

A Training Program for Physics Teachers Based on Self-Learning Strategies and Its Effect on Their Technological Enlightenment and Productive Thinking

Assist. Prof.dr. Etmad Naji. Fayadh alzobai & Dr. Sameerah Adnan Thrther A-Qaisi

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A Training Program for Physics Teachers Based on Self-Learning Strategies and Its Effect on Their Technological Enlightenment and Productive Thinking

Assist. Prof.dr. Etmad Naji. Fayadh alzobai

Assistant professor of Methods of Teaching physics, Center for Continuing

Education, University of Fallujah, Iraq

Dr.etmad.naji@uofallujah.edu.iq

Dr. Sameerah Adnan Thrther A-Qaisi

Lecturer of Methods of Teaching physics, College of Education for Pure Sciences,

University of Anbar, Iraq

Sameraalqass@gmail.com

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Abstract: This paper aims to construct a proposed training program according to self-organized learning strategies for physics teachers and its effect on their technological enlightenment and productive thinking. The sample consists of (32) teachers and schools; (16) teachers as an experimental sample and (16) as a control sample. The tools are prepared, which are the Enlightenment Technology Scale, which was adopted by (Faez, 2016) consisting of (60) items. The Researchers have prepared the Productive Thinking Test, which consists of two domains: The Critical Thinking Field, which consists of (15) and the Creative Thinking Domain consisting of (9) situations. The stability of productive thinking is (0.88), and the results show that the proposed training program, according to some self-organized learning strategies, meets the training needs of the trainees with remarkable effectiveness to improve the level of their teaching and educational technological performance and achieve the desired goals. The training is influential in bringing about the transfer of training to their students in developing their attitudes towards self-learning. The recommendations are to; apply the training program to the applied students in colleges, reduce the burden on physics teachers, reduce the fear of physics and increase the efficiency of teaching and learning.

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Key words: Training program, self-organized learning strategies, Technological Enlightenment, Productive Thinking.

Introduction

The success of education and its development depends mainly on the teacher who possesses a set of skills and techniques that help him to meet the various educational levels of students and the diversity of requirements. For achieving this, it is required to increase the attention and serious interest in training teachers during their teaching in order to improve and develop their performance and motivation towards education. Physics is a fertile field for training through variable situations that require awareness of the relationships between its elements. This subject needs a new approach and a new method (Al-Fawzan, 2008). The use of a training program based on self-organized learning strategies is a key for the success and development, as it occupies a prominent place in the progress of the scientific renaissance and education. This is because the scientific thinking and self-organized learning are the basis on which the numbers of individuals and the various educational programs must be built (Al-Amrani and Abbas, 2011: 100).

And after questioning the physics teachers about this strategy and both concepts of the technical enlightenment and productive thinking, it became clear that they have not heard of this concept before and have no knowledge of the activities that are used to teach productive thinking skills. Furthermore, they have not participated in a training course related to productive thinking. thus, many of them need training programs based on self-organized learning strategies and courses that related to the topic of technological enlightenment and productive thinking. As a result, realize a sense of the problem that needs to be solved and the desire to construct a training program for productive thinking for physics teachers. According to the invitation of educational supervisors, school administrations and the meetings with teachers electronically, they emphasize the secondary educational staff need the effective training programs for thinking and providing teachers with various thinking skills to improve their productive thinking and eventually raise the education to a level that keeps pace with the series of rapid changes and tremendous development.

Objectives

- 1- Experimental studies are considered as one of the most scientific curricula which are implied the scientific methods. They are the most accurate scientific studies that can affect the relationships between study variables.
- 2- This study is considered as one of the studies of self-organized learning that can be applied in understanding the competencies of the 21st century.
- 3- constructing a training program according to the self-organized learning strategy to highlight the importance of training for physics teachers in particular as a theoretical importance.
- 4- For the first time, a training program for physics teachers has been implemented in the preparation and Training Directorate in the Anbar Education Directorate, as far as the Researchers apprehend the theoretical importance.
- 5- The prepared program in this study helps curriculum developers in the Ministry of Education to design appropriate curricula for students according to the organized learning strategies as a practical importance.
- 6- It can prove its effectiveness in; the General Directorate of teachers' preparation, training and educational development to improve the quality of prepared training programs and direct teachers to adopt the modern methods of teaching as an applied importance.
- 7- Identifying the impact of the proposed training program on physics and productive thinking to teachers as well as a practical importance.
- 8- Granting a realistic and thoughtful perception of the methods of preparing and developing staff technologically enlightened faculty who are capable of keeping pace the scientific and technological development via implementing the prepared training program for them.

The study samples

- 1- Constructing a proposed training program based on some self-organized learning strategies for physics teachers.
- 2- Identifying the impact of the proposed training program in the productive thinking of physics teachers.

The hypothesis of the study

- There is no statistically significant difference at the level of (0.05) between the average grades of physics teachers who were trained according to the proposed training program (experimental group) and physics teachers who were not trained according to the training program (control group) in the technological enlightenment scale.
- There is no statistically significant difference at the level (0.05) between the average grades of physics teachers who were trained according to the proposed training program (experimental group) and physics teachers who were not trained according to the training program (control group) in the productive thinking test.

Study samples:

- 1- Spatial Limits: a group of physics teachers.
- 2- Human Limits: Physics teachers of both sexes.
- 3- Objective limits: self-organized learning strategies.

Existing studies:

Training Program:

- (Sakarneh 2011): It is a planned, organized and continuous process aims to; developing the skills and abilities of the trainees, increasing their knowledge, improving their behavior and attitudes, as well as enabling him to perform their job efficiently and effectively. (Al Sakarnah, 2011: 16)

- The theoretical definition: It refers to a set of activities and experiences that are planned and implemented by those responsible for training in a specific subject, for a specific period of time with the purpose of developing the knowledge and skills of the trainees for achieving the goals that are set in accordance with their training requirements.
- Procedural definition: It is a set of knowledge, skills and training activities which are planned, organized and programmed in time to acquire the educational skills that aim to raising the performance level of physics teachers.
- Self-organized learning strategy:
- (pintrich & et al 2000): It indicates to those processes that students use for themselves, using cognitive and metacognitive strategies, in addition to their willingness to adopt those strategies in order to control the learning process. (70, pintrich & et al 2000)
- Theoretical definition: It means the plans that help the learner to acquire the educational material inside and outside the classroom in the least effort and time. This is done via organizing and arranging the location that is devoted to studying and summarizing the academic content through requesting assistance from (learning / peers / parents) where a record of homework can be kept in order to get self-evaluation of the student and give feedback from the teacher, and this will enhance his self-confidence and motivation for getting a major achievement.
- Procedural definition: it is the teachers' use of the experimental group of self-learning strategies, whose training was developed by the Researchers, as they taught their students according to the strategy.
- Impact: (Ibrahim, 2009) it is the ability of the operator under study to achieve a positive result, but if this result does not get a positive level, the operator may be one of the direct causes of negative repercussions (Ibrahim, 2009: 199)

