materials that enable one to record these original ideas in 3Bs.

It is also unknown how long it takes to produce an original idea. It may take hours, days or months and even years. However it is known that the creative ideas need to a short or long period of incubation. This incubation period is very vital for original ideas. In this period the subject invades a very large area in mind even if seems from outside being forgotten.

It is also known that creative ideas are mixture of reality and imagination. The percentage of the imagination to reality is unknown and it differs from one idea to another. Thus, the imaginations of children should not be forbidden, but it has to be encouraged from the first years of schooling.

It is also known that creative ideas increase in an environment where the games, fun and more stimulus are

available. Thus, it is useful to offer these environments not just for children but for adults, too.

4. Why Creativity? In Which Levels of Life Creativity is Necessary?

Creativity is very important for all levels of life. For the purpose of simplifying the work Riza (2001) tackled this area under the topics of individual, educational system, industrial sector, communication and society.

a. Individual Level

Individuals are important in the way that they formulate the society. Individual has many hidden innate abilities, energies and capabilities. Education is the process of investment on these abilities, energies and capabilities that can achieve many advantages for the individuals and society. For this purpose the people has to be educated generally and in the area of creativity in special. In reverse these abilities, energies and capabilities are wasted from the view point of both individual and society. The individual without education is as a person who has hidden treasure under his house while he has no information about it. Consequently he does nothing in order to get this treasure and lives poorly for his whole life. Thus, education and creativity education are both important for every one. The creativity education is important because by this education every one can double his creativity many times.

The person without creativity usually repeats doing something in one way. His life is boring with no colors. So, he accepts everything as it is without spending any effort to change. He does nothing to improve his life. This means that he is living for death and waiting for death is too horrible.

Creativity at individual level is too important because it achieves many concrete and psychological advantages for the person. The individual today is very different than the one two century before or even two decades before. Today individual is in a very high competition with others. So the individual today has to get enough education and has to specialize in a profession in order to live in society which has divergent needs. The needs are developing, changing and broadening. Today marriage and constituting a family is not easy.

Today unemployment grows rapidly in societies. Getting a diploma does not guarantee a job. Employers look for special skills and traits of any applicant. The applicants who are creative have more chances in getting jobs and earning money more than others. The creative individuals compared with noncreative ones get more money.

On the other hand getting workers to do some work at home is very expensive. Thus, doing some works at home offers anyone tasting the work and saving money that can be used in fulfilling other needs.

When this work is done by individual at home and day by day needs are met his self confidence raises, he enjoys his life and became happy from the view point of psychological advantages. Doing something creatively makes the person to be in the first spot plan. A creative production especially when it is original one makes person feel proud.

When some work is done creatively the need of achievement which is in the top of human needs in Maslow's Pyramid is fulfilled. While doing this the person gets prestigious and becomes famous. We all like being shown on the screens of televisions. When this happens, the person becomes famous among his/her peers and friends and feels comfortable. Being a creative person, innovator, inventor or discoverer is the best way to be distinguished among the people and becoming eminent.

Hall and Wecker (1996: 164) pointed that producing a new, distinguished and original thing changes the customers' buying style. Good ideas can be advantageous as they have not been experienced before. The pioneers in their areas are diminishing something negative. Original ideas amaze people, make them pay attention and concentrate on them for a long time. We all remember that Neil Armstrong was the first person who went to the moon. However the people who remember other astronauts who went to moon are rare. Being only one in something puts person in a distinguished status and will be in the first spot of news agencies. It makes others to stop on something and take notes. The pioneers get their fruits of their distinguishing and became to core of society attention and earn much. Related to this idea Hall and Wecker (1996: 164), points to a research concluded that pioneers earn 2.7 times more than imitators. Pioneers in addition to their earns they participate in raising the national and world richness. This idea supports Torrance (1994: 139), conclusions that inventors add richness to the richness of the world.

b. Educational System Level

Education deals with the discovery of hidden capacities, energies and abilities of individual and development of them to the top level for the benefit of individual himself and the society. Everybody takes by heredity special

capacities, energies and abilities from his parents. Leaving the individual without education these capacities, energies and abilities are wasted from the view point of both individual and society. Thus, the education is an investment on a long range. When educational system is doing its function it balances between the benefits of individual and society, not sacrificing the benefits of one side for the other. In each society there is a unique educational system that fulfils this balance.

