

**Deanship of Graduate Studies**

**Al-Quds University**



**The Impact of Using ICT on the Ninth Graders in  
Acquisition of Electricity Concepts, Mental Models, and  
Creative Thinking**

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**M.Sc. Thesis**

**Jerusalem-Palestine**

**2014**

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Acquisition of Electricity Concepts, Mental Models, and  
Creative Thinking**

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**This Thesis Submitted in Partial Fulfillment of  
Requirements for the Master Degree in Teaching Methods  
in the Faculty of Educational Sciences/Al-Quds University.**

**2014**

**Al-Quds University**

**Deanship of Graduate Studies**

**Teaching Methods**



**Thesis Approval**

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**Jerusalem –Palestine**

**2014**

## **Dedication**

To my dear family (my parents, my dear uncle Hasan Fakhereddin, my dear grandfather Nazeeh Taher , my grandmother Yousra Taher, my brother Kareem, and my sisters), and to my sweet heart and my future wife, these who are always support me and give me the light in my life.

I dedicated this work.

Ayman Hossam Adel Fakhereddin

## **Declaration**

This is to certificate that this thesis is for Al-Quds University to achieve the master degree and it's a result of my special research except what the researcher pointed to where occurred, also this thesis didn't offered to any other universities to achieve any other high degree else.

Signature:.....

Name: Ayman Hossam Adel Fakhereddin

Date:7 / 4/ 2014

## **Acknowledgment**

I would like to extend my sincere gratitude and my high appreciation to my supervisor Dr. Kamel Hashem who guided me in accomplishing this work and bringing it into existence.

In Addition I would like to thanks my professors in Al-Quds University, especially Dr. Ziad Qabaja, Dr. Gassan Sirhan, Dr. Mohsen Adas, Dr. Rashid Jayousi, Dr. Afeef Zaidan, and Dr. Nabeel Abed Elhadi for their insights and support.

My deep thanks correlated to Mrs. Hala N. Bakeer who gives me rich recommendations.

I would also like to thanks the science teacher Mrs. Dina Dawani in Santa Joseph School, and 9th grade students for their cooperation in my study.

Special thanks to the judgment committee for there continues and sincere advice concerning my program and skills test.

To them all my deep respects.

## **Abstract**

This use of information and communication technology (ICT) has become a necessary and important part in the educational process especially in teaching and learning from this important the researcher designed a computerized program in order to measure the impact of information and communication technology through applied learning methods (blended collaborative learning, and blended individual learning) on the acquisition of electricity concepts, mental models, and creative thinking to the 9th graders.

The study adopted the experimental design. A purposeful sample included (90) 9<sup>th</sup> graders from among students of three classes in two of the Santa-Joseph school consist from (blended collaborative learning (experimental group), and face- to- face learning (control group)), and one group in Al-Rawda School consist from blended individual learning (experimental group).

An acquisition of electricity concepts test, creative thinking test, and mental model test were developed by researcher for the purpose. Reliability and validity were achieved. A pre-test and posttest were performed using of the electricity concepts test, mental model test, and creative thinking test to measure the impact of using ICT, the means and standard deviations, ( one way- ANCOVA) test, were used in this study. The results showed that:

There were statistically significant differences between BIBL, BCL on acquisition of electricity concepts, and the level of significance (0.49) between them so the null hypotheses were accepted in favor of the BIBL.

There were statistically significant differences between BIBL and BCL on mental models, and the level of significance (0.144) between them so the null hypotheses were accepted in favor of the BCL.

There were statistically significant differences between BCL and BIBL on creative thinking, and the level of significance (0.135) between them so the null hypotheses were accepted in favor of the BCL.

In the light of the results of the study, there is a need to employ these methods in teaching and learning science, also service programs should be offered to train teachers on using ICT and more studies should be conducted to investigate the impact of ICT on different variables.

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# Chapter One

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## Introduction

### 1.0 Background

Information Communication Technology (ICT) are very important tools in the educational process since they could be applied in many educational settings and specifically in teaching and learning science. There is all over the world a technological revolution which has been reflected in many fields. Social and educational sciences are reflected in the changing of the educational systems through the change in the learning environment and in the methods of teaching suit the technological development, so they contribute to development of the capabilities of students which suit development in many developed countries.

Nowadays, ICTs have become an urgent need to the educational process as they contribute to discovering solutions to most educational problems. Recently, a need emerged for the use of information technology in the educational process. Researchers have tried to find solutions to several educational problems. These solutions included increasing the number of curricula, attention to individual differences, learning outside the school environment. Also recently, open resources have designed educational applications on the internet. These included Moodle system which facilitates the application of virtual learning outside the school environment. With this moment and interest some of the curricula and educational materials have started to become computerized to facilitate their presentation with the use of technologies (Salem, 2007).

The application of information technology in teaching and learning largely depends on two parts: theoretical and practical. The theoretical part depends on teaching and learning theories in the design of one educational tool in terms of its inputs, outputs and processes. All ideas and appropriate educational aids are combined for a teaching setting. The practical part depends on the design of audiovisual aids for the sake of

employing communication technologies in true educational process (Nashwani, 2010).

Moreover, the educators have considered applying ICTs in educational institutions through specific methods of learning in order to get desired results; these methods of learning depend on using ICTs such as Electronic learning, blended learning, and computer assisted instructions. Electronic education is one of the educational means that supports the educational process and transforms rote learning to interaction through dependence on computers and networks to transfer information, knowledge and skills (Hijazi, 2009).

Electronic learning includes learning through the web, virtual classrooms, and digital cooperation. Despite the advantages and rational of electronic education, some researchers believe that it has some shortcomings. For examples, electronic education has failed to overcome the problem of social media network among the students and problem of some academic activities which need practical application. These challenges have led to the emergence of blended learning which blends electronic learning with usual learning, thus overcoming the downturns of electronic learning (Kilani, 2001).

Blended learning is considered one type of modern education in which the teachers blends usual learning and electronic learning. The importance of this type of learning is not only in its mere mixture of different patterns of learning. It blends learning online and learning offline. Through online, internet and intranet used. In contrast, offline learning takes place in traditional classroom settings. Blended individual learning with electronic learning includes blending traditional individual learning with electronic learning and individual learning processes upon request which is done upon the need of the learner and speed suiting him/her. Blending between collaborate learning and electronic learning is done through teaching of students in small groups and blending electronic learning technologies with it (Milheim , 2006).

Therefore, the researcher used blended learning, in all its forms, in the teaching process.

Educators have shown interest in introducing information technology in science teaching in order to apply new methods of science teaching because the science

material includes a number of theories and phenomenon, thus requiring a lot of illustration. For there, scientific laws are likely to change from time to time (Al-Faar, 2002).

Therefore, there is a need to apply law new methods in the teaching of science discipline according to the needs of both the teachers and the learners.

Against this background, the transfer of learning from traditional learning to innovative learning is meant to improve the educational system, achieve motivation to acquire concepts, and develop thinking. The researcher has conducted this study to investigate impact of using ICTs on the 9<sup>th</sup> graders in acquiring electricity concepts, mental models, and creative thinking.

### **1.1 Problem Statement**

New technologies can shape both what and how students learn, but too often, they mistakenly believe that the presence of new technology will be enough to cause change. The ability to learn new concepts and ideas through the use of technology, for example, is greatly influenced not only by the technologies used but also by the ways in which they are presented.

The results of TIMMSS exam in science, held by the ministry of education in 2007, showed that the students, achievement were 404 and average. For six percent of students failed to achieve the minimum score on the last. The results reflected the low performance and were lower than the international average. The results also revealed a high percentage of students were suffering from problem it in mastering basic skills and concepts in science, thus affection negatively achievement in Palestine (TIMMSS, 2007).

Results of UNRWA final science exams for the 9<sup>th</sup> graders showed low level in the average of science exam, and lack of student achievement in answering questions of creative thinking (UNRWA, 2012).

Therefore, this study seeks to find solutions to these problems by designing a computerized program to investigate its impact on developing Palestinian 9<sup>th</sup> graders' understanding/ acquisition of electricity concepts, mental models, and creative thinking.

## **1.2 Study purpose**

This study seeks to examine the impact of applying different learning methods (blended self- based learning - BSBL, blended collaborative learning – BCL, usual learning) on acquiring electricity concepts, mental models, and creative thinking by 9<sup>th</sup> graders.

## **1.3 Research Questions**

In the essence of the learning process, students will learn through different learning methods. This research has raised the following questions:

1. How do different learning methods (blended individual based learning, blended collaborative learning, and face to face learning) affect students' acquisition electricity concepts?
2. How do different learning methods (blended individual based learning, blended collaborative learning, and face to face learning) affect students' mental models?
3. How do different learning methods (blended individual based learning, blended collaborative learning, and face to face learning) affect students' creative thinking?

## **1.4 Study hypotheses**

1. There is no statistically significant difference at the significant level ( $\alpha \leq .05$ ) between the mean scores of 9<sup>th</sup> graders in acquiring electricity concepts due to the face to face learning, BIBL, and BCL.
2. There is no statistically significant difference at the significant level ( $\alpha \leq .05$ ) between the mean scores of 9<sup>th</sup> graders in mental models concepts due to the face to face learning, BIBL, and BCL.
3. There is no statistically significant difference at the significant level ( $\alpha \leq .05$ ) between the mean scores of 9<sup>th</sup> graders in creative thinking due to the face to face learning, BIBL, and BCL.

### **1.5 Study significance**

1. Provide teachers with useful teaching methods to develop their methods of teaching which might be helpful in choosing the proper learning method when acquiring concepts, use of mental models, and creative thinking.
2. Provide learners with appropriate learning tools so that they can use them as much as they need.
3. One of the theoretical implications of this study is that it will offer great benefits to curriculum designers in Palestine to design the learning environment (by curriculum developers) that can support learning about electricity concepts, thus making learners more aware of the many opportunities available for application of this knowledge .

### **1.7 Terms definitions**

**ICT:** "Information and Communication Technology.", an umbrella term for IT, (Information Technology) is a technique that supports computer applications through storage, retrieval, sending, and protection of information. Besides, it depends on dealing with CT (communication technology) in order to serve computer applications such as the Internet, cell phone networks, and satellite technology. And also, CT has made it possible for users across the world to communicate with each other in real-time on a regular basis such as inclusion, instant messaging, video-conferencing, online multiplayer gaming, and social networking websites" (Rouse, 2005). Seelz & Richey (1998, P.39) defined ICT is "Information Communication Technology (ICT) is a generic name used to describe a range of technologies for gathering, storing, retrieving, processing, analyzing, and transmitting information"(Seelz & Richey, 1998,P.39). And also, Zaytoon (2005, P.174) defined ICT is" Information and communications Technology (ICT) is an umbrella that involves any communication application or device, encompassing: television, radio, satellite systems, cellular phones, computer hardware and software. ICT are widely used in Healthcare, schools and libraries". In addition, Fallown & Brown (2003, P.2) defined ICT is " Tools are devices and objects used in information and communications technology. Examples are: computers, cell phones and cell phone towers, televisions, video conferencing software".

The researcher believes that information technology and communication works to enable the transfer of written texts to digital form in order to save it on the computer and computer network .this has led to the introduction of new methods of teaching.

**Acquisitions concepts:** "mean mental images which learners have acquired and saved in memory in the form of symbols and images through comparison of concepts with critical attributes in order to be acquired. The concept categories contain similar elements and common properties. Besides, this can be classified into bloom taxonomy: remembering, understanding, application, high thinking skills" (Hasan, 2004, P.1). Abu- Hatab (1998, P.58) defined Acquisitions concepts: The mental image form of the common properties of scientific phenomena includes their names and meanings. It is used measured through a test designed specifically for them.

The writer believes that the individual acquisition of meaning and understanding is associated with the scientific terms cited in the electricity unit this acquisition was measured through a grade which the school students got in the scientific concepts acquisition text which the researcher has designed/developed for this purpose.

**Mental models:**" Mental models are deeply held in internal images of how the world works images that limit us to familiar ways of thinking and acting. Very often, we are not consciously aware of our mental models or the effects they have on our behavior "(Young, 2008). Johnson-Laird (2005) defined mental models:" a model has the same structure as the situation that it presents like the physical models; a mental model is also partial because it represents only certain aspects of the situation. There is accordingly a many-to-one mapping from possibilities in the world to their mental model". And also, Johnson-Laird (2001) defined mental models:" People form mental models through experience, training, and instruction. The mental model of a device is formed largely by interpreting its perceived actions and its visible structure. I call the visible part of the device the system image".

The researcher defined the mental models model as the person's thinking process on how to do/make something. That is, it's the person's way of understanding of the surrounding environment. Mental models rest on incomplete facts, past experience, and axiomatically perceptions. These models give specific shape to human behavior and influence human being's decision on how to understand and solve their problems.

**Creative thinking:** Torrance defined "refers to a process of generating novel ideas and alternative courses of action, and skills, thus leading to complex mental activity and the formation of new ideas through giving freedom to learner in thinking more to get to a creative output. And also, creative thinking includes levels of creativity: fluency, flexibility, and originality (Hassan, 1995, P22-25). Ibrahim (2004, P.798) defined Creative thinking: is a specific thought processes which improve the ability to be creative by being in an optimal state of mind for generating new ideas, to think deliberately in ways that improves the likelihood of new thoughts occurring, and also in order to maximize the ability of the brain to think of new ideas. And also, Ali (2002, P.43) defined creative thinking : "The ability of thinking of original, diverse and elaborate ideas through a series of mental actions which produce changes and developments of thought process of exploring multiple avenues of actions or thoughts". Abed elhamid ( 1993, P.30) defined creative thinking: "Is actually both capacity to blend or synthesize to present suggestions, images, or experience in unique ways and the expertise of thinking, responding and dealing in a creative way characterized by a higher level of development, risk taking and divergent thinking".

The researcher has this definition of creative thinking .it's the process through which the mind organizes its own experiences in new way to come up with the a number of solutions for a particular. This kind of thinking is measured through a certain test developed for this process.

**Face to face learning (control group):** is one method's teaching between teacher and student in a classroom, mainly depending on memorization, and rote learning without the using of modern methods of teaching (Wikipedia, 2003,P.1).

**Electronic learning:** E-learning is one of the new learning methods which depend on the use of electronic means to communicate between teachers and learners through the support of computer applications. This method does not need classroom because learning takes place in the virtual world through the use of computer applications such as internet, and computerized programs (Al-Saleh, 2006, P.5). And also, Amer (2007, P.21) defined E- learning: learning that is accomplished over the Internet, a computer network, via CD-ROM, interactive TV, or satellite broadcast. In addition, Musa (2002, P.6) defined E- learning: Term covering a wide set of applications and processes, such as Web-based learning, computer-based learning, virtual classrooms,

and digital collaboration. It includes the delivery of content via Internet, intranet/extranet (LAN/WAN), audio- and videotape, satellite broadcast, interactive TV, CD-ROM, and more.

Electronic learning, according to the researcher, is learning that depends basically on the use of computers and networks for the transfer of knowledge and skills. Its applications include learning through the web, the computer, virtual classroom and digital cooperation. The content is introduced on the net, audio and video cassettes as well as CDs.

**Blended learning:** "This is a combination between two learning methods (face to face learning and e-learning) and this method requires the presence of learners and teachers in the classroom" (Zaytoon , 2005, P.168). And also, Singh & Reed (2001, p.1-2) defined Blended learning: "Blended learning combines online with face-to-face learning. The goal of blended learning is to provide the most efficient and effective instruction experience by combining delivery modalities". In addition, Garrison, (2006, P.2 ) defined Blended learning:" Is a pedagogical approach facilitated by a teacher where students have some control over their learning; and the teacher seamlessly incorporates the use of online learning tools (e.g. discussion boards, online collaboration, blogs, etc.), technology tools (computers, digital white boards, cameras, etc.), and face-to-face instruction so that instruction and learning can be accessed at any time by the student through multiple electronic devices". Kelani (2001, P.8) defined Blended learning: "Is used to describe a solution that combines several different delivery methods, such as collaboration software, Web-based courses, EPSS, and knowledge management practices. Blended learning also is used to describe learning that mixes various event-based activities, including face-to-face classrooms, live e-learning and self-paced instruction".

Blended leaning , according to the researcher, is teaching or learning (integrated training) in which electronic learning is blended with traditional classroom learning in one frame work .to this end, electronic education devices are used .save are computer based on lecturing or teaching. Training session usually take place in real classrooms equipped with network communication hardware and software.

**Blended individual learning:"** is an intentional procedures process in which the learner tries to acquire standardized amount of knowledge, concept, principles,

attitudes, values, and skills using on benefitting from computer applications. These applications can be in programed books, teaching methods, and devices as well as variety of assignments "(Kelani, 2001, P.13). And also , Robert & Ronald (1994, P.53) defined blended individual –based learning:" it depends largely on the learner's activity and personal effort which suits his/her speed and abilities, He/she uses am technological resources, such as CD, audio visual aids, TV programs, and recorders, to achieve best levels of improvement, growth and development and the individual's education goals".

**Blended collaborative learning:"** is one method of learning in which a group of students, who have individual differences, interact within a learning environment and use technology applications to achieve one specific aim under the supervision and direction of a teacher" (Contlan ,1989,P.1). And also, Krause ( 2007, P.5 ) defined blended collaborative learning:" is blended collaborative learning; students in class are divided into small groups of (2-6) members each. Each group is given one learning task/assignment and in asked to make use of technology applications to do it. Each group member is assigned one task to do. Results of groups' work are benefitted from through generalization of the benefit on all other students" (Krause, 2007, P.5).

## Chapter Two

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### **Theoretical Framework and Related Studies**

This chapter has two sections; the first section is a theoretical framework, and the second section is a review of previous studies. Theoretically, the researcher explains learning methods (electronic learning, blended self-based learning, and blended collaborative learning). In addition, he sheds light on the instruments used in this study such as acquisition of accusation concepts, mental models, and creative thinking.