- The theoretical definition: The expected result that may appear on male and female teachers as an outcome of education and thinking after subjecting them to programs or studying an educational subject.
- Procedural definition: the difference in physics for male and female physics teachers after the training program is based on self-organization.
- Technological enlightenment (Sabry, 2003): It is (the technological literacy of the individual, that is, providing the individual with the minimum level of knowledge, skills and trends that enable him/ her to deal with the applications of modern and developed technology in a correct manner. Besides, the individual can interact with technique positively in a way that achieves the maximum benefit for self and his/her society. It also helps to draw for him/ her the moral and social limits in using these applications, and the negative effects that may affect him/her and his/ her society because of the exceeding those limits (Sabry, 2003: 11)
- **The International Technology Education** and technological project for All Americans: it is (the ability of using, managing, evaluating and understanding technology) (ITEA&TAAP, 2007, p4).
- The researchers define it theoretically as it is (providing the individual with the possible range of knowledge, skills and trends that enable him/ her to properly deal and interact with modern and developed technological applications. In addition, s/he can achieve the maximum benefit for himself/ herself and the community according to the ethical and social limits and awareness of the negative effects that may reflect on him/ her and the society as a result of overcoming those limitations).
- It defines it procedurally as it is (the physics department's teachers possess the minimum knowledge and skills that enable them to understand and apply modern technology in practical life, measured by the degree obtained in the technological enlightenment scale prepared by the paperer for this purpose).

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Productive thinking

- (Attia 2015): it is a mental process in which the sensory perception interacts with experience and it requires a set of abilities or skills to seek and discover new relationships or unfamiliar methods to achieve a specific goal with internal or external motivations, or both (Attayah, 2015: 131)
- Theoretical definition:
- It signifies a type of thinking that links the skills of critical thinking and creative thinking. and problem-solving. They are used in order to propose a set of fruitful modern practical ideas that can be used in different life situations.
- Procedural definition: it is a planned process that includes a set of mental skills and includes eight skills (assumptions, interpretation, evaluation, arguments, deduction, conclusion, fluency, flexibility, originality). It also includes the strategies, activities and practical applications that target physics teachers for the purpose of introducing them to productive thinking skills and training them in units. The objective of this process is to raise their motivation towards education and stimulate thinking among their students during the training application period, and it is measured by the degree obtained in the test prepared for this purpose.

Theoretical background: It is necessary to use various educational strategies, and these strategies must be based on the optimal employment of activities and effective educational technology. The trainee's feeling of the importance of training is important and this feeling leads to his/her acceptance of training to get benefit from in order to achieve the goals for which the training program was set (Al-Sakrana, 2011: 19). Training in self-structured learning strategies according to Zimmermann and Bones is a set of plans that help the learner to successfully use cognitive, metacognitive and motivational strategies in addressing and solving academic tasks. Therefore, it is logical for students to possess the important skills for these cognitive and metacognitive strategies, and their possession of them is to be trained because they are applicable to be acquired.

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- **Principles of strategy training**

- 1- Inclusion of students in the evaluation process.
- 2- Evaluating the changes that occurred in the performance and knowledge of the students' attitudes.
- 3- Coupling the evaluation process with the learning process.
- 4- Evaluating the actual use of strategies by students (Salem, Amal, 209: 218-217)

The importance of training in the strategies: The principle of self-organized learning is based on the personal freedom. Zimmermann's work emphasizes that the greatest academic successes occur when the students and teachers use the self-organized learning model to guide learning and teaching. By achieving that, it will make the understanding of self-organization for learning an important requirement for both teachers and students. It was designed for this purpose the multi-situations that may face any learner at any stage of learning, and these situations as follows:

- 1- Quarterly learning: questioning the learner about the method he uses when he remembers the information that was discussed in the chapter on a topic.
- 2- A homework assignment: the learner is questioned about the way in which he plans to write a specific topic s/he is asked to write
- 3- An assignment in physics: the learner is questioned about the method for solving a problem in physics or when he faces difficult issues.
- 4- Self-evaluation in the case of doing homework.
- 5- Exam performance: the special method for the tests preparing that conducts in the end of course units.
- 6- Self-evaluation in the case of taking a school test: the method which can obtain the highest amount of correct answers.

- 7- Motivation: The method that is used to push and motivate the learner to do the assignment in the presence of circumstances that distract him from studying, that is, shift him/her away from external stimuli of distracting the attention.
 - 8- Home construction, the method that the learner follows in organizing and arranging the place of study and how s/he prepares himself/ herself to write the school assignment.
- **Some self-organized learning strategies**
 - Self-tasks improvement strategies: (the goal setting and planning strategy, organizing and transferring information, recollection and recall)
 - The strategies for improving academic behavior (self-evaluation strategy, self-reward, record-keeping)
 - -The strategies for improving the learning environment (environmental ranking strategy, seeking information, seeking help, reviewing records (Zimmerman, 1986,33-40)
 - The two Researchers have extracted the most important strategic steps after reviewing many sources that suit the sample, and the most important are (Al-Janahi, 2015, Soleimani, 2016, Abdul-Majeed, 2015)
 - Technological enlightenment: Through the following chart, we note the relationship of the concept of technological enlightenment with other terms

Technological enlightenment

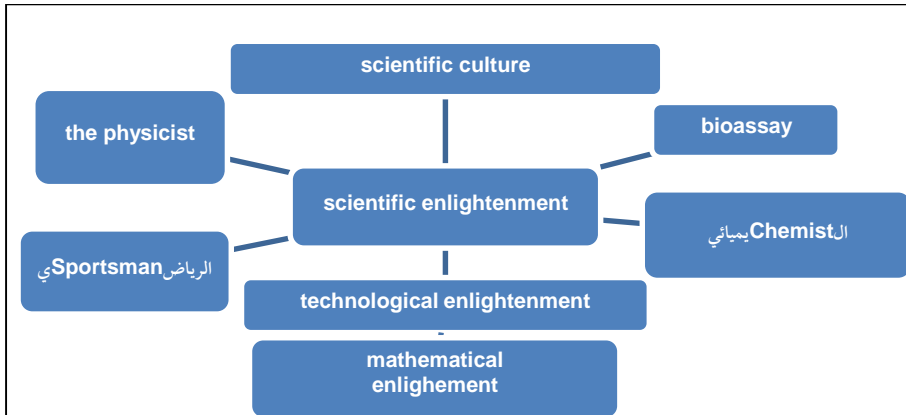


Chart No. (1) The relationship of technological enlightenment to other terms (prepared by the two Researchers)

It is a basis in the work of the technological enlightenment scale that are adopted by the two Researchers.