Educational system should always be a pioneer in directing the individuals towards the best in all areas of life. For this purpose it has to play the leading role when its function related with those dealing with the benefits of the society. There is no big crises for educational system such as being behind other sectors in the society.

The development, changing improvement and forwarding of society, depend on the thinkers of that society and labor power who try to put the thoughts into application. The education and training in the area of creativity has not paid enough attention for a long time because of the complexity of the area. Without this education and training the society can not be developed, can not take its status in the world and can not solve their problems properly.

The education of both of thinkers and labor sectors depends on the educational system. The educational system which just transferring cumulative knowledge and depends on imitation of others can not solve the problems in continuously changing world and will face new problems continuously.

In facing these challenges just transferring the knowledge will not be enough for the educational system. Thus, an educational system that basis on creativity, encourages the creativity and works for achieving creativity. It is too necessary to educate and train the people who can develop the society towards the best, who can use their creative capabilities and take the responsibilities of competitive changing world on the national and international basis. We are living now in a knowledge explosion century in which knowledge in each some years is doubled. The doubling of knowledge is taking place in less time while we are advancing forward. This cumulative knowledge only can be learned just by an educational system that depends on aiming creativity and using methods of creativity.

We have been experiencing a technological revolution. The basis of development and improvement is formulated by advanced technology. Regarding information technology an investment in the area of computer earns much money for the investors. Technology is a product of creative works and is a very wide and fertilized area for creativity.

Educational system has to play important role in achieving the objectives of society. The educational programs that emphasize the creativity develop the creativity of individuals. Torrance (1994; 137) points out that Japanese society starting from kindergarten encourages the creativity. The whole educational program emphasizes fine arts, gives priority to historical customs and formulated on achieving creativity in small groups by cooperation.

c. Industrial Sector Level

Developing countries can not stay for ever a market for developed countries importing expensive industrialized goods and exporting their rough (crude) materials. On the other hand depending on others in fulfilling some needs includes some political and economical cautions. In the world today so many embargoes imposed on those developing countries that contradicted developed countries in their internal or external politics. Thus, it is very necessary to build national industries and keep a kind of independence that would be useful especially in crisis time.

Although complete independence is very difficult, it is necessary to build self independent on local productions in order to limit the external imposes. The need for production of weapons, food and clothes are in the top of these sectors. Weapons are required for internal and external security. Food and clothes are necessary for day by day life to be continued.

On the other side the domestic materials are used in industry, manufactured in order to gain money for the benefit of the country. The businessmen invest their money inside the country if they get crude materials and market for their goods. This is also valid for agricultural productions that could be produced in different ways.

On the other hand the industrial sector creates jobs for local labor. Offering jobs is a very important requirements of today's life. The governments have to make continuous attempts in order to get new areas for

labor and have to broaden these areas. Industrial sector is one of important areas for labor.

Industrial sector in any country has three alternatives. To imitate, to adapt or to invent. Imitation requires to buy machines, the rights of producing a good from foreign companies in order to manufacture something locally. This situation requires importing new machines and signing special contracts. It is usual in this situation to be for the side of foreign companies. When goods are produced some parts or materials have to be imported from these foreign companies and trade marks have to be used. This production on the short range is cheaper than the one depends on investigations and inventions that their results are not expected. So imitation includes dependence on other countries.

Whatever the situation is the imitation is necessary in the beginning even it has its own cautions. In imitation there is little creativity. The developing countries because of the cheap labor can get some advantages in the production. But the imitation should not continue a long time. It has to be followed by adaptation and making changes in production to fulfil the local needs.