Concerning the review of related studies, the researcher provided summaries of results of theses and journals articles. This literature survey covered studies in Arabic and other languages. Moreover, the researcher highlights implications of these studies for the present study.

### **2. Literature Review**

#### **2.1.1 ICT in Teaching and Learning**

ICT have been an accelerated system in tandem over the last decade in many educational sectors. In recent years there has been a flow in using technological applications in teaching and learning In order to contribute in improve efficiency and effectiveness of educational process (Tinio, 2007).

Educational institutions have given ICT many definitions. UNESCO (2003) stated that it consists of two concepts. The first is Information Technology (IT). IT is a term used to describe items of equipment (hardware) and computer programs (software) that allows us to access, retrieve, store, organize, manipulate and present information through computer applications. The second concept is Communication Technology (CT), a term used to describe telecommunication pieces of equipment in which information can be searched for and accessed. Rouse ( 2005) defined ICT "is an umbrella term that includes many communication devices, encompassing radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with

them". And also, Al- Heilah (1998, P.54) added that education technology helps the teacher in keeping him/her abreast of development in modern educational trends which consider the learner as the center of learning/ teaching process. They also seek to develop the learner's physiological, cognitive, linguistic effective aspects and social behavior.

The ICT is considered a priority in the educational process for many reasons: rapid inventions, and spread of technology tools through development of educational process especially in teaching and learning to provide teachers and learners with suitable methods of teaching and learning to achieve positive results through increase of learning, its reinforcement and motivation of students to learn. many plans have been made include ICT as a major component in the training of teachers to provide schools with many suitable tools and devices to be able to apply them in educational institutions, leading to an output from the educational process to a new pattern in order to achieve the goals easily through interaction with new methods of teaching and communication with electronic tools (Qandeel, 1998).

ICT contributes to the educational process by taking into account all individual differences like groups with special needs and learning difficulties through dependence on new methods of teaching that suit all individual differences by providing all contents through using stimulation, multimedia, sounds effects, interactive video, and educational games (Salameh, 1998).

Al-Far (2002, P.47) mentioned the advantages of using ICT in education:

1. ICT can make a difference in the teaching and learning process.
2. It can increase the effectiveness of learning.
3. It can also provide educational contents in a sophisticated and easy form, and it allows the use of modern educational patterns when there is a difficulty in applying or using usual learning.
4. It also makes it possible for the integration of theory and practice with computer applications, linking contents with theories, practice, and reality.
5. Finally it provides an educational material arranged from easy to difficult.

Al- Kharendar (2006, P.35), mentioned the rationale of using ICT in education:

1. Using ICT in education has become a necessity because of the needs to speed access to information with less time and effort.
2. It also prepares students to be ready to use new modern Techniques.
3. ICT is a suitable tool because it takes into consideration individual differences, and provides solutions to learning difficulties of some students and the mentally retarded.

Bransford (2007) explained the educational patterns applicable in ICT

ICT contributes to development of educational services to apply them in new methods of teaching or pedagogy for an effective teaching and learning in educational institutions which would subsequently improve achievements' learners. So ICT characterized as a guidance to teachers by using suitable methods of teaching, through dependence on electronic tools, and as guidance to learners to do experiments, hold debate, and comparisons , and acquisition of pieces of information through dependence on effective methods as follow:

1. Active learning: ICT-enhanced learning through focusing on the learner as the center of learning. This includes engaging students in electronic debates, analysis of pieces of information, and doing experiments, by depending on ICT, in contrast to memorization-based or usual learning; ICT-enhanced learning promotes learners' engagement.
2. Collaborative learning: ICT-supported learning encouragement of interaction and cooperation in the study of a particular topic among students, teachers, and it supports learning and teaching to individual differences.
3. Creative Learning: ICT-supported learning which promotes creation of new methods to acquire pieces of information rather than dependence on usual learning.
4. Integrative learning: ICT-enhanced learning which promotes a thematic, integrative approach to teaching and learning, through accessing all subjects for the sake of increasing understanding, and the relationship among the disciplines.

5. Evaluative learning: ICT-enhanced learning directed at diagnosis of learners and allowing them to explore and discover rather than merely listen and remember through many different learning pathways.

Riser and Dembseq (2002), in their review of education technology, pointed out that the purpose of technology is to understand the way in which the individuals learn and the manner of designing educational systems and materials to facilitate the learning process. It also, means using appropriate technology to help in designing and conveying concepts/contents of material. In their opinion, education technology represents, today the solution for all problems pertinent to education. It helps in solving problems pertinent to performance.

Al-Faqeh (2005) explained the computer applications should have a number of good features:

1. The first feature is containment of the reality which can be created from the needs of the community.
2. The second is regularity in presenting subjects.
3. The third is explanation by presenting subjects in a detailed fashion through dependence on many sources.
4. The fourth feature is internal consistency: consistency in subjects with exercises and exams.
5. The fifth feature inclusion by presenting all subjects in electronic educational tools.
6. The sixth feature is economy. The costs should be low to design and easy to make to make majority of students able to buy it.
7. The last feature is applicability it has suitable devices and is applicable to the educational process in educational institutions.

Recently methods of teaching have seen an interesting development: new methods of teaching through integration of teaching and learning with computer applications to convert the classroom into an effective place through the use of networks and computerized programs. Examples of these new methods of teaching are E-learning, distance learning, E-class, video conferences, and blended learning. Most scholars consider E- learning a method of teaching that enables teachers teaches learners everywhere. This will make storing contents easy in computerized programs or on

educational websites divides subjects into input, process, and output that can add motivation tools to increase interaction between students and teachers (Zaytoon, 2005).

### **E-learning**

Is defined many definitions, E-learning: is one of the new methods which might give a full encouragement as a change in the educational process through motivation interaction between teachers and learners to exchange experiences. That depends on the use of electronic tools to facilitate communication between them as well as among learners and educational institutions (Rouse, searchcio-midmarket, 2005). And also, Aqel (2007, P.21) defined E-learning: as one form of education at a distance, can be defined as a way of learning through the use of modern communication means/ resources such as the computer, the network, multi-media, and internet portals to convey information to learners at great speed and at lowest cost and way that enables proper management control and use a sure of the learning process and evaluation of learners' performance. In addition Harbash (2003) defined E-learning: is a creative way of introducing an interactive environment in which the learner is the center of the learning process. This creative way is well designed beforehand, user friendly for all in any place and at any time. Internet resources and digital technologies were used in harmony with the principles of educational designers appropriately distributed and flexible for an open educational environment. Gorab (2003) defined E-learning: is one way of learning by using modern means of communication such as the computer, network, multimedia sound, and images) drawing, search engines and electronic libraries. These means includes also internet portals or in classroom. The important thing is sing all technology to convey the information to the learner in the shortest time, least efforts and maximum benefit.

In this study, the researcher used electronic – learning technologies inside classrooms.

Qandel (1998) mentioned the importance of electronic applications:

1. Developing academic materials that lead to interaction with then to achieve the intended goals.
2. Setting up a number of alternative perceptions for the desired system.
3. Setting up criteria for evaluation of the alternatives.

4. Selection of the best alternatives through the application of some of these criteria.
5. Taking the decision suitable for the educational situation.

Shunaq (2009) explained E- Learning environments depend on management systems that have the following:

1. Learning management system (LMS) which is software in using management (lecture, learning activities, and virtual learning).and this system doesn't focus on content development.
2. Learning content management system (LCMS), this system focuses on developing content and editing, and also contains files to save repository and facilitate the editing process.

LMS and LCMS are two different things but in reality they complete each other. However, in this research, the focus will be largely on LMS.

Kelani (2001) mentioned the LMS important advantages:

1. Registration: listing and management of trainee's data.
2. Scheduling: scheduling of textbook material and setting up a training plan.
3. Conveying: making content accessible to trainee.
4. Follow up: following up the trainee's performance and producing periodic reports about it.
5. Communication: communication between the trainees through chats, discussion forums, mail and sharing of monitors.
6. Tests: holding tests for trainees and dealing with their evaluation.

Talabe (2008) explained the type of electronic learning:

1. Synchronous: electronic education brings together the teacher and the students at the same time in order to allow synchronous communications between them, through device in real time.
2. Asynchronous: this electronic device allows the user to communicate with the other users indirectly. That is, it does not require the user and the other users to be online during communication. These include e-mail and educational electronic website.

Electronic learning is distinguished because information can be easily updated and edited thus overcoming the increasing numbers of learners; they also offer learning services to learners at any time and everywhere. This reduces classroom management that burdens teachers; this will provide both teachers and learners with feedback about learning evaluation. But E-learning receives a lot of criticisms due to the lack of using educational patterns like collaborative learning, individual learning, and activities in lectures (face to face). This causes decrease in social interactions between learners and teachers, thus affecting personal maturation. There are a lot of material whose understanding depends on the explanation by the teachers (face to face) practical experiments and discussion of results (Cohen, 2000)

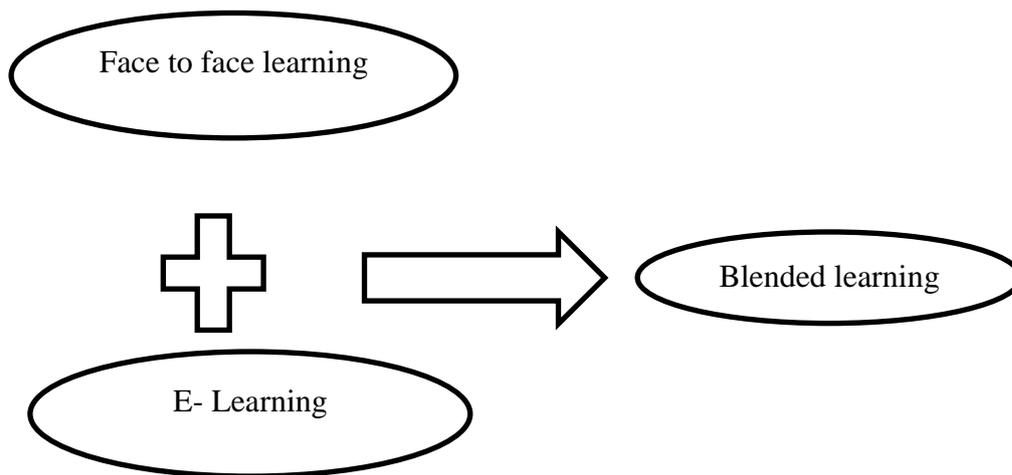
E-learning is considered a basic method in an updated educational process in a modern era to overcome challenges in both teaching and learning, but some researchers believe that e-learning does not fit all subjects. Some subjects depend on the presence of teachers. Besides, some subjects depend on experiments and explanations, though this problem lead to discovery of new methods of teaching through integration of both methods (E-learning with blended learning) This is called blended learning through blended E- learning with patterns educational to get a better productivity in the educational process (Hosler, 2013).

Researchers have provided many definitions for blended learning:

Blended learning: this is one form of learning/education (integrated training) in which electronic learning is blended with traditional classroom learning in one form. Different electronic devices are usually used for this purpose. Some are computer based while others are network based and are in the form of lessons, lectures and training sessions which mostly take place in real classroom, required with both hardware and software (Bersin,2005,P.10). And also, blended learning: is one kind of learning which brings together online and offline models of education. These models are intranet or internet. Offline models take place in conventional classrooms while the online models take place in virtual classrooms (Shomali, 2007). In addition, Faqeh (2005) mentioned the blended learning includes traditionally a group of multimedia designed to complete each other.

Kelani (2001) considered a blended learning program may include a number of learning tools: collaborative learning programs and internet- based text books.

Blended learning blends a number of events based on an activity which includes learning in traditional classrooms in which teachers and students meet face- to – face. In blended learning, modern technology is at work in teaching but without giving up the conventional learning environment is direct interaction in classrooms through the use of modern communication means such as computers, networks, and internet portals as following flowchart (2.1) shows:



**Blended learning form (2.1)**

In this study, the researcher used electronic learning synchronously with learning patterns taking place inside classrooms.

Faqeh (2005) mentioned the advantages of using blended learning

1. Blended learning has a number of advantages It first increases the effectiveness of the educational process, and learners' satisfaction with teaching
2. It also achieves the educational process through technological application.
3. Further to increases motivation through the use of reinforcement.
4. Moreover, it saves time and efforts of teachers, and develops educational skills, and communication skills of learners.
5. Finally, it lowers cost of the educational process compared with E-learning.

Zaytoon (2008) gave the following advantages of blended learning system:

1. It combines between electronic learning advantages and those of traditional learning.

2. It allows the training of learners on the use of e- learning technology during learning.
3. It supports traditional learning methods used by faculty members through multi- media technologies.
4. It provides physical resources (classrooms and equipment) for learning.

Salameh (2005) explained the rational of using blended learning:

1. The teachers feel that he/she plays a role in the educational process and does not feel that his role is withdrawn.
2. It saves learners' and teachers' time.
3. It allows two ways of learning, thus allowing more than one choice of learning instead of one way.
4. It addresses the problems pertinent to lack of resources for some students.
5. It focuses on cognitive and effective aspects and skills but without one affecting the others.
6. It maintains the original link between the students and the learner. It is the basis of the learning process.

Blended learning requires a new type of teachers who use easily use modern technology and programs and communications through the internet. He/she can also design electronic tests and can teach the material in the traditional way and practically apply it on the computer and do these electronic tests. He/she can access links related to the material he/ she wants to explain .He/ she has the research skills to find latest developments about the subject being through . Like the teacher, the student participates in the research process and he/ she stops becoming only a receiver of information .this type of learning expects the teacher to design the lesson himself/herself in harmony with the available resources at school instead of making the academic material available in an advanced way which the teacher can implement. Simple programs can be used. Ready-made programs can also be made available (Kelani, 2001).

Salameh (2005) explained the qualities of a blended –learning teacher:

1. Ability to combine between traditional way of teaching and electronic learning.
2. Ability to design tests and handle multimedia.

3. Ability to create spirit of participations and interaction in class.

Faqeh (2005) explained the components of blended learning:

1. Synchronous hardware versions:
  - a) Classrooms and lectures supervised by teacher
  - b) Labs and manual workshops.
  - c) Field trips.
2. Synchronous network versions ,simultaneous electronic learning:
  - a) Electronic meeting.
  - b) Virtual classrooms
  - c) Seminars broadcast through the world wild web.
  - d) Training
  - e) Direct message.
3. Asynchronous self –learning model
  - a) Document and internal pages.
  - b) Training units based on computers or network.
  - c) Net learning communities and forum groups.

Points to be considered when applying blended learning

Teachers should plan well before applying technological communication in blended learning environment. To this end, teachers should be trained to apply the technological communication and computer application in both teaching and learning. This is in addition to checking the availability of computer applications, and training for both teachers and learners before teaching subjects. Finally a variety of applications should be used to suit / meet all individual differences (Kilani, 2001).

Rationale for the use of blended learning

Applied teaching and learning in an educational process depends on technological communication to provide a new quality that takes into consideration individual differences. It entails the use of social contacts in teaching and learning, enabling both teachers and students to use technological skills, facilitating the application of both formative evaluation and final evaluation, and lack of appropriate e-learning opportunities in both public schools and in some subjects (Faqeh, 2005).

Khan (2005, P.3) believed the learning needs different from one learner to another. Therefore educational and training intuitions must introduce variety of learning methods and patterns to allow integration of all. The blended learning program must include multiform of learning tools and systems such as collaborative programs, virtual programs, electronic textbooks, electronic performance support and learning managements systems.

Zaytoon (2005) it's crystal clear that blended learning is a teaching method that blends employment of computer technology and the internet in particular, and the traditional methods. In this research the researcher chose the blending between electronic media and methods of teachings in individual self – based learning and collaborative learning.

### **I. Individual –based learning:**

Individual –based learning : " is an important method of learning, individual self – based learning allows the employment of learning skills efficiently, thus contributing to development of the learner in terms of behavior, cognition and affection. It provides him/ her with an important "weapon" which enables him understand the development of the coming age" (Gamel, 1997, P.11). Abu- elhiaja ( 2003, P.83) defined the individual -based learning: is also defined as a process which learners teach them using blended learning and other methods to achieve their clear goals without directed help from the teacher. Gamel ( 1997) defined It's a learning style which allows the people to learn how to learn on his own. individual self –based learning is also achieve learning which the learner has to do motivated internally with the purpose of developing his potentials, abilities and resources and responding at the same true to his /her desires ,tendencies and interests to ,thus achieving the development of a full personality. It allows also successful interacts with the self – learner's community through dependence on his own abilities and individual-confidence in these abilities in the learning and teaching process. In this way, the learner is thought how to learn self- learning is also an educational system that makes possible for the learner to experience different educational activities ,thus helping him or her achieve his/ her doal.in this way ,the learner will change behavior and personality towards letters levels of growth and promotion.

It is crystal from the aforementioned definitions that the learner is the center of the learning process in self- learning. The learner learns on his own through prepared educational programs designed for this kind of learning. The learner decides how to deal with true educational unit. He/ she is the first person responsible for results of his/ her learning and the decisions which he/ she takes in dealing with the educational tool (Iskandar & Gazawi, 1994).

Nashwan (1994) explained the importance of individual – based learning, individual-learning has received significant attention in education because it is a learning style that achieves learning that suits his/ her abilities and individual-speed of learning. It also depends on his/ her motivation. This kind of learning in short has the following advantages:

1. The learner plays a positive and achieve role in learning.
2. Self- learning enables the learner to master the necessary basics skills necessary to continue his/ her learning and this continuous for life.
3. It creates a fertile educational environment for creativity.
4. Self- learning creates an opportunity for discovery of the pupils taken and abilities.
5. The learner takes responsibility for decisions he/she takes which are linked to different methods and suitable times to achieve goals.

Zaytoon (2002) adds that individual – learning is important because it allows teacher positive interaction with the educational content through feedback and direct reinforcement methods. It also, provides alternatives and activities which contribute to activation and activities, it allows individual- evaluations, thus achieving learner's dependence finally, individual- learning takes into consideration individual difference between learners.