Areas of technological enlightenment:

Technological enlightenment programs include a group of areas, the most important are the following:

- 1- The nature of science and technology: it is to introduce students to the nature of science and technology, as this field includes:
 - A. The nature of science: There are three views that differ within in determining the nature of science and they are:
 - The static view of science. – The Dynamic view of science. - The integrative view of science.
 - B. The nature of technology: There are several visions of the nature of technology, the most important are:
 - -Considering technology as an application of science that has its own devices and tools.

- 2- The relationship of science in technology: This relationship is emerged in several aspects, the most important are:
 - Independence of science and technology. -The overlap of science and technology.
 - Integration of science and technology. -Science and technology interaction.
 - Science and technology, whichever comes first.
- 3- The relationship of science and technology with society: it is an interactive and reciprocal relationship, as each is affected by and influenced by the other.
- 4- The Issues resulting from the interaction of science, technology and society: This field focuses on the problems and issues resulting from the interaction of science, technology and society that have negative effects on the individual and his/her environment locally and globally.
- 5- The ethics of science and technology: This field includes three basic factors, as follows:
 - The ethics of those working in science and technology. -Ethics of science and technology users.
 - Settling controversial ethical issues.
- 6- Modern applications of science and technology: This field includes everything that is modern and innovated from the applications of science and technology in all aspects and fields of human life. (Sabry and Salah, 2005: 49)

The Dimensions of technological enlightenment

- 1- The Knowledgeable: It includes the information and knowledge that should be provided to the individual regarding the mentioned areas of technological enlightenment which includes facts, concepts, terminology, principles (generalizations), laws and theories.

- 2- the Skillful (psychomotor): it includes mental skills such as scientific thinking skills, critical thinking, innovative thinking, and science processes (observation, classification, measurement, inference and expectation, communication, interpretation, etc.). The practical skills are as the skills of dealing with devices, equipment, materials, the skills of using them, maintenance, and the skills of performing some operations (forming, cutting, linking, mixing, measuring, design, etc.).
- 3- The effective: This dimension includes all the outputs related to the emotional aspect, such as technological awareness, technological sense, and tendencies towards technology.
- 4- The social: This dimension includes all the experiences that the individual needs to acquire in the areas of technological enlightenment related to the negative and positive effects, results, issues and social changes resulting from science and technology, and the extent of this reflection on customs, traditions and social values.
- 5- The ethical: If technology ethics is the most important area of technological enlightenment, then the ethical dimension represents one of its most important dimensions, as this dimension focuses on providing students with patterns of ethical behavior in dealing with technological applications. It also focuses on raising the individual's awareness of ethical issues related to science and technology, and developing his/her ability to understand and analyze the causes, consequences and consequences of those issues by focusing on the stages of decision-making and its procedures.

2- Decision-making: It is considered the most important dimension that affects and is affected by other dimensions. This dimension focuses on qualifying and training the ordinary individual and accord him/her the ability to make decisions, and issuing a correct opinion or judgment when confronting any situation, problem or issue related to science and technology. This process can be summarized in five stages:

planning, data acquisition, data organization, data synthesis, and decision making. (Sabry, 2005: 95)

Productive thinking: the individual takes to understand reality and make honest judgments about facts and problems via using the mental conduct with the intention of reaching specific goals or treatments. In the sense that, it is an approach of thinking for the purpose of understanding, analyzing and diagnosing on the basis of the causative relationships between its variables. Productive thinking is the type that addresses reality and leads to results with beneficial benefits for the individual and society. So, it is creative generative thinking in reaching prominent results as it is a part of the creative process. One of the prominent features is breaking out of the ordinary and feeling in need since our thinking is still verbal due to a problem in our educational curricula, cultural backgrounds, or ruling systems that have succeeded our nation (Atiyah and Al-Hashemi, 2015: 131).

- **Literature review**

Studies dealing with self-structured learning strategies

Paperer's Name	Paperer's Name	Paperer's Name	Paperer's Name	Paperer's Name	Paperer's Name	Paperer's Name	Paperer's Name
Country	Country	Country	Country	Country	Country	Country	Country
Name	Name	Name	Name	Name	Name	Name	Name
Paper Year	Paper Year	Paper Year	Paper Year	Paper Year	Paper Year	Paper Year	Paper Year
Stage of Study	Stage of Study	Stage of Study	Stage of Study	Stage of Study	Stage of Study	Stage of Study	Stage of Study
Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
Size Paper	Size Paper	Size Paper	Size Paper	Size Paper	Size Paper	Size Paper	Size Paper
Tools	Tools Paper	Tools	Tools	Tools	Tools	Tools	Tools
Paper	Results	Paper	Paper	Paper	Paper	Paper	Paper
Results		Results	Results	Results	Results	Results	Results