Adaptation is getting other people experiences and adding something else to it. It means broadening something on the basis of special needs. Adaptation includes borrowing something from others and completing it. It includes dependence on others in some ways and independence on the other ways. Adaptation means self sufficient to some extent. Adaptation and changing are the requirements of industrial sector. Adaptation is a kind of balancing scale between imitation and invention.

DeBono (1993; 40) comparing Western and Japanese industry defends that while Western industry waiting for entire changes and big jumps that include new concepts it neglects practical creativity. Japanese industry on the other hand getting from day to day a very good cumulative experiences when imitating others, making new adaptations, changes, continuous small innovations and arranging relationship among things. Regarding this area Torrance (1994; 146-147) points that Japanese industries search the world for ideas and information and Tokyo is becoming information capital of the world in post industrial society. After obtaining enough information the Japanese industries try to examine it, modify it, adapt it and elaborate some special new things.

Invention invades the top of the production process. It means producing the sources of production and owning them. On other words; it is producing the special machines, apparatus and aids for production. Invention is producing something new and getting its patent. For achieving invention in industrial sector generally a team of engineers in different areas has to be recruited. Invention needs in addition to others experiences much creativity and less dependence on others.

Industry with new investments, initiation and pioneer works can earn much money for the investors. The pioneers in any field always can earn more money than others. The creative industry earns more than imitative one. Hall and Wecker (1996; 164-165) points to the relationship between originality, oneness and gained success. The new and different productions gain 69%, while the imitative productions gain 31%. It means that unique and new industry gains as twice as much of imitative industry. Hall and Wecker (1996; 164) points to some research revealing that creative pioneers earn 2.7 times more as much as imitative ones. Creative people do not raise only their profits but they participate in raising the national and international profits. Torrance (1994; 134) supports this idea. Industry can put into application the ideas of creative people and transfers them into production and forwards them into the national and international market. Thus, the investment that depends on the creative individuals and teams confirms themselves, tackles the competition and brings more money.

d. Communication Level

The most important development in the second half of twentieth century goes against earth gravity and helps man find a way to the space. Russians were able to send Sputnik to the space in late 1950's. This situation created a kind of race between Russians and Americans in order to go out space. This great scientific advancement revealed sending so many satellites to the space by other countries in order to fix it in orbits to reflect and transmit different sound and vision waves. As a result of this, the space became very crowded with these satellites and a very high advancement is achieved in different areas of communications such as telephone, fax, television, computer and the Internet. This advancement reflected on different areas has eased printing and publishing books, journals, newspapers and getting radio and television waves and spreading the Internet to every part of the world. In a full contradictions in benefits of individuals, groups and societies the competitions and disputes among domestic and international communications are inescapable.

The new very high developed technology and its continues development provided a very wide range of capabilities by the satellites, radio stations, television channels and computer networks. These facilities offered

to reach people in their own home wherever they are. The cautions in the use of communications is in its capability to go beyond the international boundaries without any passport and reach the people wherever they are in their own home without any permission. Thus, communication means educate our people in their own home in some way that we may not want it and which may contradict our national education.

Communications give periodical services and regularly innovate their programs and need creativity more than any other area. Whenever this period is short the need for creativity is more. Journals need the creativity more than the books, the newspapers need creativity more than journals. Radio programs need creativity more than all. Films, television and computer programs need creativity more than others because they address two senses at the same time. The programs need creativity as they need to be demonstrated from the screen. The less this time the more need for creativity. Advertisements because of short broadcasting needs more creativity and reflects in real creativity. The advertisements that published or demonstrated by communication means are fertilized area for creativity.