Relation between individual- learning and information technology and communications: Individual- learning is directed application of the concept of technological approach. Educational literature asserts that this approach is a group of experiences which the learner interacts with to acquire their content through individual activities by using modern technology. The learner finds in these experiences principles of evaluation, and reinforcement of responsive behavior (Tick, 2006).

The technological approach is reference framework in contemporary through. It calls for the systematic use of various devices and multimedia accompanied by a sequence instructions and guide lines based on principles taken from behavioral science and modern theories, and also the technological approach helps students to practice individual- learning through preparation of enrichment programs to a company of school materials using multimedia and programmed instruction devices systems analysis mastery learning and the computer in educational field (Khamees, 2007).

In the light of what we have said, can easily realize the close relationship between information technology, and methods of individual- learning as a practical aspect to achieve the goals of the technological approaches.

Faqeh (2005) explained the pattern of individual- learning:

As stated earlier, individual- learning depends on the learner's effort and ability in line with his/ her potentials and experience. Thus style of learning allows students to learn through a number of patterns:

1. Programed individual- learning: this kind of learning is done without the teachers help. The learner himself/ herself acquires an amount of knowledge, skill, attitude and values determined by the program at hand through learning multimedia technology (print out academic materials or computer programed materials or audio-visual cassettes) about a particular subject/material or part of it. These programs provide each learner with opportunities to direct the course of his/ her education according to individual – speed along with continuing feedback to introduce appropriate reinforcement, that's increase motivation.
2. Programmed individual- learning is one kind of individual learning in which the learner on himself/herself to achieve good outcomes of learning. It depends on the activities of the learner himself/herself. It has the own advantages in achieving the goals of education through various means: booklets, slides, films, pictures and computers.
3. Individual –learning through educational packages: an educational is a well-organized program consisting of a set of educational activities and alternatives which help in achieving specific objectivities all depending on principles of individual- learning .there enables the learner to interact with the academic

material, according to his/her ability, to follow a certain course of learning. This program consists of organized interrelated educational materials printed out or photocopied. The package consists of a variety of elements in which the employment of audio visual aids, as ancillary Medias is taken into consideration.

In this study, the researcher depended on the application of the programmed individual – learning and computer –based individual- learning given the availability of devices. The academic material in these programs is divided into four levels. The learner moves from one level to another level after mastering the previous one for each discipline separately in line with his/her individual- speed and the method he/she likes and suits his/ her circumstances and potentials. Usually the teacher and the learner participate in setting goals, activities and evaluation methods.

Viliation (2002) mentioned the role of teacher in individual-based learning:

The teacher's role, in the individual- learning strategy, differs from his/ her traditional role in transferring knowledge and making students' practice role learning. His/her role is to direct and guide the learner. His/ her role can be summed up in the followings:

1. Identifying the learner's ability, tendencies and attitudes through first hand observation, summative and structural evaluation tests.
2. Preparing the necessary educational materials such as educational packages, learning resources, employment of technological resources such as the TV, movies and computer.
3. Directing the students to choose objectives that match the level determined by the diagnostic test.
4. Setting up remedial plans to enable students to fill in gaps and complete the necessary experiences they need.

Carmen (2002) explained the blended individual –based learning has two formats:

1. Synchronous online format (live e-learning)
  - a) Electronic meetings.
  - b) Seminars and broadcasting on the internet.
  - c) Direct messages.
  - d) Computerized programs.

2. Individual -based, synchronous formats:
  - a) Documents and internet webpages.
  - b) Computer-based or internet –based training units.
  - c) Simulation.
  - d) Net learning communities (groups) and discussion forums.

In this study, the researcher used the synchronous individual- learning format.

## **II. Collaborative learning**

Collaborative learning: is one concept of different meanings depending on learners' interests and opinions. There definitions can be summarized in the following:

Collaborative learning:" is one of the means of organized the classroom environment, depends on diving students into small groups of different mental abilities and academic background to do a specific common assignment for the purpose of learning through it" (Ibrahim, 2004, P.723). And also, Zaytoon (2003) defined collaborative learning: is one format of classroom environment organization in a specific framework according to clear and specific strategies. These strategies are based on diving students into small groups of different mental abilities. They are then asked to work together and interact with each other to finish a certain assignment. Through interaction, they teach each other and all hold responsibility for learning within the group until achieving the required goals under the teacher supervisor". Abo Naser (2007, P.80) defined collaborative learning: is also learning in small group of (2-6) students, allowing then to work together efficiently, help each other to raise each other level and achieve the common educational goal. The performance of students is measured by comparing it to previously prepared simulations to measurer extent of each individual progress in completion of tasks assigned to them.

Zaytoon (2003) mentioned the characteristics of collaborative learning:

1. Collaborative learning is a format of multi-strategies used for teaching based on organization of the classroom into small groups.
2. Interaction between students within the groups allows this kind of learning to achieve the goals at highly required level.
3. Collaborative learning is characterized by social ability in performance of learning roles. Learning takes place in the context of mutual social interaction

between groups numbers and between groups and between the groups and the teacher

4. Collaborative learning depends on the efforts of both the learner and the teacher. Each has his/her roles in the process of educational interaction, and these roles are linked with realization of sought goals of learning.
5. Collaboration and providing assistance among group members characterizes this kind of education, thus making it a require format which works to integrate experiences of all learners.

In the light of what has been said, collaborative learning is work that needs planning and implementation and the talking of measures and effective evaluation to achieve its goals. It also, requires taking into consideration student's motivation and the way of learning, the participants in the activity, application of methods necessary for cooperators among the students. It also requires identification of the types of collaboration activities which students have to do achieve effective collaboration (Bloom) required that providing small groups an opportunity to collaborate and share advice (Alaqani, 1999, P.124).

Collaborate learning is considered one of the learning strategies to master and understand information. Therefore it has become a necessity to use collaborative learning to keep abreast of the huge technological and scientific developments which affects all aspects of life collaborative learning is conducted through division of students into groups and through cooperation using educational multimedia. For example, the focus is usually or computerized collaborative learning, collaborative group work through computerized learning, computerized educational environments is characterized by internet connection between the students. The central media in it is the digital text (Alhela & Mer'e, 2002).

Faqeh (2005) mentioned the technologically computerized collaborative learning

This is computerized teaching which includes a number of interactive elements and in considered part of the educational process .these elements are used by the student in his/ her interaction with other students as followings:

1. Computerized media in collaborative learning (work).
2. Discussion groups: in these groups, a certain topics are raised for discussion.

3. E- mail: in this electronic media a personal messages are sent and received for the save helping exchange of information .however discussion in groups yield better results.
4. Video conference.

Zaytoon (2003) mentioned the teacher's role in collaborative learning:

1. Choice of most suitable lesson.
2. Determination and wording of goals.
3. Formation of groups.
4. Preparation of the classroom environment.
5. Building collaborative assignments.
6. Defining each student's role in the group.
7. Explanation of required tasks for each group.

Zaytoon (2003) mentioned the Students' collaborative skills:

1. Good listening.
2. Individual –expression.
3. Encouragement.
4. Leadership.
5. Communication with others.

Formation of groups in collaborative learning: There are many ways to divide students in to groups. All of them depend on the goal of using collaborative learning. Individual differences between the students are likely to be effected.

Ibrahim (2004) explained the types of collaborative learning groups:

1. Homogenous groups: in this kind of groups, the teacher takes into consideration the homogeneity of the students in terms of them academic levels, psychological conditions, age, attitudes, tendencies and ideas.
2. Inhomogeneous groups: in this kind of groups, the teacher takes into consideration differences between students in terms of level of academic achievement and individual differences.
3. Random groups: in this kind of groups, the teacher randomly choses students without paying attention to individual differences between them the teacher usually uses the following method:
  - a) Alphabetical order.

- b) Proximity in classroom.
- c) Students' desires.

Educators have through of an educational method that employs electronic education resource and at the same time one come the shortcomings resulting from it. They come up with blended learning which depends on combination of electronic education methods and several patterns (styles) of learning inside classrooms in educational institutions. This method is employed for its qualities in electronic education and teaching methods. One of these is collaborative learning. In this kind of learning, collaborative learning and electronic learning (electronic web pages) are blended. In this way, the learner has the choice of studying it in a digital form from the internet with audio and visual support, movement, forms and colors, thus supporting and polishing education from all sides during interaction within a collaborative environment (Kelani, 2001).

**Blended collaborative learning:** Blended collaborative learning with electronic learning includes move dynamic communication between the learners, thus increasing sharing of knowledge and experience through electronic media (Zaytoon, 2005).

Therefore, blended learning includes a number of media all designed to complete each other. A blended learning program may include a number of learning tools such as online virtual collaborative learning software, internet-based textbooks, individual-learning textbooks, ancillary systems for electronic performance, management of learning systems. Blended learning also mingles several events which depends on activity and this includes learning in usual classrooms in which teacher and learners meet face- to – face. Individual – learning in it mixes between synchronous and a synchronous learning (Faqeh, 2005).

**2.1.4 Acquisition of Scientific Concepts** Scientific concepts is considered the most important in the scientific process to get knowledge and acquire concepts in both teaching and learning in order to make it become meaningful learning. The scientific concepts are defined as follows:

**Acquisition of Scientific concepts:** means an abstract set of symbols, facts, and notes which we work to promote concepts related to them and organize them in the mind (Ateieh, 2009). And also, Zaytoon (2002) defined acquisition of scientific concepts: is learners' mental perception that is used to express symbols, and words which share

same properties. The importance of scientific concept can be seen in the following: Understanding the concepts makes it easy in both teaching and learning. It helps learners to convert learning into a meaningful learning, and it also increases effectiveness of learning through interaction with new subjects, and understanding concepts and connecting old concepts with new concepts. In addition Nashwan (2001:p.40) defined it as "an amount of information which has something in common about a certain thing formed in mind and includes common qualities distinguishing it."

Against the background of the aforementioned definitions, the researcher believes that the scientific concept is a mental perception linking a group of things which have common qualities /traits. It is also an amount of information (fact) and ideas which are in the form of a symbol, or word.

Zaytoon (1990) mentioned the scientific concepts are classified into several types:

1. Linking concepts: concepts linked with properties of other concepts.
2. Affective concepts: concepts which depend on feeling and tendencies
3. Relationship concepts: relationship concepts with more than one concept.
4. Scientific concept: concepts which depend on a scientific experiment.

The researcher believes that the classification of physical concepts suits the following classification:

- a) Concrete concept: these concepts can be felt by using senses or sense assisting tools. Examples are concepts of melting, barometer and smell.
- b) Abstract concepts: these are concepts which can be understood through mental processes, certain mental perceptions. Examples of such concepts are energy, and nuclei.

Hassan (2004) explained the properties of scientific concepts:

1. Scientific concepts are characterized by a group of properties which make them different from other components of scientific knowledge. The scientific term consists of two parts: name (symbol or usage).
2. The scientific concept includes generalization for example; matter is everything that occupies space can be felt by senses.

3. Every scientific concept has a number of characteristics and which all numbers of the concept category have in common and make it different from other scientific concepts. It has other available or secondary characteristics.
4. Scientific concepts formation and growth in continuing process graded in difficulty from one grade to another and form one school stage to another due to the growth of scientific knowledge itself. Maturity of the student and increase of his/ her academic experiences load to the development of scientific concepts.

It is crystal clear that the scientific concept consists of a symbol and a verbal indication in which all concept elements to have several things in common. That is, it includes generalization; the scientific concept is also characterized by continuity and development due to the growth of scientific knowledge.

Important of learning scientific concepts:

Learning scientific concepts allows organizing and linking groups of things and events. It also helps to transfer impact of learning. Moreover, learning leads to increase of pupils, interests in science, their motivation and gives them incentives to specialize in it. Besides, learning these concepts provides a foundation for selection of experiences, organization of educational attitude and identification of the goal of the curriculum. Finally the teaching of scientific concepts enables us to highlight the linkage between areas of sciences (Darwazeh, 2004).

Bloom considered "cognitive domains as one of the most important domains", so researchers use Bloom levels to analyses contents and measure tests. This is that the field that is pertinent to memorization of information. It extends to the development of mental skills and abilities .bloom classifies this field to six levels: memorization of information, understanding, application, analysis, structuring and evaluation. (Zaytoon, 1990, P.79).

Darwazeh (2004) explained the Bloom's classifications as follow:

1. Knowledge: learners' recovery of subjects that have already been learned in the past. Example: a student members names of three physics of makes a list of names of devices working on electricity.in the formula of goals of this level ,several verbs are used: mention, name ,specific, describe, list, identify.

2. Comprehension: learners' realization of subjects through a meaningful learning. Example: the learner changes the relationship between volume, mass and velocity to a mathematical relation. The learner cum up in his/her own words the properties of hydrogen which he read in his school text book. In formulation of the goals of this level, several verbs are used: illustrate, reorder, reformulation, infer, conclude, and sum up.
3. Application: Learner's ability to use what they have learned in new situations. Examples: the learner of differentiates between planet cells and animals cells. The learner computes the Fahrenheit upon finding the percentage of temperature using in that the relationship between them. In formulating the goals of this level several verbs are used: apply, use, explain, and solve (an issue / problem) compute and illustrate.
4. Analysis: learners' ability to analyses subjects into partial components. Example: the learner classifies materials (elements onto after understanding their general properties. Another example is learner's listing of iron properties after understanding the properties of mineral. In formulation of the goals of this level, a number of verbs are used: prove the validity of action, compare, distinguish and identify.
5. Synthesis: learners' ability to put parts to create a new form. Example: the learner concludes to the food chain in the environmental system and follows up journalistic scientific articles and prepares one such article. Verbs used in the formulation of soars of this level include design (an experimental), plan, suggest (a way/ method), and combine.
6. Evaluation: learners' ability to evaluate ideas. The learner gives his/ her opinion on kinds of food which he/ she takes in terms of their importance to human body. He/ she differentiate the areas of weakness in a simple column. Verbs used in the formulation of goals of this level include make a judgment on, criticize, argue for/ against, asses/ evaluate, estimate value of, find contradiction in, support with evidence.

It is clear from Bloom's and his colleagues' taxonomy of cognitive field that the criterion of gradation in which it was used is the degree of complexity of mental processes. Low levels of memorization require only a small amount of understanding or mental processing while high levels (analysis, structuring and evaluation) require

high degrees of understanding and an ability to discuss and analyses ideas and passing judgment on them.

### **2.1.5 Mental Models**

Recently, mental models have appeared in modeling and in the educational sciences which have contributed to discovery of brain function through likening function to a computer process in a stored process of information. This is in addition to cognitive theory which is adopted in modeling the explanation and analyzing the brain functions: thinking processes, solving problems, memorization, storing pieces of information, and remembering pieces of information that happens in an internal language. This is similar to the CPU which stands for Control Process Unit in the computer to represent pieces of information and coding. This theory contributes to the discovery of how the learner uses his brain (Norman, 1998).

"Mental models are deeply held internal images of how the world works, images that limit us to familiar ways of thinking and acting. Very often we are not consciously aware of our mental models or the effects they have on our behavior" (Senge, 1990). And also, Young (2008) considered "Mental models are deeply held in internal images of how the world works images that limit us to familiar ways of thinking and acting. Very often, we are not consciously aware of our mental models or the effects that exist in our behavior."

One concludes from the mentioned that the mental models "are a person's thinking on how to do / make something. That is, they are about how a person understanding the surrounding world. However, there mental models rest on incomplete facts and past experiences as well as axiom perception. They give a specific shape or for- to human behavior and effect peoples decision on how to solve and understand their problems.

Young (2008) mentioned characteristics of mental models:

1. Mental models rest on beliefs rather than on facts. There is a big difference between beliefs and facts. What we believe in is not always a fact. In contrast, facts are permanent. As designers, we hope the users' thinking would be closely related to the reality by brining reality closer to the user's mental models. This can be through prediction of their expectation and then their realization.

2. Every user has his / her own mental model in his/ her mind users build different mental models for the same interface one of the dilemmas facing these models the gap between the mental models of designers and those of users. Designers' experiences are usually more and they know more. They shape their mental models in wonderful ways , an indication of their creativity ,thus making themselves believe that every trait characteristic they have included would be easily understood by own other user. However, this is untrue. Mental models of users, metaphorically speaking, are still like those of a "small child who is yet to become mature". The user does not deal with the same member of events and experiences which the designer lives. Therefore, the user is more vulnerable to make mistakes.

Norman (1998) described how to do mental models emerge through our habits in our daily life, our experiences (beginning in infancy), gained knowledge, cultural habits and customs, influence from others, and training and instruction. An also he mentioned the benefits of mental models for learners:

1. Making it faster and easier for us to reach a decision.
2. Making decisions.
3. Predicting the results of our actions.
4. Understanding complex pieces of information.

The mental models can be applied through educational means such as mental mapping and analogy, explanation of ideas, acquisition of pieces of information that can store subjects in the memory through designing a workable model that links a realistic world in both teaching and learning (Bloch, 1990).

It is well known that every person has his/ her own mental model and when he/ she save idea other people think of, he/ she makes in a way different from that of designer become they live different experiences. The designer has his/ her own model while the person who has no information about the title of the model will have a model of his/ her own which is different from that of the designer given their different experiences. In addition, the design of a person who has previous information will differ from those afore mentioned models (Young, 2008).