1 Abdul Majeed, Ahmed Sadiq Sudan 2015 College of Education 50 Self-learning skills test for the effect of strategy Divergent thinking (the superiority of the experimental group)	1 Abdul Majeed, Ahmed Sadiq Sudan 2015 College of Education 50 Self-learning skills test for the effect of strategy Divergent thinking (the superiority of the experimental group)	1 Abdul Majeed, Ahmed Sadiq Sudan 2015 College of Education 50 Self-learning skills test for the effect of strategy Divergent thinking (the superiority of the experimental group)	1 Abdul Majeed, Ahmed Sadiq Sudan 2015 College of Education 50 Self-learning skills test for the effect of strategy Divergent thinking (the superiority of the experimental group)	1 Abdul Majeed, Ahmed Sadiq Sudan 2015 College of Education 50 Self-learning skills test for the effect of strategy Divergent thinking (the superiority of the experimental group)	1 Abdul Majeed, Ahmed Sadiq Sudan 2015 College of Education 50 Self-learning skills test for the effect of strategy Divergent thinking (the superiority of the experimental group)	1 Abdul Majeed, Ahmed Sadiq Sudan 2015 College of Education 50 Self-learning skills test for the effect of strategy Divergent thinking (the superiority of the experimental group)	1 Abdul Majeed, Ahmed Sadiq Sudan 2015 College of Education 50 Self-learning skills test for the effect of strategy Divergent thinking (the superiority of the experimental group)
2 Al-Janahi Saudi Arabia 2015 College 40 Scale for Decision Making Training Program (Outperforming the Experimental Group)	2 Al-Janahi Saudi Arabia 2015 College 40 Scale for Decision Making Training Program (Outperforming the Experimental Group)	2 Al-Janahi Saudi Arabia 2015 College 40 Scale for Decision Making Training Program (Outperforming the Experimental Group)	2 Al-Janahi Saudi Arabia 2015 College 40 Scale for Decision Making Training Program (Outperforming the Experimental Group)	2 Al-Janahi Saudi Arabia 2015 College 40 Scale for Decision Making Training Program (Outperforming the Experimental Group)	2 Al-Janahi Saudi Arabia 2015 College 40 Scale for Decision Making Training Program (Outperforming the Experimental Group)	2 Al-Janahi Saudi Arabia 2015 College 40 Scale for Decision Making Training Program (Outperforming the Experimental Group)	2 Al-Janahi Saudi Arabia 2015 College 40 Scale for Decision Making Training Program (Outperforming the Experimental Group)

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3 Soliman Egypt 2016 High School 100 achieveme nt test	3 Soliman Egypt 2016 High School 100 achievemen t test	3 Soliman Egypt 2016 High School 100 achieveme nt test	3 Soliman Egypt 2016 High School 100 achieveme nt test	3 Soliman Egypt 2016 High School 100 achieveme nt test	3 Soliman Egypt 2016 High School 100 achieveme nt test	3 Soliman Egypt 2016 High School 100 achieveme nt test	3 Soliman Egypt 2016 High School 100 achieveme nt test
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Studies dealing with technological enlightenment

The name of the paperer and the country, the university, the type and size of the sample, the material, the type of curriculum, the experimental design, the independent variable, the dependent variable, the outcome	The name of the paperer and the country, the university, the type and size of the sample, the material, the type of curriculum, the experimenta l design, the independent variable, the dependent variable, the outcome	The name of the paperer and the country, the university, the type and size of the sample, the material, the type of curriculum, the experimenta l design, the independent variable, the dependent variable, the outcome	The name of the paperer and the country, the university, the type and size of the sample, the material, the type of curriculum, the experimenta l design, the independent variable, the dependent variable, the outcome	The name of the paperer and the country, the university, the type and size of the sample, the material, the type of curriculum, the experimenta l design, the independent variable, the dependent variable, the outcome	The name of the paperer and the country, the university, the type and size of the sample, the material, the type of curriculum, the experimenta l design, the independent variable, the dependent variable, the outcome	The name of the paperer and the country, the university, the type and size of the sample, the material, the type of curriculum, the experimenta l design, the independent variable, the dependent variable, the outcome	The name of the paperer and the country, the university, the type and size of the sample, the material, the type of curriculum, the experimenta l design, the independent variable, the dependent variable, the outcome	The name of the paperer and the country, the university, the type and size of the sample, the material, the type of curriculum, the experimenta l design, the independent variable, the dependent variable, the outcome
1 Al-Bayadh, Majdi Ahmed, 2009, Palestine Islamic University / Gaza 22 students / Computer Department / College of	1 Al- Bayadh, Majdi Ahmed, 2009, Palestine Islamic University / Gaza 22 students / Computer Department	1 Al- Bayadh, Majdi Ahmed, 2009, Palestine Islamic University / Gaza 22 students / Computer Department	1 Al- Bayadh, Majdi Ahmed, 2009, Palestine Islamic University / Gaza 22 students / Computer Department	1 Al- Bayadh, Majdi Ahmed, 2009, Palestine Islamic University / Gaza 22 students / Computer Department	1 Al- Bayadh, Majdi Ahmed, 2009, Palestine Islamic University / Gaza 22 students / Computer Department	1 Al- Bayadh, Majdi Ahmed, 2009, Palestine Islamic University / Gaza 22 students / Computer Department	1 Al- Bayadh, Majdi Ahmed, 2009, Palestine Islamic University / Gaza 22 students / Computer Department	1 Al- Bayadh, Majdi Ahmed, 2009, Palestine Islamic University / Gaza 22 students / Computer Department