Communications fulfil their functions in two important ways. They address the citizens and try to develop their attitude of citizenship in one hand and address the foreigners in order to export the culture of the country on the other hand. The publication of newspapers, journals and books in this competitive atmosphere needs a high percentage of creativity. The programs that prepared to be transmitted from radio, television and computer require to be continuously new and creative. Otherwise the people do not pay them any attention or they do not fulfil their functions as it is expected. The citizens or foreigners will change their radio station or television channel to listen and watch other radio stations or television channels. Thus, following of the programs of these communications depends on how are these programs effective or attractive and this depends on capability of people who are working in these communication means to improve, develop their programs and to show their innovation and creativity continuously in every production and program.

e. Society Level

Creativity includes always changing everything continuously. This situation contrasts the traditions and customs that societies are forming by the time which need some kind of resistance to change. Accordingly; societies differ from each other in encouraging or discouraging the creativity. The one who encourages the creativity will succeed in its development and its participation in the world civilization. The one which resists the changes and draws barriers in front of creativity remains underdeveloped. This is somehow related to political structure ruling the country.

Torrance (1994;138) points out that American society from the beginning appreciated adventures, willingness to experiment different tasks, independence in thinking, judgement, courage in believe, industry, high level in energy, persistence, self confidence, sense of humor, flexibility, willingness to take risks and curiosity. These characteristics all are in pioneer spirit and related to creativity. In order to improve the atmosphere of creativity and national invention these characteristics have to be emphasized again and valued highly.

Individual is the nucleus of the society and the society is formulated from the individuals. Developing the creativity in individuals means developing the creativity in the society. However, the society is more complex than the crowd of individuals. It has a special form of relationships, organizations and institutions that effect the individuals. As individuals need to creativity in their different relations the society also needs creativity in order to organize their internal and external relations through their different organizations and institutions. Social customs, values and norms in a society encourage or discourage creativity by means of approval and disapproval. The societies which limit the imaginations, neglect fine arts and literature limit the creativity. While the societies which encourage creativity, fine arts and literature develop the creativity.

One way of approving the creativity is to make rules that save the rights of creative people and inventors. These rules get benefits for individual and society at the same time. In any country when patents are organized and supported by government the number of inventors raises continuously. Torrance (1994; 133) points out that national politics and local laws effect the inventions. He gives Japan as an example who in 1960 enacted laws that save the rights of inventors. At that time the number of inventions in this country was less than USA. As a result of these laws the numbers of inventions increased and consequently Japan reached the level of USA in 1967. As a result of neglecting in USA the number of inventions decreased while for the reasons of encouragement in Japan the number is increased and in 1978 Japan exceeded USA. Regarding this subject Torrance (1994; 134) concludes that when the individuals and nations invent they live and grow. When they stop their inventions they collapse and die. This has been always true from the beginning of history till now.

Encouraging the creativity of organizations and institutions in any society is vital in the development of creativity in that society. Whatever the societies encourage, they get it. When you plant something you get the fruits later. Regarding this Torrance (1994; 132) mentions the American experience in which they encouraged the inventions in 1960's after the advancement of Russians in sending Sputnik to the space. The number of inventions in 1958 was 76565 and increased to 84864 in 1962. The patents that supported in that period increased from 43407 to 51065 and regarded this period as being the golden age of inventions in USA. After a decade encouragement decreased and the number of patents decreased, too. In 1978 the number of patents decreased %15. As a result of that Americans begin to buy the advanced technology from other countries such as Japan, Germany and other countries instead of developing their national industry.

It seems from the previously mentioned information that the politics of the society in supporting the inventions is very important in increasing the number of inventions in a country. The one who encourages the creativity and inventions develop these energies in their individuals in a good manner for the benefits of individuals and the society at the same time. Regarding this Torrance asked the children from 12 countries in 1992 and 1993 to write stories on their future. He analyzed these stories to define those children who imagined themselves as being inventors. Japanese children were in the first level (35%), Americans and South Africans were in the second and third levels (26%) and (24%). These percentages were in parallel with the number of patents afforded in these countries.

5. What Aspects of Educational Technology have to be Investigated?

Ridha (1997; 384-385) and Rıza (2000; 40-41) defined educational technology as being “An amalgamation of systems derived from scientific data to be applied in broad areas of education, dealing with specific objectives, contents, instructional methods, audio visual aids, measurement and evaluation, creating a proper environment for learning, aiming at use of teachers and students' power in a proper way in order to solve the problems of education, raise the quality of learning and highlight the productivity.”