Norman (1998) mentioned the mental models have several benefits in the educational process:

1. Increasing motivation of learner in both teaching and learning.
2. Increasing the level of remembering and focusing of the learner.
3. Abstracting contents in a favorite form.
4. Using multiple parts of the brain.
5. Understanding of the linkages and relationships

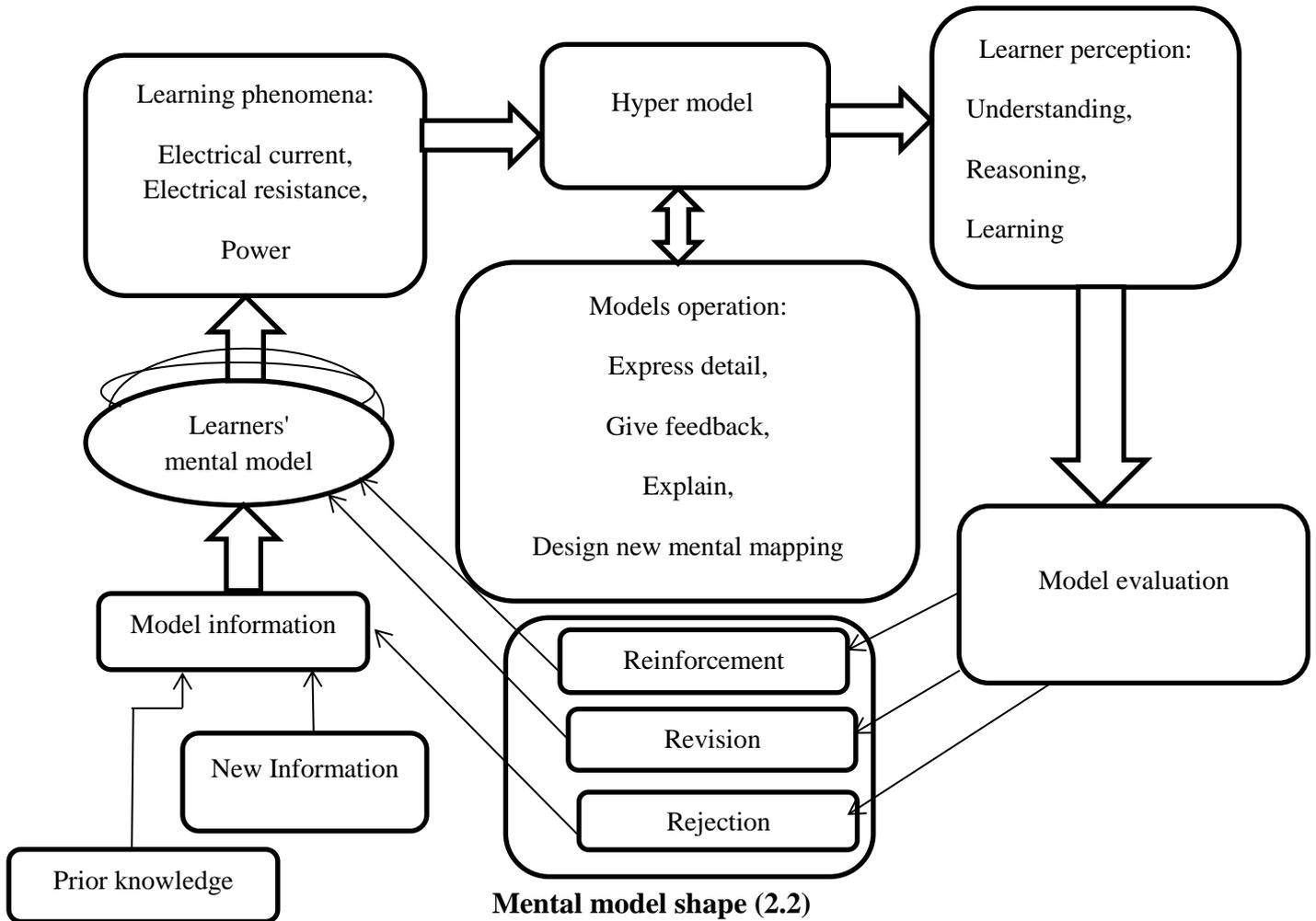
The researcher believes that the advantage of the mental models is that it allows the student to understand and from " a mental mode" and this will enable his/ her to realize quality of the problems of usability of special designs when one sees people making mistakes in design of a model, the reason is most probably that of the user who has formed a wrong mental model.

Hashem and Mioduser (2011) explained the mental models have three categories to evaluate the educational means:

1. Structure: learners describe how to express in details (number of branches home, number of branches sub, and arrangements) function: there are feedback loops within the mental mapping; these are the explanations within the mental mapping.
2. Behavior: there is a difference between mental process mapping and new mental mapping, what draws the new mental mapping" See mental models framework flowchart (2.2).

The following flowchart (2.2) shows how the human being's mental model takes shape. We can notice that man's knowledge consists of previous and new knowledge. The previous and the new knowledge take shape of a model of information which renders a formation in the learner's mind, of a set of phenomenon. Then he / she begin to imagine designing a model and link it with his /her facts and concepts. Subsequently, the learner forms a perception of under understanding and logic and acquired things he/ she learn. A model is usually evaluated through observation of whether it has made reinforcement in the learner and modification of information. As

a result of this process, a mental model is formed in the learner. If the model is rejected, this indicates that the learner has not linked new facts and concepts with old ones. Flowchart (2.2) as follow:



Young (2008) mentioned the criteria for design of mental models:

1. Mental models are taught audience through analysis of tasks which the user will perform on model and through interviews with users.
2. The mental model is designed to suit the levels of learners.

In this study, the researcher selected a mind map to represent knowledge, information, behavior, structure, and function.

A mind map is a "method of visual representation of ideas, accessing of intelligence, allowing a rapid expansion and exploration of ideas in a note form." ( Bozan, 2006).

Mental maps: are a mean of expression's point of view concerning the world of ideas and plans instead of limiting it to words only. Pictures, colors are used to express an idea (Refa'e, 2008).

The researcher considers the mental map away which depends on drawing all one wants on one paper in an organized way. They try as much as possible to replace words for picture/ image which refers to it. Everything is put on one paper in a condensed brief and easy way to make it possible for the learner to memorize it.

Features of mental map: it is inexpensive to design, there are no limitations in drawing; it expresses creative drawing; transforms usual learning to learning fun; aids learner in remembering and understanding subjects; clarifies relationship between concepts and facts, and helps students who suffer from learning difficulties ( Bozan, 2006).

Moving from one idea to another is due to a link the person has. This moves through ideas due to remembrance of particular thing. In the end, the learner thinks of a thing which on surface appears to have no relationship with the basic point he/ she started from. However, as long as he / she have moved to another idea, definitely his/her mind has found a way of linking them through other ideas. The mind has found a way of linking them through other ideas. The mental map depends on a sequential way. It begins from a specific central point and then ideas are allowed to flow. Giving the mind absolute freedom motivates it to open closed doors and shed light on dark corners which might seem to be illogical to the learner (Bozan, 2006).

The mental map strategy depends on Ausubel's educational theory (meaningful learning). He thinks that every educational material has a structural organization which differentiates it from other materials. In every structure the more comprehensive and more general concepts and ideas are processed. Under these ideas, there are less comprehensive and less general concepts and ideas followed by accurate detailed information. The knowledge structure for any academic material is formed in the learner's mind in the same order: most comprehensive to least comprehensive (Ausubel, 1962).

Mental models can be used in tests if the aim of the exam is to test student's knowledge and understanding rather than his/ her writing ability. The mental map is the test solution. The map can prove to the lecturer if the learner understands the material is general or not. It also sheds light immediately on his / her areas of weakness and strength it also gives the teacher clear and objective idea about the level of the student's knowledge away from anything that might affect him / her objectivity in marking. This would also save a lot of time which teachers spend on reading and correcting mistakes in student's answers to questions of the exam (Bozan, 2006).

Bozan (2006) considered the following evaluation system can be followed when developing a test the following mental maps to get grade criterion:

1. Educational content.
2. Additional content.
3. Symbol.

It is worth noting in this respect that there are many good programs, written in Java language and they are free. They provide a number of mental models and can be designed via the computer. For more one can visit :<http://freemind.sourceforge.net>. The researcher depended on this free website in this design of the mental models.

### **2.1.6 Creative Thinking**

Processes of thinking are interested in many educational sciences to develop skills such as imaging, and explaining problem and finding solutions. There are many thinking types such as creative thinking, logical thinking, and critical thinking.

Thinking: means an exercise which is practiced by the mind in order to make a new decision, remember, recollect, and choose between options (Abdeen, 1983).

Creative thinking: means a new production resulting from the interaction between an individual and a material experience (Masad, 2005). And also, creative thinking: a mental process based on experiences, and environment to produce ideas and creative solutions; it consists of innovative thinking abilities: originality, flexibility, and fluency (Abdeen, 1983). Soror (2001, P.272) mentioned "it is worth noting that innovation, as continues interactive dynamic process, and like all other psychological process, is a multi- stage interactive interdependent process.

Creativity is the organization of a number of simple mental abilities. However, these abilities differ due to the differences in creativity. These abilities are fluency in thinking and adaptive flexibility, originality, sensitivity to problems, renewal. All these together are called innovation thinking elements (Masad, 2005).

Therefore, creative thinking is considered one of the most important skills which learners should possess to achieve the needs of community, solve problem, and overcome challenges.

Abdeen (1983) mentioned the factors which can develop creative thinking:

1. Scientific environment: an environment consisting of cultural components, scientific components, and experiences component.
2. Motivation: a desire in behavior to learn.
3. Memories: memory capacity of thinking methods.
4. Social interaction: Social relationships between individuals and freedom in society.

Ibrahim (2004, P.128) mentioned the individuals' innovative qualities:

1. More interest in knowledge and personal curiosity. In gathering, for example, innovators tend mostly to have positive curiosity and desire to research. They are also always dissatisfied with current conditions and they always ask for renewal and development.
2. Commitment to a lofty aim in work to reach it.
3. Ability to provide ideas persuasive suggestions or wonderful plans.
4. Spontaneity and flexibility when dealing with others in addition to self-confidence when dealing with others and teaching crises.

Zaitoon (2001, P40) considered "The innovative process in a number of different stages during which new ideas are generated". This process has a number of stages and levels. Characteristics of an innovation personality:

1. Independence.
2. Openness.
3. Acceptance of self.
4. Flexibility.

Jarwan (2002, P.86) explained the levels of innovation thinking:

1. Originality: creates something new and useful to a discipline, and domains, and also it is one of the most important innovative abilities. Zaitton (1991) defined "it is means presenting things in new way ". It is usually measured by impossibility scale or distant results. In the narrative title scale, a person is a short strong and is then asked to come up with other possible title for that story: a number of non-traditional titles (less frequent).

In measurement originality, the researcher used a number of non – traditional titles which were less frequent.

2. Fluency: enables learners to produce many ideas at a specific time. Darwaze (2004) defined "it is the individual's ability to produce the largest number of appropriate responses possible such as (symbols, numbers, figures, words and ideas) which have same special conditions during a specific period of time. There are several factors for fluency:

- a) Expressional Fluency: this kind of fluency requires recalling the biggest number of meaningful sentences. They consist of words gives in a certain order or consist of certain letters. One such test that measures this kind of fluency is the four – word structure test.
- b) Ideational Fluency: it is the ability of the individual to quickly recall ideas in response to a problem or a stimulating / exciting situation at a certain time one example of an exam, testing this factor / type, is the tester's remembering of the largest number of ideas possible about a particular subject or the largest number of solution for a specific problem.
- c) Associational fluency: it is the ability to quickly produce the largest number of utterances which have certain conditions concerning the meaning and the ability to give the largest number of synonyms for a specific word.

3. Flexibility: the ability to cross conceptual boundaries. It consists of many types:

- a) Spontaneous flexibility: depends on the speed of production which is related to new ideas; it is also flexibility in giving problem solutions.
- b) Adaptive flexibility: depends on enabling learners to change methods of thinking to adapt to new circumstances.

Flexibility abilities are measured in more than one way. One is revealing the number of shifts from one idea to another or from one type to another of meanings in one context. It is also possible to identify the different types of ideas and images produced by an individual. His score is calculated according to number of these types.

In this study, the researcher used number of shifts from one idea to another to measure flexibility.

## **2.2: Related Studies**

A few studies have been conducted on the topic of the present study. These studies were conducted in both Arab and foreign countries.

### **2.2.1 Studies conducted in foreign countries**

Chang (1990) conducted a study on the impact of collaborative learning using the computer for the comprehension of Spanish as opposed to the individual way. The sample of the study consisted of 113 students enrolled in a Spanish language course in the USA Airforce Academy. The students were randomly distributed into two groups: experimental group in which students worked in pairs, and a control group in which each student worked alone. The same topics of the course were given to the two groups, using the computer, for two weeks. After that, a 42-item posttest was given to all samples in reading comprehension. It was found that there were no statistically significant differences between the two groups when it came to individual learning and collaborative learning using the computer.

Jentry (1992) also conducted a study to find out the impact of using the collaborative learning strategy via the computer and individual learning using the computer on achievement in math, he also studied the attitude of students who had studied algebra before entering the university. The sample of the study consisted of two groups. The experimental group studied an algebra using the individual way and the control group studied algebra using the collaborative learning strategy. The results revealed statically significant differences between the two groups whether in achievement or in attitudes. The differences were in favor of the collaborative group students.

Another study, conducted by Rowry (1995), sought to find out the effects of computer controlled interactive videodisc in teaching high school chemistry. The study sample consisted of a control group, and an experimental group. The control group studied according to usual learning while the experimental group studied by using the computer and videos. The study results showed a distinction in achievement by experimental group.

Kenney (1996) also conducted a study to find the effects of computer- assisted instruction on mathematics achievement of school. The study sample consisted of 171 students. They were divided into experimental, and control groups. Eighty nine

students studied according to the usual learning method and 32 students studied using the computer. The results of study showed that there was no statistically difference in achievement between the experimental group and control group.

Wheeler, Waite, and Bromfield (2002) conducted a pilot study which aimed at promoting creative thinking through the use of ICT in the United Kingdom. The research focused primarily on social interaction and group work, and student achievement levels and curriculum development. The result of the study indicated that there was an impact of information and communication technology (ICT) on development of creative thinking.

Çavaş, Karaoglan and Çavaa(2004) also conducted a study on the use of information communication technologies in primary science education: The researchers designed an educational model for science education that deployed active learning concepts in school and home environments and assessed the effects of the model on the learning of the children. To that end, a science topic was selected for 6<sup>th</sup> graders and some micro worlds were either developed or downloaded from the Internet. All the materials were uploaded on the course web page. E-mailing was used as a medium of interaction. For three weeks, ICT-based and traditional education was practiced with both the experimental and the control groups. It was found that ICT- based science education had a positive impact on the learning of children and achievement. It was also observed that the children in the experimental group were more willing to participate in the class discussion.

Sevinç Gülseçen & others (2005) examined the effort of blended learning on motivation of students at Turkish private and government universities. The hypotheses of the study was that blended learning would contribute to increase of private university students, interest, who had no interests in blended disciplines, and would make them more enthusiastic. A sample of so students was randomly chosen from two different universities. They were also surveyed, it finds out their attitude towards blended learning. The researchers found out that blended learning provided students with equal opportunities regardless of whether they were attending private or public universities the motivation for success depends on the learner's thinking abilities, personality, attitudes. Learning style and personal needs.

Another study was conducted by Cliff (2005), it aimed at finding the effects of computer- assisted instructions (CAI) on students' achievement in Taiwan. The study sample consisted of 52 studies applied in Taiwan. The researcher compared the traditional methods with experimental group (CAI).The results of 52 studies recommended using CAI and statistically, the results showed a difference between the experimental group and control group in favor of experimental group in achievement.

Al-Qahtani (2010) conducted an experimental study to find out the effectiveness of using e-learning, blended learning and traditional learning on students', achievement and attitudes towards a course in Islamic culture. This study focused on identifying the benefits of e-learning (studying through an asynchronous classroom only) and blended learning (studying through an asynchronous virtual classroom in addition to traditional learning) as compared to traditional learning (attending classroom lectures) in terms of their effects on students' attitudes and achievement featuring the Islamic Culture course (101). The results of the study revealed that there was a statistically significant difference at the 0.05 level between the three methods in terms of students' achievement favoring blended learning method, while no statistically significant differences were found at 0.05 levels between e-learning and traditional learning in terms of students' achievement. Yet, in terms of attitude, the results of this study have indicated that there was a statistically significant difference at 0.05 level between the two experimental groups on one hand and the control group on the other hand favoring the former, while no statistically significant difference (at the 0.05 level) was found between blended learning and e-learning in terms of students.

Hashem and Mioduser (2011) conducted a study on the contribution of learning by modeling (LBM) to students' understanding of complexity concepts. This study investigated the effect of different modes of involvement in exploring scientific phenomena, using a computer agent-based modeling tool, on students' understanding of complexity concepts. Quantitative and qualitative methods were used to report on 121 freshmen students that engaged in participatory simulations about complex phenomena, showing emergent, self-organized and decentralized patterns. Results showed that LBM played a major role in students' concept formation about complexity concepts.

Another study was conducted by Sucaromana (2013). The study compared the results of blended learning with face-to-face learning among university students studying English as a foreign language. The participants were separated by gender, and the following variables, intrinsic motivation for learning English, attitudes towards English as a subject, and satisfaction with the learning climate, which was either a blended learning environment or a face-to-face learning environment, were analyzed. The participants of this research undergraduate student enrolled in English courses. The two class samples were drawn at random. This study consisted of control group, and experimental group. The experimental group was taught using blended learning, and the control group was taught using face-to-face learning. The results of the research did not differ by gender. The students had significantly higher levels of intrinsic motivation for learning English, a better attitude towards English as a subject, and better satisfaction with the learning climate after they were taught by blended learning. Finally, the students who were taught using blended learning had significantly higher levels of intrinsic motivation for learning English and a better attitude towards English as a subject, as well as greater satisfaction with the learning climate than the students who were taught using face-to-face learning".

### **2.2.2 Arabic Studies**

Alaheeb (1999) also conducted study to find the impact of using computerized program on the achievements students. The sample of study consisted of 50 students of two groups experimental group, and control group. The experimental group studied with the help of computerized programs while the control group studied according to the usual method. The results of study revealed no statistically significant differences between two groups.