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Professional and Applied Sciences Courses of the Department of Descriptive and Analytical Computer Technological enlightenment for students (knowledge level, attitude and skill) The higher the students' grades in the field of technology, networks and electronics the more this leads To increase the level of technological enlightenment of the students and vice versa	/College of Professional and Applied Sciences Courses of the Department of Descriptive and Analytical Computer Technological enlightenment for students (knowledge level, attitude and skill) The higher the students' grades in the field of technology, networks and electronics the more this leads To increase the level of technological enlightenment of the students and vice versa	/College of Professional and Applied Sciences Courses of the Department of Descriptive and Analytical Computer Technological enlightenment for students (knowledge level, attitude and skill) The higher the students' grades in the field of technology, networks and electronics the more this leads To increase the level of technological enlightenment of the students and vice versa	/College of Professional and Applied Sciences Courses of the Department of Descriptive and Analytical Computer Technological enlightenment for students (knowledge level, attitude and skill) The higher the students' grades in the field of technology, networks and electronics the more this leads To increase the level of technological enlightenment of the students and vice versa	/College of Professional and Applied Sciences Courses of the Department of Descriptive and Analytical Computer Technological enlightenment for students (knowledge level, attitude and skill) The higher the students' grades in the field of technology, networks and electronics the more this leads To increase the level of technological enlightenment of the students and vice versa	/College of Professional and Applied Sciences Courses of the Department of Descriptive and Analytical Computer Technological enlightenment for students (knowledge level, attitude and skill) The higher the students' grades in the field of technology, networks and electronics the more this leads To increase the level of technological enlightenment of the students and vice versa	/College of Professional and Applied Sciences Courses of the Department of Descriptive and Analytical Computer Technological enlightenment for students (knowledge level, attitude and skill) The higher the students' grades in the field of technology, networks and electronics the more this leads To increase the level of technological enlightenment of the students and vice versa	/College of Professional and Applied Sciences Courses of the Department of Descriptive and Analytical Computer Technological enlightenment for students (knowledge level, attitude and skill) The higher the students' grades in the field of technology, networks and electronics the more this leads To increase the level of technological enlightenment of the students and vice versa	/College of Professional and Applied Sciences Courses of the Department of Descriptive and Analytical Computer Technological enlightenment for students (knowledge level, attitude and skill) The higher the students' grades in the field of technology, networks and electronics the more this leads To increase the level of technological enlightenment of the students and vice versa
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2 Zaqout, Shaima Mahmoud Ahmad, 2013, Palestine Al- Azhar University / Gaza 74 teachers and teacher of the science course in the basic stage, descriptive and analytical, level of technological enlightenmen t, classroom performance of science teachers in the higher basic stage, the presence of a positive relationship with statistical significance between the level of technological enlightenmen t and the classroom performance of teachers Sciences .	2 Zaqout, Shaima Mahmoud Ahmad, 2013, Palestine Al-Azhar University / Gaza 74 teachers and teacher of the science course in the basic stage, descriptive and analytical, level of technologic al enlightenme nt, classroom performanc e of science teachers in the higher basic stage, the presence of a positive relationship with statistical significance between the level of technologic al enlightenme nt and the classroom performanc e of teachers Sciences .	2 Zaqout, Shaima Mahmoud Ahmad, 2013, Palestine Al-Azhar University / Gaza 74 teachers and teacher of the science course in the basic stage, descriptive and analytical, level of technologic al enlightenme nt, classroom performanc e of science teachers in the higher basic stage, the presence of a positive relationship with statistical significance between the level of technologic al enlightenme nt and the classroom performanc e of teachers Sciences .	2 Zaqout, Shaima Mahmoud Ahmad, 2013, Palestine Al-Azhar University / Gaza 74 teachers and teacher of the science course in the basic stage, descriptive and analytical, level of technologic al enlightenme nt, classroom performanc e of science teachers in the higher basic stage, the presence of a positive relationship with statistical significance between the level of technologic al enlightenme nt and the classroom performanc e of teachers Sciences .	2 Zaqout, Shaima Mahmoud Ahmad, 2013, Palestine Al-Azhar University / Gaza 74 teachers and teacher of the science course in the basic stage, descriptive and analytical, level of technologic al enlightenme nt, classroom performanc e of science teachers in the higher basic stage, the presence of a positive relationship with statistical significance between the level of technologic al enlightenme nt and the classroom performanc e of teachers Sciences .	2 Zaqout, Shaima Mahmoud Ahmad, 2013, Palestine Al-Azhar University / Gaza 74 teachers and teacher of the science course in the basic stage, descriptive and analytical, level of technologic al enlightenme nt, classroom performanc e of science teachers in the higher basic stage, the presence of a positive relationship with statistical significance between the level of technologic al enlightenme nt and the classroom performanc e of teachers Sciences .	2 Zaqout, Shaima Mahmoud Ahmad, 2013, Palestine Al-Azhar University / Gaza 74 teachers and teacher of the science course in the basic stage, descriptive and analytical, level of technologic al enlightenme nt, classroom performanc e of science teachers in the higher basic stage, the presence of a positive relationship with statistical significance between the level of technologic al enlightenme nt and the classroom performanc e of teachers Sciences .	2 Zaqout, Shaima Mahmoud Ahmad, 2013, Palestine Al-Azhar University / Gaza 74 teachers and teacher of the science course in the basic stage, descriptive and analytical, level of technologic al enlightenme nt, classroom performanc e of science teachers in the higher basic stage, the presence of a positive relationship with statistical significance between the level of technologic al enlightenme nt and the classroom performanc e of teachers Sciences .	2 Zaqout, Shaima Mahmoud Ahmad, 2013, Palestine Al-Azhar University / Gaza 74 teachers and teacher of the science course in the basic stage, descriptive and analytical, level of technologic al enlightenme nt, classroom performanc e of science teachers in the higher basic stage, the presence of a positive relationship with statistical significance between the level of technologic al enlightenme nt and the classroom performanc e of teachers Sciences .
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Studies have dealt with productive thinking

Paperer	Paperer	Paperer	Paperer	Paperer	Paperer	Paperer	Paperer
Country	Country	Country	Country	Country	Country	Country	Country
Paper	Paper	Paper	Paper	Paper	Paper	Paper	Paper
Study	Study	Study	Study	Study	Study	Study	Study
Stage	Stage	Stage	Stage	Stage	Stage	Stage	Stage
Sample	Sample	Sample	Sample	Sample	Sample	Sample	Sample
Size Paper	Size Paper	Size Paper	Size Paper	Size Paper	Size Paper	Size Paper	Size Paper
Tools	Tools	Tools	Tools	Tools	Tools	Tools	Paper
Paper	Paper	Paper	Paper	Paper	Paper	Paper	Paper
Results	Results	Results	Results	Results	Results	Results	Paper Results
1 Al-Jubouri, Salam Daoud, Iraq: The Effectiveness of the Karen Model in Achievement and Productive Thinking of Second-Grade Students.	1 Al-Jubouri, Salam Daoud, Iraq: The Effectiveness of the Karen Model in Achievement and Productive Thinking of Second-Grade Students.	1 Al-Jubouri, Salam Daoud, Iraq: The Effectiveness of the Karen Model in Achievement and Productive Thinking of Second-Grade Students.	1 Al-Jubouri, Salam Daoud, Iraq: The Effectiveness of the Karen Model in Achievement and Productive Thinking of Second-Grade Students.	1 Al-Jubouri, Salam Daoud, Iraq: The Effectiveness of the Karen Model in Achievement and Productive Thinking of Second-Grade Students.	1 Al-Jubouri, Salam Daoud, Iraq: The Effectiveness of the Karen Model in Achievement and Productive Thinking of Second-Grade Students.	1 Al-Jubouri, Salam Daoud, Iraq: The Effectiveness of the Karen Model in Achievement and Productive Thinking of Second-Grade Students.	1 Al-Jubouri, Salam Daoud, Iraq: The Effectiveness of the Karen Model in Achievement and Productive Thinking of Second-Grade Students.