Educational technology as it seems from the definition is a systems amalgamation of nine elements. It is an interacted combination of these elements. On the other hand it is a way of thinking, a systematic approach dealing with all aspects of education. Its usefulness especially with creativity seems to appear when it is used in this way. Looking to educational technology as being audiovisual aids or instructional methods decreases its effectiveness due to uncontrollable factors that are neglected in each research. Technology is a product of creativity and creativity is needed in all aspects of technological revolution and the different areas of education.

Because of the great scientific and technological developments generally in twentieth century and especially in the last two decades different aspects of the educational systems have to take these developments into consideration. In any research especially those are dealing with creativity all the following factors should be concerned as a whole:

a. Specific Objectives

Ignoring the objectives in research dealing effectiveness of educational technology leads to ambiguities and complexities. These ambiguities and complexities may cause concentration on low levels in the hierarchy of educational objectives. This situation probably gives chances for achieving unwanted and disliked results.

Specifying the objectives is very important task that has to be given a special attention. It enables researchers to identify what has been and what has not been achieved. Specifying the objectives creates chances to know what type and which level of objectives have been identified. If diversity leads to creativity is accepted as a fact then, efforts have to be given to concentrate on all types and levels of objectives. While the low and intermediate levels of objectives should not be ignored the consideration should be given on the highest levels for creativity purposes. Thus, computers should not be used for achieving low levels of objectives in the hierarchy. While the low and intermediate levels of objectives could be achieved by cheaper equipment and instructional methods, computers (the most expensive tools) should be used for achieving the highest levels of objectives. Using higher technology for low levels of objectives is wasting time, effort and money.

Creativity could be achieved in the best way when the students participate in specifying the objectives. While this procedure is not easy and many difficulties can be faced in the beginning it should not be ignored at all in researches.

The educational aims have to be formulated first. Then, they have to be transferred into objectives apparently for researchers, teachers, students and all who are concerned in the the area of education. Defining the specific

objectives in any research for the purpose of achieving creativity has to be given priority. Creativity can be achieved when objectives from three categories are formulated. Regarding this area Torrance (1994; 125), points out the importance of practice in that revealed in his researches in 1964 and 1965. The students who used scientific laboratories compared with those who did not use these laboratories were in their achievements equal to others but in developing their creativity, written creativity, originality, imagination, their professional interests towards the science, invention, liking the school and not being absent much better than others.

b. Contents

Educational technology is able to offer many and different alternatives. Using different resources means richness, flexibility and leads to creativity. Beside computers and the Internet, television, radio, books, journals, magazines, newspapers, journeys, exhibitions, museum, libraries, educational technology centers can be used. Each resource has advantages and disadvantages. Computers should be used only when it is more effective than any other resource.

Written materials on the other hand are important when a learning package is produced. In research dealing with creativity in the area of educational technology the students have to participate in producing learning packages individually or in groups. They have to learn how to deal with written facts and present their work in effective ways. The scripts can be prepared in many ways. Kemp (1980; 50-51) gives three examples of treating written materials for the purposes of production. Expository, personal involvement and dramatic treatments are among these ways. In expository treatment a logical demonstration is aimed. It starts with introduction, exhibition and ends with conclusion. The material also can be demonstrated in an effective way of question and answer manner. The facts have to be demonstrated after analysis and being manipulated in personal expressions, summarizing, synthesizing and evaluation in a way that the person can claim that the work is really his work and not others. It is like kneading a dough and producing something else. In personal involvement the script is demonstrated in a story manner. The dramatic treatment includes concentrating on the negative aspects of existed subject.