Al- Herish and Mukdadi (2000) conducted a study to compare between collaborative learning style and individual learning in the students' acquisition of program skills , text editing and ability of retaining them. The sample of the study was 39 students studying a computer course in education at Yarmouk Univesity. Two purposive sections were chosen. One researcher toughed there two sections: 20 students were in the collaborative learning section and 16 were in the individual learning section. It was found that there were statistically significant differences in the means of students' acquisition of the program skills (theoretical and practical). The differences were in

favor of the collaborative group. However, no statistically significant differences were found in the means of students' retaining of the program skills (text edition practical test). Nevertheless, differences were found in the two tests as- whole and they were in favor of the collaborative group.

Another study was conducted by Sharehan (2002) .This study examined the impact of using computer on achievements of 11<sup>th</sup> graders in physics. This study was administered on two groups: experimental group, and control group. The experimental group (25 students) studied using computers and control group (25 students) studied according the usual method. The researcher used Bloom's level of measurement of the study. The study results found statistically significant differences in the understanding level in favor of the experimental group and statistically significant differences in the applied level in favor of experimental group.

Another study, conducted by Ajlouni and Abu Zaineh (2006), examined the impact of educational bag on achievement of students. This study was applied on physics. The sample of study consisted of 78 students. The researcher divided the sample randomly into four groups: two experimental groups, and two control groups. The study results showed statistically significant differences in achievements of students in favor of the educational bag, and showed statistically significant differences in gender in favor of female students and showed lack of statistically significant differences in interaction between the method of teaching and gender".

Zarnoqi (2007), he also conducted another study to find out the effect of the use of computer on the development of creative thinking and achievement in physics class of secondary school for female students. The researcher adopted the semi-experimental methodology in dealing with the problem of the study. The experimental group and the control groups were made up of 57 female students each. The researcher applied the two tests dimensionally on the students. Thereafter, she tested the study hypotheses using ANCOVA. The findings obtained by the research indicated that the members of the experimental group outdid their peers of the control group in the dimensional average of the creative thinking test at all levels collectively and individually. This outdoing was statistically significant at ( $\alpha \leq .05$ ) level. The researcher also found statistically significant differences at ( $\alpha \leq .05$ ) levels between the dimensional average of the experimental group scores, and the dimensional

average of the control group scores in the school achievement dimension. Hence the researcher recommended that a flexible setting be provided using modern technology in order to allow the students to increase their level of perception and thinking, and develop the curricula and educational tools on a continuous basis in a manner which will keep pace with the technological advances

Abedlmu'ti and Asayed (2007) researched the effect of electronic learning and blended learning in developing skills, design and production of educational websites by professional diploma students. They also surveyed their attitudes toward electronic learning. They conducted their study on a sample of 36 female and male students. They were divided into three even groups. Two of them were experimental groups. The first group studied the program via the internet while the second group studied the program through blended learning. The third group studied the program in traditional way. It was found that there were statistically significant differences in the arithmetic means of achievement in the cognitive aspect of the students who studied and used blended learning. The averages of achievement in the cognitive aspect of the students who studied the program via electronic media were in favor of blended learning.

Badi (2011) conducted study to find out the impact of using computers, in teaching, on student achievements' in chemistry. The researcher administered the study on an experimental group, and a control group. The experimental group, consisting of 20 students, studied by using educational computer while the control group (20 students) studied using the usual method. The result of study showed that there was no statistically significant difference in achievement of students between two groups.

Another study conducted by Horani (2011) identified the impact of the mind map strategy on the achievement of ninth grade students in science. The study sample consisted of two schools that were selected intentionally and included 117 students. The sample was divided into two groups: one experimental and one control; the control group consisted of 33 male students and 27 female students, while the experimental group consisted of 30 male students and 27 female students. The results showed that there were statistically significant differences in the mean differences between the experimental and the control groups; however, no statistically significant impact was found which could be attributed to the gender variable or the interaction

between the teaching method and gender. In the light of the results, the researcher recommended the use of mind maps in teaching.

### **Summary**

Having made a thorough review of previous studies, concerning the use ICT in learning, the researcher noticed how much important the use of ICT and new methods of teaching is in students' achievement, and great advances made in applying these methods in Palestinian classes. Given the results of the previous studies which have proved the impact of using ICT in teaching and learning, the researcher has conducted this experimental research to find out the impact of using ICT in teaching and learning. In the light of the findings of the previous studies, the following observations are worth giving:

1. A number of studies have found the effectiveness of using the computer through the formation of collaborative groups in comparison with the effectiveness of individual learning style have arrived at this conclusion.
2. Change (1990) has found the ineffectiveness of using the computer the formation of collaborative groups in comparison with the individual learning style.
3. A number of studies have revealed the effectiveness of learning using the computer, in comparison with the traditional way.

One notices the dearth of studies which tackled the effectiveness of using the computer in educational technologies disciplines. This proves the importance of the current study.

## Chapter Three

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### Methods and Procedures

This chapter is devoted to methodology, population of the study, sample of the study, design of the study, research instruments, reliability and validity of the instruments, and procedures of the study.

### 3.1 Methodology

The researcher has used the experimental approach in term of using three learning methods: blended self-based learning, blended collaborative learning, and usual learning.

### 3.2 Population of the study

The population of this study consisted from 90<sup>th</sup> students of female and male students: 30 male and female students attending Al-Rawda College Coeducational Secondary School , and 58 male and female students attending Saint Joseph Coeducational Secondary School of the Palestinian (two private schools in Nablus city).In the second semester of the academic year 2012/2013.

**Table (3.1) shows the distribution of participants of the study as following:**

School Name	Blended individual Learning	Blended Collaborative Learning	Face- to –face learning
Saint Joseph-School	30	30	
Al-Rawda-School			30

The sample was chosen intentionally for several:

1. The two schools have all facilities, supplies and equipment to fit to the application of the study.

2. The two schools are located in the same region.
3. The academic level of the two schools' students is the same when looking at their record of grades in both schools.

### **3.3 Research Instruments**

The researcher constructed three instruments: a test to measure the impact of ICT on acquiring electricity concepts; mental models, and creative thinking. The instrument of this study (a computerized program) was designed after referring to literature that belonged directly to the instrument of the study and after looking at certain instrument used in previous similar studies.

The researcher followed following steps:

1. A deep reading of the science curriculum of the ninth grade taught in 2012/2013 academic year in Palestine.
2. Content analysis through dependence on Bloom's Taxonomy to select facts, concepts, theories, and principles in the study (Appendix 1).
3. Design of a specification table to acquire electricity concepts (Appendix 3), creative thinking (Appendix 6), and then its submission several juries and expert teachers (Appendix 10).
4. Design of tests to measure the effect of the study through dependence on data of the specification table. The electricity concepts acquisition test consisted of 31 multiple choice paragraphs (Appendix 2), and a creative thinking test consisting of 7 paragraphs (Appendix 5), and a mental models test consisting of a mental map (Appendix 8). Standards taken into account even design tests:
5. Formulation of test instructions.
6. Ease of phrases and absence of errors.
7. Questions meeting individual differences.

The researcher used test items analyses through difficulties coefficient, discrimination coefficient of effective of alternatives. This method has several advantages:

1. It allows the teacher to identify the areas of weakness and strength among the students and diagnose the reasons whether they are technical, in the test, or pedagogical in the style of teaching.
2. The teacher can get items in terms of difficulty and discrimination. He can keep them and make use of them in future tests.
3. Identification of degrees of difficulty determines location of items in the test. If the item's degree of difficulty is high (i.e. easy item), it usually comes at the beginning of the test. In contrast, if the degree of difficulty of item is low (i.e. difficult item) the item usually comes at the end of the test.

Coefficient of difficulty: coefficient of difficulty helps in showing the extent of ease or difficult of a question in an exam. It represents the percentage of students who have correctly the question. In general, the coefficient of difficulty depend the purpose of the test. In ordinary achievement tests, the best coefficient of the question of item is 5% or around 50 %.

Coefficient of discrimination: is coefficient is correlated to a high degree with the coefficient of difficulty. If the purpose of the test is to differentiate between capable students, the discriminating question leads to achievement of that purpose the task of the undetermined coefficient should be to determine the extent/ degree of the effectiveness of a question in differentiating between a highly capable student and a poor student. The test has the potential of distinguishing between them in the final grade in general.

There is, however, no rule concerning the acceptance of a question or an item depending on discrimination. Nevertheless, we can say that. Any item/ question whose coefficient of discrimination is negative are deleted. In addition, any item/ question whose undetermined coefficient in zero- 19% is weak in and it is advised to delete it. Besides, any item/ question whose coefficient of discrimination is between 20 %-39% are considered of an acceptable discrimination and it is advisable to improve it (or modification of stem of the question or alternatives). Finally, items whose discrimination is higher than 39 % are consideration good. In general, the higher the coefficient of discrimination is, the better it is.

All previous tests were applied on a pilot study to calculate difficulty coefficient and discrimination coefficient of the tests:

1. The difficulty coefficient was in the range of 30%-80%, and the discrimination coefficient was in the range of 20%-50% to acquire electricity concepts (Appendix 4).
2. The difficulty coefficient was in the range of 30%-60%, and the discrimination coefficient was in the range 30%-40% in the creative thinking (Appendix 4).
3. The difficulty coefficient was in the range of 37%-62%, and the discrimination coefficient was in the range of 23%-40% in the mental models (Appendix 4).

One concludes from the aforementioned results, by calculated the coefficient of difficulty in acquisition of electricity concepts, that the result ranged between 30 %-80 %. It was also found that the best coefficient of difficulty/ question was 50 % on around it. That means the following result is considered acceptable. Pertaining to the coefficient of discrimination in the acquisition of electricity concepts, the result was 20 %- 50 %. Items of the coefficient of discrimination were between 20%-39% and are considered acceptable. It was also found the presence of higher discrimination items: higher than 39% there are good items for discrimination.

One also notices, through calculated of the coefficient of difficulty of mental model test, that the result was between 30 %-60%. It was also found that the test coefficient of difficulty the question/ item is 50 % or around it. That is, the subsequence result is considered acceptable pertaining to the coefficient of discrimination of the mental model test; it was found that the result was 80%-40%. There were items chose coefficient of discrimination was 30%-39% and these items have an acceptable discrimination. Items whose coefficient of discrimination was high than 39% had good discrimination. Moreover, through calculation of coefficient of discrimination in mental model tests, the result was between 37%-62%. The best coefficient of discrimination of the question / item was 50% or around it. That is, the subsequent result is considered acceptable. Higher than 39% coefficient discrimination items were good discrimination items.

### **3.5 Test validity and reliability**

#### **3.5.1 Electricity Concepts Acquisition Validity and Reliability:**

To ensure content validity (Acquiring Electricity Concepts) the test was submitted to several juries of supervisors and expert teachers at school and university levels (Appendix 10). A pilot study on 9<sup>th</sup> graders in Ibn Qutaiba Secondary School was conducted to ensure understanding of words, instructions, and time appropriateness.

And also to check internal reliability, Pearson's formula was used. Retest as applied on the pilot study to check reliability within 20 days .Test reliability, using Pearson correlation was 0.85.

#### **3.5.2 Creative Thinking Validity and Reliability**

To ensure content validity of the creative thinking test, it was also submitted to several juries of supervisors and expert teachers at school and university levels (Appendix 10). A pilot study on 9th graders in Ibn Qutaiba Secondary School was conducted to ensure understanding of words, instructions, and time appropriateness.

Also to check internal reliability, Pearson's formula was used .Retest was also applied on the pilot study to check reliability within 20 days .Test reliability was 0.880 using Pearson correlation.

#### **3.5.3 Mental Models Validity and Reliability:**

To ensure content validity of the mental models test, it was submitted to several juries of supervisors and expert teachers at school and university levels (Appendix 10). A pilot study on 9th graders in Ibn Qutaiba Secondary School was conducted to ensure understanding of words, instructions, and time appropriateness.

And also to check internal reliability, Pearson's formula was used .Retest was also applied on the pilot study to check reliability within 20 days .Test reliability was 0.840 using person correlation.

#### **3.5.4 Computerized Program Validity**

To ensure computerized program validity, it was submitted to several juries at the university level (Appendix 10).

The researcher faced many difficulties in the design of the computerized program:

1. Difficulty in finding suitable learning methods that would fit with the computerized program in school. To solve this problem, the researcher hired teacher of physics to discuss the learning methods.
2. Classroom management groups according to the learning method. The researcher prepared 30 computers in the lab to allow the participants to study from the computerized program.
3. Providing educational facilities to lab through increase of the number of computers to prevent failure in the lab.

### 3.7 Study Design

This experimental study consisted of three learning methods: Face- to- face learning, BIL, and BCL. Three instruments (acquisition of electricity concepts, mental models, and creative thinking) were represented in the following form:

Group one (BIL):     $O_1$      $X_1$      $O_2 O_3 O_4$

Group two (BCL):     $O_1$      $X_2$      $O_2 O_3 O_4$

Group three (Face- to- face learning):  $O_1$      $O_2$      $O_3 O_4$

The previous abbreviations are as follows:

$X_1$ : Experimental treatments (BSBL).

$X_2$ : Experimental treatments (BCL).

$O_1$ : Pretest

$O_2$ : Posttest

$O_3$ : Mental models

$O_4$ : Creative thinking

### **3.8 Research Variables**

#### **Independent variables**

1. Blended individual learning.
2. Blended collaborative learning.
3. Face- to- face learning.

#### **Dependent Variables**

1. Acquisition of concepts.
2. Mental models.
3. Creative thinking.

### **3.9 Procedure**

The study was carried out in stages:

1. Preparation of the elements necessary for the computerized program: text, photos, voices, and video.
2. Downloading of these elements and storing them on computerized program.
3. Choosing (C sharp) a program to include these elements in one application.
4. Production of final application and experimentation on the pilot study.
5. Training of teachers on how to use blended individual learning through computerized program.
6. Training of teachers on how to use blended collaborative learning through computerized program and division students in homogeneous groups.
7. Training of students on the computerized program and on how to use steps and educational tools (educational games, video, and flash).
8. Learning environment: the researcher downloaded the computerized program on all computers in lab, and examined it.
9. Design of time plan for each lesson as the following table (3.2) shows.

**Table (3.2) showed the time plan for each lessons:**

<b>Lesson No.</b>	<b>Time of using usual learning</b>	<b>Type of electronic educational tools</b>	<b>Time of using electronic educational tools</b>
Lesson one	20 min.	3DMAX, Video tutorial, and flash	25 min.
Lesson two	25 min.	3DMAX and games	20 min.
Lesson three	22 min.	3DMAX, Video tutorial, and flash	23 min.
Lesson four	20 min.	3DMAX, games, and flash	25 min.
Lesson five	20 min.	3DMAX, and games	25 min.
Lesson six	25 min.	3DMAX, Video tutorial, and flash	20 min.
Lesson seven	22 min.	3DMAX, and games	23 min.
Lesson eight	20 min.	3DMAX, and games	25 min.
Lesson nine	25 min.	3DMAX, and games	20 min.
Lesson ten	10 min.	3DMAX, video tutorial, and flash	35 min.
Lesson eleven	20 min.	3DMAX, and games	25 min.
Lesson twelve	15 min.	3DMAX, and games	30 min.
Lesson thirteen	25 min.	3DMAX, video tutorial, and flash	20 min.
Lesson fourteen	10 min.	3DMAX, games	35 min.
Lesson Fifteen	25 min.	3DMAX, video tutorial, and flash	20 min.
Lesson Sixteen	25 min.	3DMAX, video tutorial, and flash	20 min.

10. Applied pretest in acquiring electricity concepts on three groups (BSBL, BCL, and usual learning).

11. During application of the study, the researcher applied formative assessment. It was designed on a computerized program according to programmed learning.
12. After completion of all lessons, the researcher applied a final assessment, designed on a computerized program according to programmed learning.
13. The researcher also applied a posttest on three instruments (acquisition of electricity concepts, mental models, and creative thinking) after completion of all lessons on the three methods (BSBL, BCL, and usual learning).
14. The researcher marked the examination, and computed the statistical analysis:
  - A. Electricity concepts acquisition test: This test consisted of 31 multiple choice statements distributed according to Bloom taxonomy, and total mark was out of 31. And have the debugging process each statement through give each statement mark.
  - B. Mental models test: This test consisted of a mental map test distributed according to Bloom taxonomy, and total mark was out of 10 and has the debugging process each statement through give each statement mark.
  - C. Creative thinking test: This test consisted of 7 statements in the form of essay questions distributed according to creative thinking levels and total mark was out of 30 by Torrance test correction through dividing paragraphs in limited time to answer it, and have the debugging process each paragraph through give each paragraph mark.

### **3.10 Coding**

Many computer applications are used in the educational process as a means to improve both learning and teaching and accordingly help learners in understanding school subjects and using many skills. In this study, the researcher designed a computerized program through C sharp language (C##) program.

C sharp language (C##) program is considered an effective programming language combining properties of C++ and visual basic, and this software programming features help to run the new devices such as IOS and ANDROID that contributes to application of the educational process in modern technological communication (Rouse, 2007).