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The productiv e thinking test the efficacy of the Karen model	The productive thinking test the efficacy of the Karen model	The productive thinking test the efficacy of the Karen model	The productive thinking test the efficacy of the Karen model	The productive thinking test the efficacy of the Karen model	The productive thinking test the efficacy of the Karen model	The productive thinking test the efficacy of the Karen model	The productiv e thinking test the efficacy of the Karen model
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Procedures

- Designing the training program after observing a set of program designs by the Researchers and they did not find a design for teacher training that fits with the objectives according to their knowledge. Therefore, the training program was designed and consists of three stages:
 - The planning stages
 - Implementation stage
 - The evaluation of the program stage

Furthermore, the semi-hermetic experimental design test is chosen, with the experimental and control groups of a post-test of the productive thinking for physics teachers in Table (1)

Teachers, group of independent variable	Teachers, group of independent variable	Teachers, group of independent variable	Teachers, group of independent variable	Teachers, group of independent variable
Dependent variable	Dependent variable	Dependent variable	Dependent variable	Dependent Variable
Measurement of dependent variable	Measurement of dependent variable	Measurement of dependent variable	Measurement of dependent variable	Measurement of dependent variable
Technologist's enlightenment is an experimental training program based on some self-structured learning strategies	Technologist's enlightenment is an experimental training program based on some self-structured learning strategies	Technologist's enlightenment is an experimental training program based on some self-structured learning strategies	Technologist's enlightenment is an experimental training program based on some self-structured learning strategies	Technologist's enlightenment is an experimental training program based on some self-structured learning strategies
Product thinking	Product thinking	Product thinking	Product thinking	Product thinking

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- The sample: The sample was chosen for the experimental group of physics teachers. The number of teachers reached (16) who had the desire as well as their volunteering to participate in the training program. Concerning the remaining number which is (16) teachers who are considered as a controlled group that is not subject to the training program for the school year (2019-2020).

General characteristics: For the purpose of fixing information about the two groups, the two Researchers distributed a questionnaire to determine the characteristics of the trainees, and after collecting the information, they find the following:

- Male and female trainees.
- All trainees are graduated from the Faculties of Education.
- All trainees have an experience of teaching nearly (4-13).
- All trainees have the degree of College of Education / Department of Physics.
- All samples have not previously participated in a program similar to this prepared training program.
- -All teachers have experience in using computers.
- Technological enlightenment scale prior to 1/10/2019 on the teaching community.

Table (2) Mann and Tenny value of experimental control group scores for Technological Enlightenment Scale

Group number	The Average ranks	Group number	The Average ranks	Group number	The Average ranks	Group number	The Average ranks	Group number	The Average ranks	Group number	The Average ranks
Experimental	16 14,44 231	Experimental	16 14,44 231	Experimental	16 14,44 231	Experimental	16 14,44 231	Experimental	16 14,44 231	Experimental	16 14,44 231
	95 64		95 64		95 64		95 64		95 64		95 64
				Control	16 18,56 297	Control	16 18,56 297	Control	16 18,56 297	Control	16 18,56 297

The test of pre-productive thinking

Table (3) Mann Whitney's value for experimental and control group scores for the productive thinking test

Group number	The number	Group number	The number	Group number	The number	Group number	The number	Group number	The number	Group number	The number
Average ranks		Average ranks		Average ranks		Average ranks		Average ranks		Average ranks	
Total ranks		Total ranks		Total ranks		Total ranks		Total ranks		Total ranks	
The computed U value		The computed U value		The computed U value		The computed U value		The computed U value		The computed U value	
Experimental 16	15,70	Experimental 16	15,70	Experimental 16	15,70	Experimental 16	15,70	Experimental 16	15,70	Experimental 16	15,70
235,50	115,50	235,50	115,50	235,50	115,50	235,50	115,50	235,50	115,50	235,50	115,50
47		47		47		47		47		47	
		Control 16	16	Control 16	16	Control 16	16	Control 16	16	Control 16	16
		16,21	292,50	16,21	292,50	16,21	292,50	16,21	292,50	16,21	292,50

Trainers: The two Researchers prepared the requirements for the training process and carried out the training on their own.

Constructing a training program: After reviewing the literature and previous studies that dealt with preparing training programs for the teacher, including the study (Al-Shahrani, 2013) (Al-Janahi, 2015), after that the stages of the training programs were determined.

- 1- Analysis stage.
- 2- The design stage.
- 3- Evaluation stage.

Table (4) sessions of the training program

Day and date session Program Vocabulary Training Methods	Day and date session Program Vocabulary Training Methods	Day and date session Program Vocabulary Training Methods	Day and date session Program Vocabulary Training Methods
Tuesday 1/10/2019 first	Tuesday 1/10/2019 first	Tuesday 1/10/2019 first	Tuesday 1/10/2019 first
Second: Definitions and program delivery Training on the Telegram program	Second: Definitions and program delivery Training on the Telegram program	Second: Definitions and program delivery Training on the Telegram program	Second: Definitions and program delivery Training on the Telegram program
The first unit: teacher cooperating groups, discussion, brainstorming, short lecture	The first unit: teacher cooperating groups, discussion, brainstorming, short lecture	The first unit: teacher cooperating groups, discussion, brainstorming, short lecture	The first unit: teacher cooperating groups, discussion, brainstorming, short lecture
Tuesday 1/10/2019	Tuesday 1/10/2019	Tuesday 1/10/2019	Tuesday 1/10/2019
Sunday 6/10/2019 the ninth	Sunday 6/10/2019 the ninth	Sunday 6/10/2019 the ninth	Sunday 6/10/2019 the ninth
The eighth session five: planning strategies for self-organized education, brainstorming, cooperative learning, and explanatory presentations	The eighth session five: planning strategies for self-organized education, brainstorming, cooperative learning, and explanatory presentations	The eighth session five: planning strategies for self-organized education, brainstorming, cooperative learning, and explanatory presentations	The eighth session five: planning strategies for self-organized education, brainstorming, cooperative learning, and explanatory presentations
Monday 7/10/2019 Eleven	Monday 7/10/2019 Eleven	Monday 7/10/2019 Eleven	Monday 7/10/2019 Eleven
Wednesday 9/10/2019 the fifteenth	Wednesday 9/10/2019 the fifteenth	Wednesday 9/10/2019 the fifteenth	Wednesday 9/10/2019 the fifteenth
The sixteenth, the eighth unit: evaluation of the teaching of cooperative group strategies, discussion, brainstorming	The sixteenth, the eighth unit: evaluation of the teaching of cooperative group strategies, discussion, brainstorming	The sixteenth, the eighth unit: evaluation of the teaching of cooperative group strategies, discussion, brainstorming	The sixteenth, the eighth unit: evaluation of the teaching of cooperative group strategies, discussion, brainstorming
Thursday 10/10/2019 the seventeenth	Thursday 10/10/2019 the seventeenth	Thursday 10/10/2019 the seventeenth	Thursday 10/10/2019 the seventeenth