The students in the area of educational technology have to be trained to write their scripts. The written materials have to be divided to small units. The units should not be longer than the students control in a time. Each unit has to be started by its objectives. Visual aids have to be used as much as it is possible. Every unit has to be completed by (a) question that gets the participation of listeners and measures the specified objectives. Gagne (1977: 95) indicates that verbal chains of about seven links represent the limit of what can be learned as a single event. So the written words that should be presented from the computer, TV and slide projector screens at a time should be about seven (plus or minus two) lines of seven words.

c. Instructional Methods:

Generally speaking instructional methods can be classified into teacher centered and student centered categories. Putting one method in a category depends on the percentage of participation of either teacher or students. The instructional methods that are teacher-centered can not achieve much creativity because of the passive situation of students in this type of instructional methods. Thus, student-centered methods should be emphasized in area of research dealing with creativity. In other words; instead of teaching the learning process has to be emphasized.

On the other hand, some students can achieve creativity when they work individually, while others can achieve it when they work in groups. Thus, both individual and group instructional methods have to be used. Using alternative instructional methods gives the students the chance of selection depending on their preference. Creating this chance gives possibility of more successfulness and consequently, creativity could be achieved in a wide range.

Learning packages are a student centered individualized and independent instructional method. Producing learning packages is a very effective way in offering the chance of achieving creativity. The students should participate in producing learning packages in research dealing with creativity in educational technology.

d. Audiovisual Aids

The learning environments that denies audiovisuals cannot achieve the creativity. Torrance, talking on deprived environments insisted that students in these environments cannot practice what is required for creativity in sciences. Thus, generally deprivation of technology and especially advanced one creates a retardation from those who possess these technologies. When these technologies are not available participation of students, adding something and solving their problems cannot be expected. On the other hand, student centered methods require

availability of enough audiovisual aids. Thus, the students can use these audiovisuals when they need and wherever they want.

Audiovisual aids in research dealing with creativity in educational technology can be used by both teachers and students. Using them by teachers offers a good model that could be imitated by students. Teachers' audiovisual aids demonstrations can be the starting point for the practical aspects of education. The learning by doing aspects of education can be achieved. Education by different audiovisual aids can reveal creativity of students in different ways. The creativity can be achieved by producing instructional materials in general and learning packages in specific. Thus, the students can participate in the process of production. Audiovisual aids production fulfills creativity in a proper way. Torrance (1994; 125) in his research in 1964 – 1965 emphasized that audiovisual usage can derive the creativity of students. In spite of equality in experimental and control groups experimental group who used science laboratory developed their creativity, expressed creatively, showed originality, imagination, interests towards technical education, invention, liking school and in attending school were better than control group.

Brown (1977: 80-81) indicates that the production of audiovisuals could be achieved in three levels. All these levels can be related to creative and original work. Those interrelated levels can create a very wide range of projects in individualized learning for both teachers and students. These levels are as follows:

i- Imitative Media Production: Imitation is a starting point in any kind of production. The students have to imitate, imitate and imitate others' works. But the model has to be very good and they have to know what they are really doing. In order to continue the work which has been prepared and tested by other people the instructions should be followed efficiently. Because of following samples or instructions of other people, this type of audiovisual production is called imitative production. Imitative production includes little creativity.

ii- Adaptive Media Production : Adaptive audiovisual production needs giving new shapes or using existing audiovisual aids in a different way. There are no instructions to be followed here. Instead of that, the producer has to decide, guide himself and show initiative behavior. Adaptive media production includes about 50% of creativity.

iii- Creative Invention: Creative production does not need instructions of other people or their experiences to a large extent. It includes definition of the problem in original methods and efforts are given to solve this problem. Production of concepts and original materials represent the creativity. Thus, the research should emphasize on this type of production. Learning packages should systematically follow the stages of planning, preparation, evaluation and improvement for further use in production.