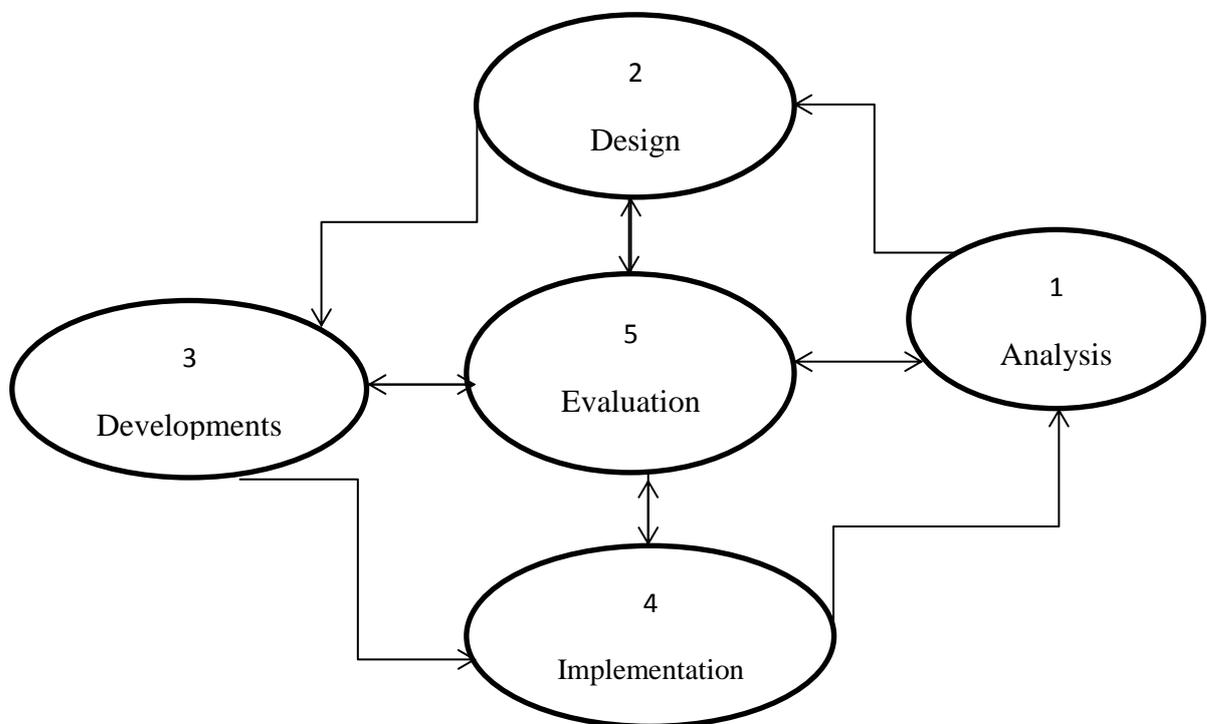
Moreover, computer applications can be designed in accordance with psychology theories to fit the individual differences between learners. These theories include Brunner and Skinner theories. There are many standards that emanate from psychology theories to design computer applications such as interest in properties of learners through psychological characteristics, interest in individual differences between learners, design of content, activities, experiments, and tests that suit all learners' levels. The learner might be the center of the learning process, and it depends on motivation and reinforcement of activities (Alfar, 2002).

The researcher used reinforcements in the computerized program for the sake of incentives and taking into consideration individual differences, using skinner and Brunner's theory on motivation and individual differences in educational design. This science tries to build a bridge between theoretical sciences on one hand (general psychology theories and learning theories in particular) and applied science (using modern techniques and technologies in learning process: on the other hand. This science is concerned with the one of educational theory in an organized way to improve educational practices through educational design. It describes the procedures pertinent to choice the educational material intended to be designed, analyzed, organized, developed and evaluated in order to produce educational curricula that help in better learning and also help the teacher in following the best educational techniques with the minimum time and effort possible. Design is a process of defining the learning conditions and drawing up the procedures and elements of the educational process in the light of the intended learning out comes. It's a systematic planning process that precedes the implementation of the plan for the problem solving.

Gorden (1993) explained the computer designed applications are implemented by following several steps:

1. The first step is analysis: analysis of the subject that contains contents, exercises, needs, and a target group. This is done to design tools according to them.
2. The second step is design: designing process according to subject goals, subject evaluations, and selections which fit the method of teaching.
3. The third step is development: developing tools according to software and hardware process.
4. The fourth step is implementation: implementation of sample pilot to check program.
5. The last step is evaluation: achieving it through the impact of the program according to two steps:
  - a) Formative evaluation: applying it after completion of the part of the subjects and
  - b) Final evaluation: applying it after completion of all subjects

The previous steps (Analysis, Design, Develops, Implementation, and Evaluation) is abbreviated ADDIE the flowchart (3.1) explaining these five steps as shown:



**Flowchart (3.1) shows the ADDIE steps**

Based on what has been said, all criteria have been taken into consideration in the design of the computerized program.

Moreover, the computerized program which was designed for this study contained many technology applications:

1. Educational video: Abedel-Hameed (2011) considered it' is a means of learning to create an excitement in the environment, thus helping learners to understand the capacity information, educational videos and achieve educational goals. in addition he considered the educational video consists from three major domains as following:
  - a) Cognitive domain: use of photos to learn principles and concepts.
  - b) Psychomotor domain: use of animation to learn motor skills.
  - c) Affective domain: use of sound effects to both imagination and emotions.
2. Three dimensions (3DMAX): use of designs shapes in three movements depending on imagination in order to develop thinking, imagination and deep understanding (Abedel-Hameed, 2011).
3. Educational games: use of integrated learning with playing games and creating new games through the use of computer applications (Abedel-Hameed, 2011).

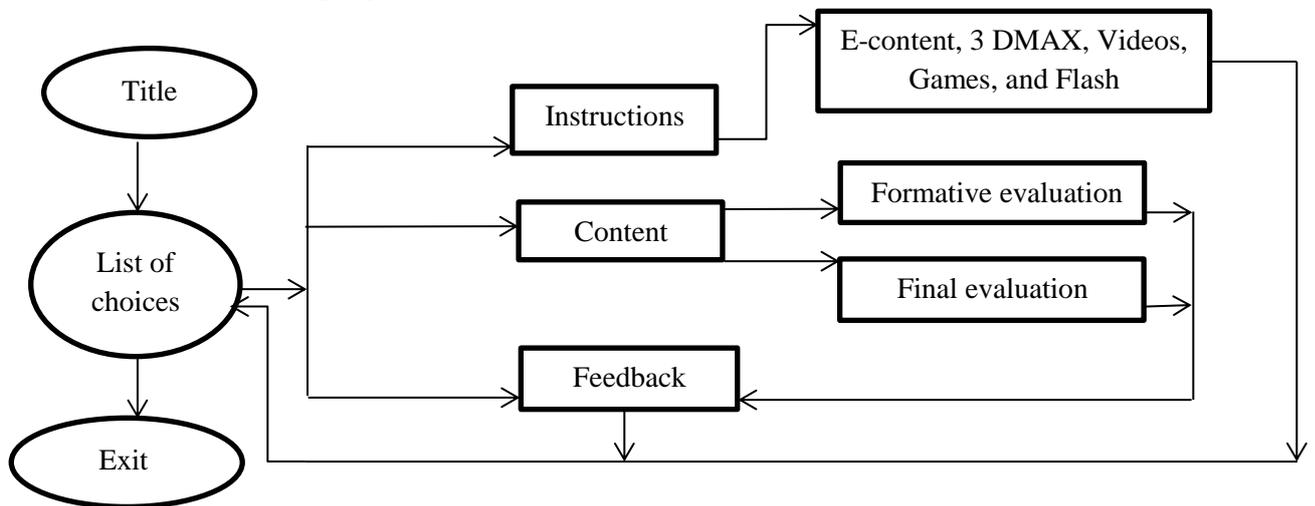
Based on previous steps and information the researcher followed the following steps in the design of the computerized program:

1. Had a deep reading of how to apply methods of learning: BSBL and BCL.
2. Selected computer applications to run in the computerized program: flash, Video, 3DMAX, and games.
3. Designed formative evaluations and final evaluations to evaluate the computerized program in order to get feedback.
4. Downloaded the computerized program on all computers in the school lab, and put a password for security.

5. Tested the computerized program in all computers to ensure its proper work.

Against this background the researcher designed the computerized program in this study is consisted of three parts:

1. Title: It is the first screen view when the program is opened, and choices for user on how he/she prefers to use program: with music or not.
2. List of choices: it consists of program choices (formative evaluation, content of material, final evaluation, instructions, and feedback).In addition to feedback, there was a display of the results of formative evaluation and final evaluation to evaluate the effectiveness of the program learning.
3. Exit: out the program.



**Flowchart (3.2) explains the computerized program's work steps**

### 3.11 Data Analysis

After collection of data, the researcher processed it using the SPSS program; he used one -way ANCOVA to test the effect of three variables on a dependent variable.

**Table (3.3) shows the instruments and treatments happened on three instruments as following:**

Instruments	Acquisition of electricity concepts	Mental models	Creative thinking
Treatments	One -way ANCOVA	One -way ANCOVA	One -way ANCOVA

## Chapter Four

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### Results

The purpose of this study was to investigate the impact of using ICT on acquisition electricity concepts, mental models and creative thinking. The findings of the study are presented in this chapter according to the research questions.

**Table (4.1) represents the groups on whom the study was done and number of students in each group:**

<b>Groups</b>	<b>Face- to- face learning</b>	<b>Blended individual learning</b>	<b>Blended collaborative learning</b>
<b>Number</b>	30	30	30

Table (4.1) shows the groups on which this study was done and they represent different teaching methods (blended individual learning, blended collaborative learning, and face- to- face learning), and number of students in each group.

Finding related to the first research question according to the dependent variables were as the followings:

#### **4.1 Results related to the first question:**

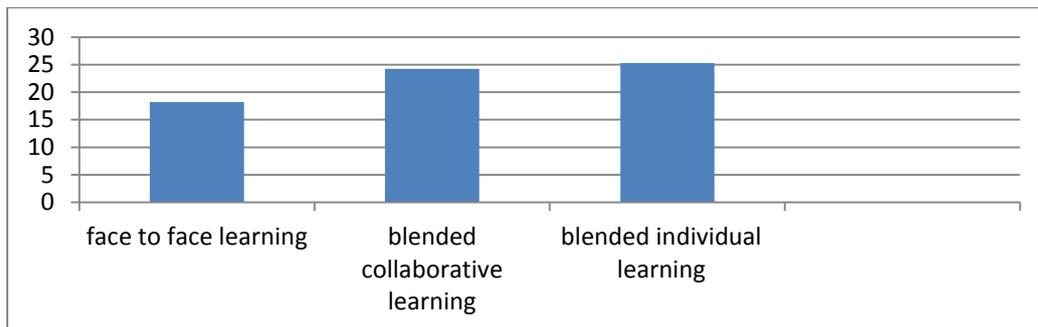
How do different learning methods (blended individual learning, blended collaborative learning, and face to face learning) affect students' acquisition electricity concepts?

To answer question mean scores and standard deviations were calculated for the learners' scores in the three learning's methods (blended individual learning, blended collaborative learning, and face- to- face learning) on acquisition electricity concepts.

**Table (4.2) shows the mean scores and standard deviation on acquisition electricity concepts:**

<b>Groups</b>	<b>Means</b>	<b>Standard division</b>	<b>N</b>
<b>Face- to- face learning</b>	18.23	5.49	30
<b>Blended collaborative learning</b>	24.26	6.082	30
<b>Blended individual learning</b>	25.3	3.37	30
<b>Total</b>	22.6	5.93	90

Data shown in table (4.2) that the adjusted means for the face to face learning was (18.23), blended collaborative learning was (24.26), and blended individual learning was (25.3) so, the difference between three groups are in favor of the blended individual learning.



**Figure (4.1) explains the mean scores of learning methods (BIL, BCL, and face-to- face learning) on acquisition electricity concepts**

Figure (4.1) shows the mean scores of learning methods (BIL, BCL, and face to face learning) in acquisition electricity concepts; it was found that the best result was in favor of BIL. The researcher tests the mean squares of the pretest to the three learning methods as shown in table (4.3).

**Table (4.3) shows the results of one way-ANCOVA test due to the three learning methods on acquisition of electricity concepts:**

<b>Source</b>	<b>Sum of squares</b>	<b>Df</b>	<b>Mean squares</b>	<b>F</b>	<b>Sig.</b>
<b>Pre</b>	25.837	1	25.837	0.995	0.312
<b>Group</b>	891.01	2	445.5	17.153	0.0
<b>Error</b>	2233.696	86	25.937		
<b>Total</b>	3133.600	89			

Table (4.3) shows that F value was (17.153) for the difference between mean scores of learners level in three groups in the acquisition of electricity concepts and the sig. level was (0.0) this value is less than the level of statistical significant difference ( $\alpha \leq .05$ ) the null hypotheses were rejected between learners in the three groups.

**Table (4.4) shows adjusted means and standard errors of the post test scores for the acquisition of electricity concepts:**

<b>Groups</b>	<b>Mean</b>	<b>Std. Error</b>
<b>Face-to- face learning</b>	18.169 <sup>a</sup>	0.933
<b>Blended individual learning</b>	25.265 <sup>a</sup>	0.931
<b>Blended collaborative learning</b>	24.366 <sup>a</sup>	0.936

One concludes from table (4.4) that the use of the software program had a significant impact on improvement of students' achievement. There was an increase in their acquisition of the electricity concepts through the use of new teaching methods.

To examine the impact of three learning methods (Face –to- face learning, blended individual learning, and blended collaborative learning) on acquisition of electricity concepts.

**Table (4.5) shows the values of LSD post-test for the three learning methods on acquisition of electricity concepts:**

<b>Group 1</b>	<b>Group 2</b>	<b>Mean Difference (1-2)</b>	<b>Std. Error</b>	<b>Sig.</b>
<b>Face- to- face learning</b>	<b>Blended individual learning</b>	7.096	1.316	0.0
	<b>Blended collaborative learning</b>	6.197	1.326	0.0
<b>Blended individual learning</b>	<b>Face –to- face learning</b>	7.096	1.316	0.0
	<b>Blended collaborative learning</b>	0.900	1.323	0.498
<b>Blended collaborative learning</b>	<b>Face –to- face learning</b>	6.197	1.326	0.0
	<b>Blended individual learning</b>	0.900	1.323	0.498

Table (4.5) shows differences in mean scores between face to face learning, BCL, and blended individual learning. The level of significance between face to face learning, BCL was ( 0.0) less than the level of statistical significance ( $\alpha \leq .05$ ) the null hypotheses were rejected. and also the level of significance between face to face learning and blended individual based learning, was (0.0) less than the level of statistical significance ( $\alpha \leq .05$ ) the null hypotheses were rejected. In addition, the results show the level of significance between BCL and blended individual based learning was (0.498) more than from the level of statistical significance ( $\alpha \leq 0.05$ ) the null hypotheses were accepted.

#### **4.2 Results related to the second question**

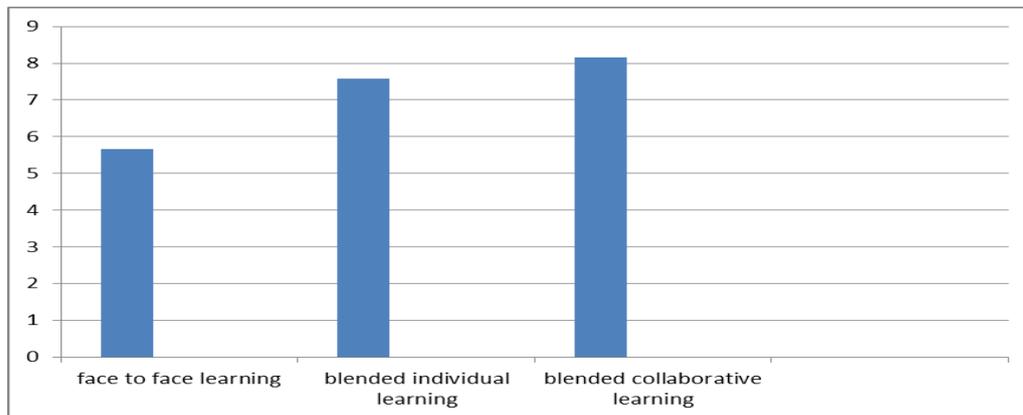
How do different learning methods (blended individual learning, blended collaborative learning, and face- to -face learning) effect on students' mental models?

To answer question mean scores and standard deviations were calculated for the learners' scores in the three learnings methods (blended individual learning, blended collaborative learning, and face- to- face learning) on mental models.

**Table (4.6) shows the mean scores and standard deviation as following:**

<b>Groups</b>	<b>Mean</b>	<b>Standard division</b>	<b>N</b>
<b>Face-to-face learning</b>	5.6667	1.42232	30
<b>Blended collaborative learning</b>	8.1667	1.28877	30
<b>Blended individual learning</b>	7.5667	1.50134	30
<b>Total</b>	7.1333	1.75589	90

Data shown in table (4.6) that the adjusted means for the face- to- face learning was (5.666), blended collaborative learning was (8.1667), and blended individual learning was (7.566) so, the different between three groups are in favor of the blended collaborative learning.



**Figure (4.2) explains the mean scores of learning methods (BIL, BCL, and face to face learning) on mental models:**

Figure (2.4) explain the mean scores of learning methods (BIBL, BCL, and face- to- face learning) on mental models; it was found that the best result was favor of BCL.

**Table (4.7) shows the results of one way-ANCOVA test due to the three learning methods on mental models:**

Source	Sum of squares	Df	Mean squares	F	Sig.
Pre	10.653	1	10.653	5.671	0.19
Group	106.324	2	53.162	28.301	0.0
Error	161.547	86	1.878		
Total	161.547	89			

Table (4.7) shows that F value was (28.301 ) for the difference between mean scores of learners level in three groups in the mental models and the sig. level was (0.0) this value is less than the level of statistical significant difference ( $\alpha \leq .05$ ) the null hypotheses were rejected between learners in the three groups. To examine the impact of three learning methods (Face –to- face learning, blended individual learning, and blended collaborative learning) on mental models.

**Table (4.8) shows the values of LSD post-test for the three learning methods on mental models:**

Group 1	Group 2	Mean Difference (1-2)	Std. Error	Sig. <sup>a</sup>
Face-to-face learning	Blended individual learning	2.005	0.357	0.0
	Blended collaborative learning	2.529	0.354	0.0
Blended individual learning	Face-to-face learning	2.005	0.357	0.0
	Blended collaborative learning	0.524	0.355	0.144
Blended collaborative learning	Face-to-face learning	2.529	0.354	0.0
	Blended individual learning	0.524	0.355	0.144

Table (4.8) shows differences in mean scores between face to face learning, BCL, and blended individual learning. The level of significance between face to face learning, BCL was( 0.0) less than the level of statistical significance ( $\alpha \leq .05$ ) the null hypotheses were rejected. and also the level of significance between face to face learning and blended individual based learning, was (0.0) less than the level of statistical significance ( $\alpha \leq .05$ ) the null hypotheses were rejected. In addition, the results show the level of significance between BCL and blended individual based learning was (0.144) more than from the level of statistical significance ( $\alpha \leq 0.05$ ) the null hypotheses were accepted.