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The eighteenth, the ninth unit: assessment tools, cooperative group, discussion, brainstorming	The eighteenth, the ninth unit: assessment tools, cooperative group, discussion, brainstorming	The eighteenth, the ninth unit: assessment tools, cooperative group, discussion, brainstorming	The eighteenth, the ninth unit: assessment tools, cooperative group, discussion, brainstorming
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search instrument:

Technological Enlightenment Scale: After the Researchers acquainted themselves with the literature and studies conducted in this field, the two Researchers adopted the scale prepared by (Faiz Salem Abd, 2016) with the following criteria (nature of technology, technology and society, design, capabilities of the technological scientist and the designer world (technological systems) which consists of (60) item.

- **The validity of the apparent scale:** The two Researchers adopted the percentage of agreement (80%) or more, as a criterion for the validity of the scale items and the accuracy of their distribution between the fields to which they belong. Moreover, its relevance is to measure the characteristic for which they were set. According to the answers of the judges, some items are amended without dropping any item.
- Construct validity: After calculating the Pearson correlation coefficients among the survey sample scores for each item, their total score on the scale and the degree of the field to which they belong, it becomes clear that all the items are acceptable and statistically significant, thus, the scale has, internal consistency, verified the validity of the structure.
- Exploratory application of the scale: The two Researchers tested an exploratory sample consisting of (35) teachers of the Department of and from the results of correcting and organizing the answers, and then the psychometric properties of the scale were determined:
 - 1- Discriminatory strength of the item: The discriminatory power was extracted and they were all statistically significant because their value is higher than the tabular value of (2.00) at the degree of freedom (59) and

the level of significance (0.05). Thus, all the scale items were considered distinct.

- 2- Stability of the scale: The Alpha-Cronbach coefficient of stability was determined, as the reliability coefficient reached (0.727) and this is an acceptable value.

The Productive Thinking Test: The two Researchers prepared the test after reviewing the literature that dealt with productive thinking which is divided into two areas: the field of critical thinking, and it consists of (15) items divided into five skills, for each skill 3 positions. The field of creative thinking which consists of 9 positions distributed on three skills, for each skill 3 items. Table (5)

Type of thinking Thinking skills Number of situations	Type of thinking Thinking skills Number of situations	Type of thinking Thinking skills Number of situations
Critical Thinking Assumptions 3	Critical Thinking Assumptions 3	Critical Thinking Assumptions 3
Interpretation 3	Interpretation 3	Interpretation 3
Arguments Evaluation 3	Arguments Evaluation 3	Arguments Evaluation 3
Deduction 3	Deduction 3	Deduction 3
Conclusion 3	Conclusion 3	Conclusion 3
Creative thinking fluency 3	Creative thinking fluency 3	Creative thinking fluency 3
Flexibility 3	Flexibility 3	Flexibility 3

* Apparent honesty: The test was presented to a group of arbitrators without their opinions about the validity of the test, and an agreement percentage of no less than (85%) was approved.

- Construct validity (internal consistency): Constructive validity indicators were checked for each domain. That is by calculating the correlation coefficient for each paragraph of the test by the degree of the critical thinking field using the Pearson equation, as the correlation coefficient ranged between each field of assumptions is (0.680-0.509) and the interpretation (0.676-0.428). Introspection is (0.691-0.431), and the reviews and counseling (0.767-0.257). The arguments evaluation (0.6668-0.363) for reflection on creative thinking

fluency (0,396), flexibility (0,458), originality (0,578), spatiality (5,220) at the level (0,05) and a score of 58 in all subjects are acceptable.

- The validity of the construction of productive thinking: Through finding the correlation coefficient of each of the test items with the total score of the test productive thinking, which ranged between (0,242-0,763) and compared to the tabular value (5,220) at the level of significance (0.05) and with a degree of freedom (58) are found acceptable.

Product thinking test application

- The first exploratory sample: the test was applied consisting of (35) teachers and was chosen randomly, and the time spent in applying the test was (50) minutes. The two Researchers supervised that, and the upper and lower groups were taken, and the number of scores in each group reached 27. To find the psychometric characteristics of the test items as follows:
 - Difficulty coefficient for the test items: After the correction, the percentage of those who answered the paragraphs with a correct answer is calculated, and a coefficient ranges from (0.32-0.55) as the test is good.
 - Distinguishing the test items: After correcting the answers ranged between (0,38-0,60) and thus all the items are considered good.
 - Stability: means that the results shown by the test are stable, that is, they give the same results if they are re-applied to the same sample in the same circumstances after an appropriate period of time. (0,88). It is a good reliability coefficient.
- Product thinking test application

The results

The first null hypothesis: To verify the significance of the differences, the Researchers adopted, so the calculated value of U was (50), which is less than the tabular U value (70) at the level of significance (0.05) as in Table (6).

Mann and Tenny value of experimental control group scores on the Technological Enlightenment Scale

C group average ranks total tables favorable ranks decision	C group average ranks total tables favorable ranks decision	C group average ranks total tables favorable ranks decision	C group average ranks total tables favorable ranks decision	C group average ranks total tables favorable ranks decision	C group average ranks total tables favorable ranks decision	C group average ranks total tables favorable ranks decision
Empirical 19,3 290 50 70 rejects the null hypothesis	Empirical 19,3 290 50 70 rejects the null hypothesis	Empirical 19,3 290 50 70 rejects the null hypothesis	Empirical 19,3 290 50 70 rejects the null hypothesis	Empirical 19,3 290 50 70 rejects the null hypothesis	Empirical 19,3 290 50 70 rejects the null hypothesis	Empirical 19,3 290 50 70 rejects the null hypothesis
			Control 7,43 111,5	Control 7,43 111,5	Control 7,43 111,5	Control 7,43 111,5

This indicates the existence of a significant difference between the moderate scores of the two groups on the technological enlightenment scale in favor of the experimental group trained according to the training program based on self-organized education strategies.