Teachers who take parts in research have to show efforts of being inventors. The original work of students has to be identified, presented to others, reinforced and encouraged. Work of students has to be evaluated due to the defined standards. At last; the value of creative work of students has to be comprehended when other similar works are produced later.

e. Learning Environment

Teachers who take parts in research have to create a healthy environment for creativity. They have to prevent any cultural, learning and cognitive barriers which inhibit creativity. The programs which are imposed on students limit creativity. The creativity can't be achieved in an autocratic environment. Creating a democratic environment in which every student can express his or her thoughts freely, whatever they are, is vital in achieving creativity. Creativity can be achieved where there is fun, sense of humor, spontaneity, risk and intuition. Programs have to give chances to the students to express their ideas and have to motivate them for this purpose.

The students' works should be continued in an environment where the chance for comparisons among students should be forbidden. There is no way for creating competitive environment among students. Competition among students leads to frustration and complexities. Instead, the students have to compete themselves.

Teachers who take parts in research have to suggest their students to deal with new things without any fear. Students have not to be threatened by grades in any way. This position causes the students to select what satisfies the teachers more than being creative.

Teachers have to show students their creative work and be good models for them. The needs of students have to be taken into account in education. If the needs of students are not taken into account and the students are educated in an environment where imposing and compelling is continued the motivation will be low and

creativity cannot be achieved. Such an environment creates negative responses in students. Being serious more than what it should be blocks the students' thoughts and prevent the creativity. The environment that limits the initiation and adventure draws barriers for students creativity.

The suitable environment for creativity is the one which is democracy based. It has to be very easy and far from any imposing and compelling. In such an environment students can express their thoughts freely and without any threatening that prevent their creativity. In this environment fun, joke aspiration are used continuously. Fun plays important role in creativity of students. Individual initiations and adventures raise the students' creativity.

f. Evaluation and Measurement

Evaluation and measurement that depends on threatening cannot achieve creativity. Because students will answer the questions as they feel that their teacher wants. They answer as they hear from their teachers or as it is mentioned in resources.

A wide range of techniques in evaluation and measurement should be used in all programs of research. True-falls, multiple choice, filling blanks and matching types used when low level of specified objectives is aimed. Among the questions there should be some with no one right answer. Open ended questions lead students to serious thinking. There has to be that type of questions that need thoroughly thinking. It has to be emphasized on student self evaluation and measurement.

The criteria for creativity should be specified in the research dealing with creativity in the educational technology. The creativity is achieved ideally where the students are given chances for production. Teachers who take parts in research have to ask their students to produce evaluation and measurement items. Thus, the item bank which includes thousands items can be developed. Discussing these items and what they can achieve with students serve creativity very much.

An important advantage of computers on other audiovisuals and instructional methods is in providing the fastest feedback to students. When the immediate feedback is provided the knowledge is kept in the mind better. This advantage of computers has to be kept in mind in all types of evaluation and measurement.

The evaluation and measurement in student centered education system does not include any threatening for students. It has to be related to high levels of objectives in Bloom's taxonomy. Thus, evaluation and measurement should be applied in different types, measuring originality, has got more alternatives, open ended and that type which can discover the creativity of students. Instead of imposing evaluation and measurement on students they have to evaluate themselves independently.

The creative students' work should be emphasized. This type of works should be reinforced by educators. The best reinforcement is the one derives internal reinforcement in which the students feel happiness of their work.

6. Conclusion

Creativity in a broad sense is distracting the strings, being open to other people experiences, going beyond the familiarized things. It is a step toward unknown, braking the existed line of thought and putting down a new one, giving different alternatives for solving a problem, exiting out of the ways that are followed by others, generating something which can open a way for other things, putting down a new relation between things or correlating the existed ideas, conceiving a new idea, bringing forth unknown new technique or method and inventing a useful aid or apparatus.

Creativity is very important area that has to be given special attention in educational technology. Technology for being a product of creativity influences all aspects of life. Its effects appear especially in individual, educational system, communication, industrial sector and society levels.

When creativity is investigated in educational technology the broad definition of educational technology that constitutes a systematic approach has to be taken into account. Thus, the different elements of educational technology such as specific objectives, contents, instructional methods, audiovisual aids, learning environments, evaluation and measurement have to be taken into consideration when a research plan is designed. Each element of educational technology in achieving the creativity is discussed in details.

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