### 4.3 Results related to the third question

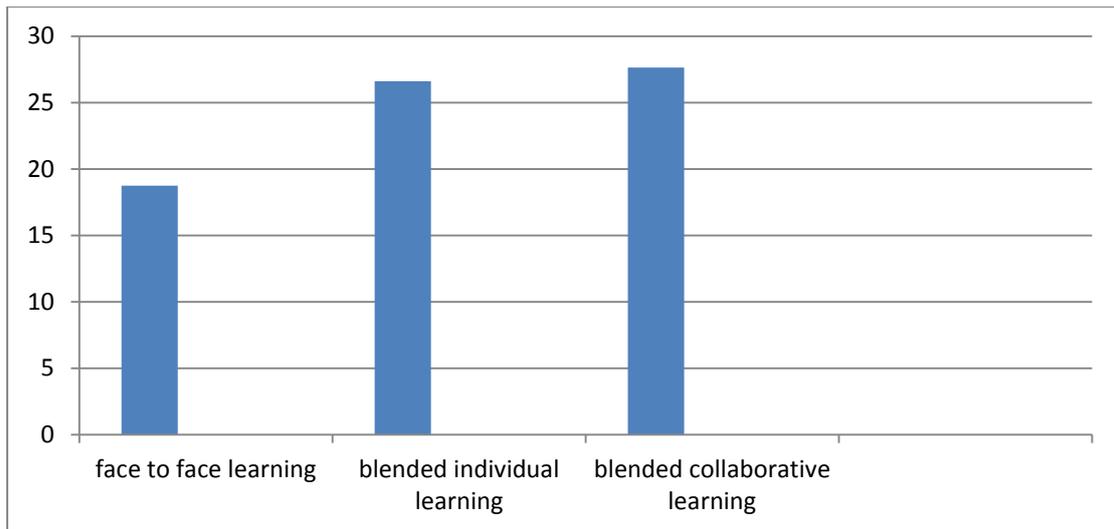
How do different learning methods (blended individual based learning, blended collaborative learning, and face to face learning) effect on students' creative thinking?

To answer question mean scores and standard deviations were calculated for the learners' scores in the three learning's methods (blended individual based learning, blended collaborative learning, and face to face learning) on creative thinking.

**Table (4.9) shows the mean scores and standard deviation on creative thinking**

<b>Groups</b>	<b>Mean</b>	<b>Standard division</b>	<b>N</b>
<b>Face- to- face learning</b>	18.7333	4.45617	30
<b>Blended collaborative learning</b>	27.6333	2.81539	30
<b>Blended individual learning</b>	26.7333	2.81539	30
<b>Total</b>	24.1444	5.17679	90

Data shown in table (8.4) that the adjusted means for the face to face learning was (18.7333), blended collaborative learning was (27.6333), and blended individual based learning was (18.7333) so, the different between three groups are in favor of the blended collaborative learning.



**Figure (4.3) explains the mean scores of learning methods (BIL, BCL, and face to face learning) on creative thinking:**

Figure (3.4) explain the mean scores of learning methods (BIL, BCL, and face to face learning) in creative thinking; it was found that the best result was favor of BCL. The researcher tests the mean squares of pretest to the three learning methods as shown in table (4.10).

**Table (4.10) shows the results of one way-ANCOVA test due to the three learning methods on mental models:**

Source	Sum of squares	Df	Mean squares	F	Sig.
Pre	70.641	1	70.641	6.328	0.14
Group	1125.199	2	562.599	50.396	0.0
Error	960.059	86	11.163		
Total	2385.122	89			

Table (4.10) shows that F value was ( 50.396 ) for the difference between mean scores of learners level in three groups in the creative thinking and the sig. level was (0.0) this value is less than the level of statistical significant difference ( $\alpha \leq .05$ ) the null hypotheses were rejected between learners in the three groups.

To examine the impact of three learning methods (Face –to- face learning, blended individual learning, and blended collaborative learning) on creative thinking.

**Table (4.11) shows the values of LSD post-test for the three learning methods on mental models:**

<b>Group 1</b>	<b>Group 2</b>	<b>Mean Difference (1-2)</b>	<b>Std. Error</b>	<b>Sig.</b>
<b>Face- to- face learning</b>	<b>Blended individual learning</b>	7.004	0.873	0.0
	<b>Blended collaborative learning</b>	8.316	0.893	0.0
<b>Blended individual learning</b>	<b>Face- to- face learning</b>	7.004	0.873	0.0
	<b>Blended collaborative learning</b>	1.312	0.869	0.135
<b>Blended collaborative learning</b>	<b>Face- to- face learning</b>	8.316	0.893	0.0
	<b>Blended individual learning</b>	1.312	0.869	0.135

Table (4.11) shows differences in mean scores between face to face learning, BCL, and blended individual based learning. The level of significance between face to face learning, BCL was( 0.0) less than the level of statistical significance ( $\alpha \leq .05$ ) the null hypotheses were rejected. and also the level of significance between face to face learning and blended individual based learning, was (0.0) less than the level of statistical significance ( $\alpha \leq .05$ ) the null hypotheses were rejected. In addition, the results show the level of significance between BCL and blended individual learning was (0.135) more than from the level of statistical significance ( $\alpha \leq 0.05$ ) the null hypotheses were accepted.

#### 4.4 Conclusion & Results

1. There were statistically significant differences between face- to- face learning and BCL on acquisition of electricity concepts, and the level of significance (0.0) between them so the null hypotheses were rejected.
2. There were statistically significant differences between face- to- face learning and BIBL on acquisition of electricity concepts, and the level of significance (0.0) between them so the null hypotheses were rejected.
3. There were statistically significant differences between BIL and BCL on acquisition of electricity concepts, and the level of significance (0.49) between them so the null hypotheses were accepted in favor of the BIL.
4. There were statistically significant differences between face to face learning and BCL on mental models, and the level of significance (0.0) between them so the null hypotheses were rejected.
5. There were statistically significant differences between face- to- face learning and BIBL on mental models, and the level of significance (0.0) between them so the null hypotheses were rejected.
6. There were statistically significant differences between BIL and BCL on mental models, and the level of significance (0.144) between them so the null hypotheses were accepted in favor of the BCL.
7. There were statistically significant differences between face- to- face learning and BCL on creative thinking, and the level of significance (0.0) between them so the null hypotheses were rejected.
8. There were statistically significant differences between face- to- face learning and BIBL on creative thinking, and the level of significance (0.0) between them so the null hypotheses were rejected.
9. There were statistically significant differences between BCL and BIL on creative thinking, and the level of significance (0.135) between them so the null hypotheses were accepted in favor of the BCL.

Note: see chapter five for more detailed discussion.

## Chapter five

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### **Discussion, Conclusion and Recommendations**

#### **5.1 Introduction**

This study aimed at investigating the impact of using ICT on the ninth graders' acquisition of electricity concepts, mental models and creative thinking in two private schools in Nablus. For this purpose, the researcher conducted this current study on sample of students on the use of three methods of learning: blended collaborative learning blended individual-based learning, and face to face learning. The discussion of the findings is presented in the questions of the study:

#### **5.2 Discussion on the findings for the first question**

How do different learning methods (blended individual based learning, blended collaborative learning, and face to face learning) effect on students' acquisition electricity concepts?

Results of analysis have shown that were statistically significant difference at ( $\alpha \leq 0.05$ ) in acquisition of electricity concepts by 9<sup>th</sup> graders in the science discipline. The differences were between three methods of teaching. The arithmetic means for the face to face learning was (18.23), blended collaborative learning was (24.26), and blended individual based learning was (25.3) so, the different between three groups are in favor of the blended individual learning.

This show the important role which the use of information and communication in raising acquisition / understanding of electricity concepts. The computer has become widespread and new methods of teaching and learning have been introduced. Of these are blended individual learning and blended collaborative learning. These create a new learning environment that suits the new development s in the field of education. Then methods have made the classroom environment effective in students, learning and in making the learning process more exciting and stimulating, thus making students participate effectively and providing each one with an opportunity to advance according to his pace and ability and in flexible and easy way. This clearly proves that

using a software program has an effective on increasing student's acquisition of physical concepts in comparison with the traditional ways. The computer is a means that contributes to the increase of confidence of learner in himself/ herself and gives immediate back to the teacher. Therefore, it is used as a means to implement news way of teaching: blended individual learning blended collaborative learning.

This study findings agree with the findings of Al-qahtani's study (2010) conducted an experimental study to find out the effectiveness of using e-learning, blended learning and traditional learning on students .The results of the study revealed that there was a statistically significant difference at the 0.05 level between the three methods in terms of students' achievement favoring blended learning method,. This study revealed that he learning outcomes of blended learning method, blended collaborative learning and blended individual learning were better than the outcomes of the traditional method in improving students' achievement and acquisition /understanding of electricity concepts.

Çavaş, Karaoglan and Çavaa(2004) also conducted a study on the use of information communication technologies in learning science this study was practiced with both the experimental and the control groups. The result of the study was found that favoring ICT- based science education had a positive impact on the learning of children and achievement, this study also conducted with the researcher's study which revealed that the outcomes of blended learning methods more much better than those of traditional learning method when it came to achievement and acquisition of concepts.

This study also support the findings of Cliff (2005)'s study on meta-analysis. It aimed at finding the effects of computer- assisted instructions (CAI) on students' achievement in Taiwan. The study sample consisted of 52 studies applied in Taiwan. The researcher compared the traditional methods with experimental group (CAI).The results of 52 studies recommended using CAI and statistically, the results showed a difference between the experimental group and control group in favor of experimental group in achievement, it revealed that the learning out comes of using information and communication technology, such as blended learning, were better than the outcomes of the traditional method in improving students' achievement and concept acquisition.

This study findings also concurred with Rowry (1995)'s findings sought to find out the effects of computer controlled interactive videodisc in teaching high school chemistry. The study sample consisted of a control group, and an experimental group. The study results showed a distinction in achievement by experimental group, results of this study that using information technology , such as blended learning (collaborative and individual ) had better impact on students' achievement and acquisition and understanding of concepts.

However, this study finding differed with Kenney's study (1996)'s, he conducted a study to find the effects of computer- assisted instruction on mathematics achievement of school. The study sample consisted of experimental group, and control group. The results of study showed that there was no statistically difference in achievement between the experimental group and control group, this study revealed that using information technology , such as blended learning (collaborative learning and individual learning) had better impact on students' achievement and concept acquisition.

However, this study finding differed with Chang's (1990), he conducted a study on the impact of collaborative learning using the computer for the comprehension of Spanish as opposed to the individual way, and the students were randomly distributed into two groups: experimental group in which students worked in pairs, and a control group in which each student worked alone. The same topics of the course were given to the two groups.it was found that there were no statistically significant differences between the two groups when it came to individual learning and collaborative learning using the computer. This study finding differed with searcher study's in revealed that using blended collaborative learning had better than blended individual learning impact on students' achievement and concept acquisition.

However, this study finding differed with Jentry (1992) also conducted a study to find out the impact of using the collaborative learning strategy via the computer and individual learning using the computer on achievement in math, the sample of the study consisted of two groups. The experimental group studied an algebra using the individual way and the control group studied algebra using the collaborative learning strategy. The results revealed statically significant differences between the two groups whether in achievement or in attitudes. The differences were in favor of the

collaborative group students. This study finding differed with searcher study's in revealed that using blended collaborative learning had better than blended individual learning impact on students' achievement and concept acquisition.

However, this study finding differed with Badi's study's (2011), he conducted study to find out the impact of using computers, in teaching, on student achievements' in chemistry. The researcher administered the study on an experimental group, and a control group. The result of study showed that there was no statistically significant difference in achievement of students between two groups, this study findings differed with researcher study's that using information technology , such as blended learning (collaborative learning and individual learning) had better impact on students' achievement and concept acquisition.

### **5.3 Discussion on the findings for the second question**

How do different learning methods (blended individual based learning, blended collaborative learning, and face to face learning) effect on students' mental models?

The arithmetic means for the face to face learning was (5.666), blended collaborative learning was (8.1667), and blended individual based learning was (7.566) so, the different between three groups are in favor of the blended collaborative learning.

This show the important role which the use of information and communication in raising mental models. The computer has become widespread and new methods of teaching and learning have been introduced. Of these are blended individual learning and blended collaborative learning. These create a new learning environment that suits the new development s in the field of education. Then methods have made the classroom environment effective in students, learning and in making the learning process more exciting and stimulating, thus making students participate effectively and providing each one with an opportunity to advance according to his pace and ability and in flexible and easy way. This clearly proves that using a software program has an effective on increasing student's mental models in comparison with the traditional ways. The computer is a means that contributes to the increase of confidence of learner in himself/ herself and gives immediate back to the teacher. Therefore, it is used as a means to implement news way of teaching: blended individual learning blended collaborative learning.

Hashem and Mioduser (2011), conducted a study on the contribution of learning by modeling to students' understanding of complexity concepts ,this study investigated the effect of different modes of involvement in exploring scientific phenomena using a computer agent-based modeling tool, Results showed that learning by modeling played a major role in students' concept formation about complexity concepts. This result concurred with the results of this study concerning the impact of ICT in mental models. Results of this study that using information technology, such as blended learning (collaborative and individual) had better impact on students' mental models.

Horany (2011) studied the impact of the mind map strategy on the achievement of ninth grade students in science. The results of his study showed that there were statistically significant differences in the mean scores between the experimental and the control groups; no statistically significant impact was found which could be attributed to the gender variable or the interaction between the teaching method and gender. He researcher recommended the use of mind maps in teaching, this result concurred with the results of this study concerning the impact of ICT in mental models. Results of this study that using information technology, such as blended learning (collaborative and individual) had better impact on students' mental models.

Abedlmu'ti and Asayed (2007), researched the effect of electronic learning a blended learning in developing skills, design and production of educational websites by professional diploma students, they were divided into three even groups. Two of them were experimental groups. The first group studied the program via the internet while the second group studied the program through blended learning. The third group studied the program in traditional way. It was found that there were statistically significant differences in the arithmetic means of achievement in the cognitive aspect of the students who studied and used blended learning. The averages of achievement in the cognitive aspect of the students who studied the program via electronic media were in favor of blended learning. This study revealed that using information technology, such as blended collaborative learning had better impact on students' mental models.

#### **5.4 Discussion of findings related to the third question**

How do different learning methods (blended individual based learning, blended collaborative learning, and face to face learning) effect on students' creative thinking?

The arithmetic means for the means for the face to face learning was (18.7333), blended collaborative learning was (27.6333 ), and blended individual based learning was (18.7333 ) so, the different between three groups are in favor of the blended collaborative learning.

This show the important role which the use of information and communication in raising creative thinking. The computer has become widespread and new methods of teaching and learning have been introduced. Of these are blended individual learning and blended collaborative learning. These create a new learning environment that suits the new development s in the field of education. Then methods have made the classroom environment effective in students, learning and in making the learning process more exciting and stimulating, thus making students participate effectively and providing each one with an opportunity to advance according to his pace and ability and in flexible and easy way. This clearly proves that using a software program has an effective on increasing student's creative thinking in comparison with the traditional ways. The computer is a means that contributes to the increase of confidence of learner in himself/ herself and gives immediate back to the teacher. Therefore, it is used as a means to implement news way of teaching: blended individual learning blended collaborative learning.

Wheeler, Waite, and Bromfield (2002) study results promoted creative thinking through the use of ICT .The result of study indicated that there was impact of information and communication technology (ICT) on development of creative thinking. , this study revealed that using information technology , such as blended learning (collaborative learning and individual learning) had better impact on students' creative thinking.

Zarnoqi (2007) conducted another study to find out the effect of the use of computer on the development of creative thinking and achievement in the physics class of secondary school of female students. The findings obtained by the research indicated that the members of the experimental group outdid their peers of the control group in the dimensional average of the creative thinking test at all levels collectively and individually. This outdoing was statistically significant at ( $\alpha \leq .05$ ) level and it

concluded with research results concerning the effect of ICT on creative thinking. This study revealed that using information technology, such as blended learning (collaborative learning and individual learning) had better impact on students' creative thinking.

### **5.5 Recommendations**

In the light of the results of this study, the researcher would like to offer the following recommendations:

1. More research project should be performed on the effects of using ICT by employing other instruments and other variables.
2. Teachers should be motivated to use computer applications in teaching and learning.
3. Give training to teacher's in methods teaching (blended individual learning and blended collaborative learning).
4. Provision of sufficient numbers of computers in schools
5. The designers of Palestinian curriculum have to reduce the number of units to give chances for learners to use computer applications in classroom
6. Made flexible educational environment so that the students can increase the level of thinking and encourages them to imagine scientifically and to express their ideas.
7. The allocation of a timetable for lectures and to include within a specific time to use ways and electronic means.
8. The Ministry of Education provides teachers computerized programs and electronic sites in science and physics education, which explain and facilitate educational process.
9. Linking educational establishments with schools via web in order to benefit from the expertise and circulated to all teachers.