The second null hypothesis: To verify the significance of the differences, the paperer adopted, so the calculated value of U was (35), which is less than the tabular U value (70) at the level of significance (0.05) as in Table (7)

Mann and Tenny value of experimental control group scores on the productive thinking test.

C Group Average ranks The sum of the taboo ranks the decision	C Group Average ranks The sum of the taboo ranks the decision	C Group Average ranks The sum of the taboo ranks the decision	C Group Average ranks The sum of the taboo ranks the decision	C Group Average ranks The sum of the taboo ranks the decision	C Group Average ranks The sum of the taboo ranks the decision	C Group Average ranks The sum of the taboo ranks the decision
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This indicates the existence of a significant difference between the moderate scores of the two groups on the productive thinking test in favor of the experimental group trained according to the training program based on self-organized learning strategies.

- Interpretation of the results of technological enlightenment:

In light of the results, it is found that the level of technological enlightenment of physics teachers participating in the training program based on some of the strategies of the self-organized scientist has changed positively than it was before the training. So, this is clear evidence of the impact of the training program that led to a positive change in the level of technological enlightenment of physics teachers towards the use of technology in general, and e-learning in the virtual laboratories in particular, which include many the technological skills that they were ignorant of.

Rather, most of them were fearful and hesitant and did not know how to use this technology or employ it in teaching physics. In addition, their participation in the training program and acquainting them with the advantages of this technology and its software had the effect of removing their fear and employing this technology in teaching. This technology prompted them to make an effective effort in using it and their desire to apply it. In teaching physics even inside the classroom, this is consistent with what was confirmed (Yaqoub: 1989) that “training teachers and providing them with knowledge and experience is an important and influential factor in achieving the goals pursued by training during the training sessions included in the training program (Yaqoub 1989: 330). With the results of many studies such as (Al-Mousawi 2012) and (Muhammad 2015) and it was confirmed by (Al-Ghazal 2015), which showed the positive impact that trained teachers and users of e-learning have on the academic achievement of their students, as well as that the exchange of experiences between the trainees during and after the program has an impact on developing their knowledge and experience. Accordingly, it raises the level of their software production as well as their use of all these matters positively reflected on the outcomes of the training process.

Interpretation of results: The results related to the second null hypothesis resulted in the superiority of the teachers of the experimental group that had undergone the training program over the teachers of the control group that had not undergone any training program in the test of productive thinking. After performing the test prepared for this purpose, the result can be attributed to the effect of the training program that was prepared according to the self-organized learning strategies because of the comprehensiveness, accuracy and objectivity they describe. The inputs in the analysis stage of the approved training program contributed to identifying the strengths and weaknesses, as well as identifying the characteristics of the trainees and identifying their needs in defining the objectives of the training program. As the content of the training program, represented by the information, skills and activities to be communicated to the trainees, has been determined, the progression in the topics and the permissible period of time, and the organization of content, activities, means and models that help trainees gain experience after consulting the opinions of teachers in light of the vocabulary of the training program. This result gets an agreement with the results of both the study (Al-Janahi, 2015), the study (Al-Jubouri 2017), and the study (Soliman, 2016) on the impact of building training programs through building and organizing appropriate content.

It also refers to the preparing various teaching methods to suit the content of the training program with the type of training, teaching, the appropriate means and activities. Furthermore, the testing evaluation methods are to improve their course during training and the final evaluation to ensure the achievement of the desired goals and the adoption of structured feedback to modify and improve the performance of trainees.

Conclusions:

In light of the results:

1. The positive effect of the training program based on some self-organized learning strategies through the change in the level of technological enlightenment of the physics teachers, the sample.
2. The positive impact of using some self-organized learning strategies by the teachers who underwent the training program in the increasing their technological enlightenment and productive thinking compared to those who did not undergo the training.

Recommendations

- 1- Applying the training program to students who applied their learning in colleges.
- 2- Reducing the heavy burden on physics teachers to reduce the fear of this subject and to increase the efficiency of teaching and learning.
- 1- 3-The educational institutions should commence to set the development of educational policies and strategies that stem from the needs of the age and keep pace with the wheel of scientific and technical development. It should also adopt setting educational and technological plans to benefit from scientific transformations in comprehensive human development projects. By adopting the modern educational strategies such as a self-organized learning strategy to achieve meaningful learning and develop interaction skills and self-reliance
- 3- Holding and organizing seminars and training workshops for science teachers to employ electronic learning media in teaching science in virtual learning environments as a technology innovator. Emphasizing the need for educational leaders to pay attention to introducing the e-learning method in all educational stages, especially the use of computers and internet in science education.
- 4- The curricula with the activities and experiments that employ the virtual learning environments in the educational process, especially in the levels of

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application, analysis, evaluation, and teaching students of the college of education should involve the special courses in the use of tools and applications of virtual education technology.

- 5- The Ministries of Education and Higher Education and Scientific Paper should take the initiative role to develop systems and legislations and prepare intensive awareness programs to spread computer culture in society. Then, they should set a comprehensive and clear-cut policy as a center for sustainable development of technological information literacy and directing students towards e-learning.
- 6- Preparing comprehensive programs that develop the level of technological enlightenment and productive thinking by providing bulletins to students and parents about the importance of technological enlightenment in various fields. It should also show its usefulness to society in order to change the orientations of teachers and students about technological courses and to work on setting the standards for designing and evaluating the electronic learning means.
- 7- Constructing and developing communication and information infrastructures by providing informational means of computers, electronics, software and experts in the field of dealing with information. It also works to hold the agreements with international universities of the developed countries to get benefits from their expertise in the field of technology and engage them to contribute in the development of educational programs in our Iraqi universities. The benefits from the experiences of developed countries can merge them to conform with the determinants of different societies to suit the customs, traditions and surrounding environment.
- 8- The contribution should increase the promotion, encouragement of scientific paper, development efforts, and do and studies on the use of organized learning environments and the productive thinking at other stages of life.

Suggestions:

1. The effectiveness of training physics teachers according to self-organized learning strategies and according to the technology program and their productive thinking on their teaching performance.
2. The effect of training physics teachers according to technology programs on their skills for designing and preparing the computerized educational programs.
3. Conducting a similar study in teaching practical experiences of the other subjects in other scientific departments.
4. Conducting a study similar in teaching physics at the secondary schools.

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