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## Appendix (1): Analysis of the Content of Electricity Moving Unit

### Chapter one

Number	Behavioral goals	Content field	Level goals
1	To know the coulomb	Science	Knowledge
2	To know the charges		Knowledge
3	To cooperate between conductor, and semiconductor		High thinking skills
4	To calculate valuation of charges		Application
5	To explain current		Remembering
6	To conclude relationship between current and charges		High thinking skills
7	To use mathematic method $A=C/T$ in answering questions		Application
8	To know name of device using calculated current		Remembering
9	To conclude how voltages result		High thinking skills
10	To know the device used in calculation of voltages		Remembering
11	To use voltmeter in measuring of voltage		Application

## Chapter two

Number	Behavioral goals	Content field	Level goals
1	To conclude coulomb law	Science	High thinking skills
2	To define coulomb		Remembering
3	To using Ohm's law in solution questions		Application
4	To connect resistors on respectively		Application
5	To connect resistors in parallel		Application
6	To conclude Resistance Equivalent		High thinking skills
7	To calculate resistance equivalent		Application
8	To define conductivity		Remembering
9	To conclude factors influencing the connector		High thinking skills
10	To determine type of resistors		Remembering
11	To calculate resistors through colors		Application

### Chapter three

Number	Behavioral goals	Content field	Levels goals
1	To list uses of batteries	Science	Remembering
2	To identify type of batteries		Remembering
3	To know the Elevator and cathode		Understand
4	To describe form of accumulators		High thinking skills
5	To explain how to charge and discharge		Understanding
6	To list things taken in charge and discharge		Understanding
7	To list kind of voltages between battery		Remembering
8	To conclude electromotive force to battery		High thinking skills
9	To use mathematic law of electromotive force		Application
10	To connect batteries on parallel and series		Application
11	To calculate electromotive force on parallel and series		Application

## Chapter four

Number	Behavioral goals	Content field	Levels goals
1	To define power, joule, and watt	Science	Remembering
2	To express relationship between power and energy		Understanding
3	To solve question $P=R \times A^2 \times T$		Application
4	To solve questions about electricity power		High thinking skills
5	To conclude relationship between power, voltage, electricity, and resistors		Application
6	To calculate price of electricity consumption		Application
7	To grounding		Remembering
8	To explain benefits of grounding		Understanding
9	To define electric molten		Understanding
10	To show importance of risky electricity		Understanding
11	To explain how electrical separation works		Understanding

## Appendix (2): Exam on acquisition of electricity concepts to the 9<sup>th</sup> graders

### اختبار اكتساب مفاهيم الكهرباء لوحدة الكهرباء المتحركة لطلبة الصف التاسع الاساسي

عزيزي الطالب/ة ضع دائره حول رمز الاجابة الصحيحه ثم ضع الاجوبة الصحيحه في الجدول المرفق في ما ياتي:

(1) الوحدة الفيزيائية للشحنة الكهربائية هي:

(أ) الأمبير (ب) الكولوم

(ج) الفولت (د) الواط

(2) يصنف الخشب والبلاستيك من حيث التوصيلية من المواد:

(أ) الموصل (ب) العازلة

(ج) شبه موصله (د) الأجابة (أ+ب)

(3) عند ملامسة سلك فلزي مشحون مع كشاف كهربائي غير مشحون فان الورقتين في الكشاف الغير مشحون:

(أ) تنفرجان (ب) لا تنفرجان

(ج) تنفرج الورقتان قليلا (د) تنفرج ورقة واحده

(4) اذا مر تيار كهربائي في موصل من مادة الحديد وكانت قيمته (0.02) امبير/ دقيقتين فان قيمه الشحنات المتدفقه هي:

(أ) 3 كولوم (ب) 2.4 كولوم

(ج) 5 كولوم (د) 6 كولوم

(5) ..... هي كمية الشحنات كهربائيه المتدفقه في موصل خلال وحده من الزمن:

(أ) الطاقه الكهربائيه (ب) الجهد الكهربائي

(ج) شدة التيار الكهربائي (د) المقاومة الكهربائيه

(6) تتناسب شدة التيار الكهربائي مع المقاومة الكهربائيه تناسباً:

(أ) طرديا (ب) عكسيا

(ج) لا يوجد علاقة (د) شكليا

7) الجهاز المستخدم في حساب شدة التيار الكهربائي هو:

أ) جلفانوميتر (ب) فولتميتر

ج) المتر (د) باروميتر

8) عند تقريب جسمين مختلفين في قيمة الشحنات من بعضهما البعض يتساوى:

أ) التيار كهربائي (ب) الجهد كهربائي

ج) المقاومة كهربائية (د) الطاقة كهربائية

9) الجهاز المستخدم في قياس فرق الجهد الكهربائي هو:

أ) الباروميتر (ب) الفولتميتر

ج) المتر (د) الجلفانوميتر

10) ..... تلعب دورا في ممانعه مرور التيار الكهربائي في الداره الكهربائيه:

أ) البطارية (ب) المقاومه الكهربائه

ج) الساعه (د) النواة

ويرمز لوحدة: ( $\Omega$  11) عند شراء جهاز كهربائي يلاحظ كتابه الرمز

أ) الأمبير (ب) الأوم

ج) الفولت (د) الجول

12) توصل المقاومات الكهربائيه في الدارات الكهربائيه عن طريق:

أ) التوالي (ب) التوازي

ج) التقاطع (د) الاجابة (أ + ب)

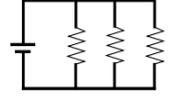
13) الصورة التاليه للدارة الكهربائيه تعبر عن طريقه توصيل المقاومات على:



أ) التوالي (ب) تقاطع

ج) تمايل (د) توازي

14) الصورة المرفقه للدارة الكهربائية تعبر عن طريقة توصيل المقاومات على:



أ) توالي      ب) تقاطع

ج) توازي      د) افقي

15) تحسب المقاومة المكافئة ( م ك ) لمقاومتين (م1 ، م2) حسب المعادلة:

أ) م ك = 1 \* م2      ب) م ك = م1 / م2

ج) م ك = م1 + م2      د) م ك = م1 - م2

16) من خصائص المقاومة الكهربائية انها تتناسب طرديا مع:

أ) مساحة السلك      ب) الوقت

ج) طول السلك      د) السرعة

17) يتم حساب قيمة المقاومة الكهربائية عن طريق:

أ) الوان المقاومة      ب) الفولتميتر

ج) الإجابة ا + الاجابه ج      د) DMM ديجيتال مالتيميتر

18) الاسم التجاري للأعمدة الكهربائية هو .....

أ) الفولتميتر      ب) البطاريات

ج) الأسلاك      د) جلفانوميتر

19) أنواع الأعمدة الكهربائية هي:

أ) المصعد      ب) الأعمدة الجافه

ج) المراكم      د) الاجابة (ج + ب)

20) في الاعمدة الجافه يصنف المصعد القطب .....

أ) السالب      ب) الموجب

ج) الجنوبي      د) المتعادل

21 ) قيمة المقاومات الداخلية للأعمدة الموصولة على طريقة التوازي:

(أ) متساوية

(ب) غير متساوية

(ج) متغيره

(د) الاجابه ب+ الاجابه ج

22 ) عمود جاف مقاومته الداخليه (0.8) اوم وقوته الدافعه الكهربائيه (3) فولت و المقاومه الخارجيه الموصوله مع قطبي العمود مقدارها (2.4) اوم احسب شدة التيار الكهربائي المتولد في الدارة:

(أ) 093 أمبير

(ب) 1 أمبير

(ج) 05. أمبير

(د) 0.2 أمبير

23) الدارة الكهربائيه التي توصل الاعمدة الجافة فيها على التوازي يكون:

(أ) جهد الاعمده متساوي و المقاومات الداخليه متساويه (ب) جهد الاعمدة غير متساوي , والمقاومات الداخليه غير متساويه

(ج) جهد الاعمده متساوي, لكن المقاومات الداخليه غير متساويه (د) جهد الاعمده غير متساوي , لكن مقاومات داخلية متساويه

24) تتحول الطاقة الكهربائيه في المدفأة الى طاقة:

(أ) شمسية

(ب) نووية

(ج) حراريه

(د) كيميائية

25) الوحدة الفيزيائية المستخدمة في قياس الطاقه هي:

(أ) الأوم

(ب) الأمبير

(ج) الجول

(د) الواط

26) مجفف شعر مقاومة سلكه ( 500 ) أوم , ويعمل على فرق جهد مقداره ( 200 ) فولت احسب الطاقة المتحولة في مجفف الشعر خلال زمن قدره ساعة , علما ان التيار الكهربائي المار به 0.5 امبير:

(أ) 95000 جول

(ب) 50005 جول

(ج) 45000 جول

(د) 6000 جول

27) القانون الفيزيائي لحساب القدرة الكهربائيه هو:

(أ) القدره = الجهد الكهربائي / التيار الكهربائي (ب) القدره = الجهد الكهربائي \* التيار الكهربائي

(ج) القدره = التيار الكهربائي + الجهد الكهربائي (د) القدره = التيار الكهربائي \* المقاومه الكهربائي

28) من طرق السلامة من خطر الكهرباء .....

(أ) التأريض (ب) الفاصل الكهربائي

(ج) الأميتر (د) الاجابة (أ + ب)

29) على الاجهزة الكهربائيه ويرمز الي (W) يلاحظ كتابه الرمز الفيزيائي:

(أ) الواط (ب) الأمبير

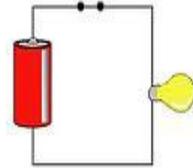
(ج) الفولت (د) الاوم

30) مدفأة كهربائية تعمل على فرق جهد كهربائي مقداره (220) فولت ويمر بها تيار كهربائي شدته (2) أمبير ويتم تشغيلها (6) ساعات يوميا احسب ثمن الطاقه الكهربائيه المتحواله خلال شهر على اعتبار سعر كيلو واط يساوي 10 قروش:

(أ) 756 قرش (ب) 700 قرش

(ج) 800 قرش (د) 900 قرش

31) في الشكل التالي يستخدم العمود الجاف في:



(أ) المقاومه الكهربائيه (ب) التأريض

(ج) إنارة المصباح (د) الأمان الكهربائي

انتهت الاسئلة

الباحث: ايمن فخر الدين

جدول الاجابات الصحيحة:

د	ج	ب	أ	رقم السؤال
				1
				2
				3
				4
				5
				6
				7
				8
				9
				10
				11
				12
				13
				14
				15
				16
				17
				18
				19
				20
				21
				22
				23
				24
				25
				26
				27
				28
				29
				30
				31

**Appendix (3): Specification Table for the acquisition of electricity concepts exam**

<b>Bloom goals</b> <b>Content</b>	<b>Number of lectures</b>	<b>Ratio of lectures</b>	<b>Remembering 35%</b>	<b>Understanding 23%</b>	<b>Application 19%</b>	<b>High thinking skills 23%</b>	<b>Total</b>
<b>Chapter one 32%</b>	5	25%	4	1	2	3	10
<b>Chapter two 19%</b>	6	30%	2	1	2	1	6
<b>Chapter three 26%</b>	5	25%	3	2	1	2	8
<b>Chapter four 23%</b>	4	20%	2	3	1	1	7
<b>Total</b>	20	100%	11	7	6	7	31

**Difficulty coefficient and discrimination coefficient for the acquisition of electricity concepts:**

<b>Statement</b>	<b>Difficulty coefficient</b>	<b>Coefficient of discrimination</b>
1	0.60	0.40
2	0.50	0.50
3	0.40	0.40
4	0.80	0.20
5	0.50	0.30
6	0.40	0.40
7	0.60	0.40
8	0.80	0.20
9	0.50	0.50
10	0.30	0.30
11	0.60	0.40
12	0.70	0.30
13	0.50	0.30
14	0.40	0.40
15	0.60	0.40
16	0.40	0.40
17	0.50	0.50
18	0.50	0.50
19	0.50	0.50
20	0.70	0.30
21	0.80	0.20
22	0.40	0.40
23	0.50	0.50
24	0.50	0.30
25	0.60	0.20
26	0.30	0.30
27	0.70	0.30
28	0.40	0.40
29	0.40	0.40
30	0.50	0.50
31	0.50	0.50

## Appendix (5): Exam to measure creative thinking

### اختبار قياس مهارات التفكير الابداعي

عزيزي الطالب/ة اقرأ التعليمات التالية:

\_ اقرأ المعلومات التي يتضمنها كل سؤال جيدا من اسئلة المقياس قبل الاجابة عنها.

\_ لا تترك اي سؤال من اسئلة المقياس دون الاجابة عنه بما يمليه عليك تفكيرك.

\_ يجب أن تكون اجابتك تلقائية وبعيدة عن أي خوف أو تردد أو اضطراب.

\_ الاجابة عن أسئلة المقياس ضمن الزمن المحدد لذلك في كل جزء منه.

شكرا لكم على حسن تعاونكم

فقرات المقياس:

أولا: قياس مهارة الطلاقة:

يتكون هذا الجزء من ثلاث فقرات و الزمن المخصص 15 دقيقة

الفقرة (1):

لديك في هذا السؤال مجموعة من المفاهيم العلمية والمطلوب منك أن تفكر في كل مفهوم وتكتب في المكان المخصص تحته أكبر عدد من الأمثلة والأشياء الموجودة في البيئة حولك و تعبر عنها:

(1) مواد موصلة للتيار الكهربائي:

.....1

.....2

.....3

.....4

.....5

(2) أجهزة كهربائية تعمل على تحويل الطاقة الكهربائية الى شكل اخر:

.....1

.....2

.....3 .....8

.....4 .....9

.....5 .....10

(3) طرق الوقاية من خطر الكهرباء:

.....1 .....6

.....2 .....7

.....3 .....8

.....4 .....9

.....5 .....10

الفقرة رقم (2):

نرى جميعا المصباح الكهربائي في المنزل ونعرف ان شكله مبين كما في الشكل أدناه:

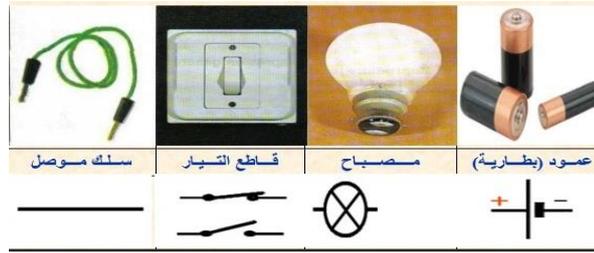


تخيل أنك أصبحت مهتماً في المنتج الذي يُنتج المصابيح الكهربائية وبدأت تفكر بصناعة أشكال مختلفة للمصباح الكهربائي من أجل زيادة مبيعات هذا المنتج، فما هي الأشكال التي يمكن أن تقترحها للاختراع الزجاجي في المصباح الكهربائي. ارسم في الأماكن المخصصة أدناه أكبر عدد ممكن من البدائل لشكل هذه المصابيح الكهربائية.

(٣)	(٦)	(١)
(٦)	(٥)	(٤)
(٥)	(٨)	(٣)
(١٦)	(١١)	(١٠)

### الفقرة رقم (3)

لديك الأدوات التالية من خلال الشكل ارسم توصيلات متعددة لدارات كهربائية:



ثانياً: قياس مهارة المرونة:

يتكون هذا الجزء من فقرتين و الزمن المخصص 15 دقيقة

### الفقرة رقم (4)

فيما يلي مجموعة من الادوات الكهربائية. اكتب في المكان المخصص تحت كل من الادوات التالية اكبر عدد ممكن من الاستعمالات المتنوعة والجديدة لها.

(1) الأعمدة الكهربائية:

- 1.....6
- 2.....7
- 3.....8
- 4.....9
- 5.....10

(2) المقاومات الكهربائية:

- 1.....6
- 2.....7

.....3 .....8

.....4 .....9

.....5 .....10

الفقرة رقم (5)

فيما يلي مجموعة من الادوات الكهربائية يمكنك اجراء بعض التعديلات على كل منها بهدف تحسين ادائها ومعالجة بعض نواحي القصور فيها. اكتب في المكان المخصص تحت كل من الادوات التالية اكبر عدد ممكن من المقترحات لتصبح في افضل صورة ممكنة.

(1) مصباح إنارة الشارع:

.....1 .....6

.....2 .....7

.....3 .....8

.....4 .....9

.....5 .....10

(2) الأجهزة الكهربائية المنزلية:

.....1 .....6

.....2 .....7

.....3 .....8

.....4 .....9

.....5 .....10

ثالثاً: قياس مهارة الاصاله:

يتكون هذا الاختبار من فقرتين و الزمن المخصص 15 دقيقة

تمثل كل من الاحداث ادناه شيئاً ممكن حدوثه تخيل ثم اكتب اكبر عدد ممكن من الترتيبات على كل منها.

الفقرة رقم (6)

الصورة التالية تشير الى استخدام طاقة الرياح والطاقة الشمسية حول العالم:



تخيل ان الحصول على الطاقة الكهربائية يتم عن طريق الطاقة المتجددة (طاقة الرياح و الطاقة الشمسيه) حول العالم فماذا تتوقع ان يحدث؟ اكتب أدناه اكبر عدد ممكن من الافكار والتخمينات التي تترتب على هذا الحدث كما تتخيله؟

الفقرة رقم (7)

تخيل ان مصادر الطاقة الكهربائية قد اختفت من الكون الذي تعيش فيه ومن البيئة المحيطة بك أو لم تكن موجودة اصلا فماذا تتوقع ان يحدث؟ اكتب أدناه اكبر عدد ممكن من الافكار والتخمينات التي تترتب على هذا الحدث كما تتخيلها؟

انتهت الاسئلة

الباحث: أيمن فخر الدين

**Appendix (6): Specification Table for the creative thinking exam: 7statements**

<b>Bloom goals</b> <b>Content</b>	<b>Number of lectures</b>	<b>Ratio of lectures</b>	<b>Fluency 43%</b>	<b>Flexibility 28.5%</b>	<b>Originality 28.5%</b>	<b>Total</b>
<b>Chapter one 14.5%</b>	5	25%	0	1	0	1
<b>Chapter two 28.5%</b>	6	30%	1	1	0	2
<b>Chapter three %28.5</b>	5	25%	1	0	1	2
<b>Chapter four 28.5%</b>	4	20%	1	0	1	2
<b>Total</b>	20	100%	3	2	2	7

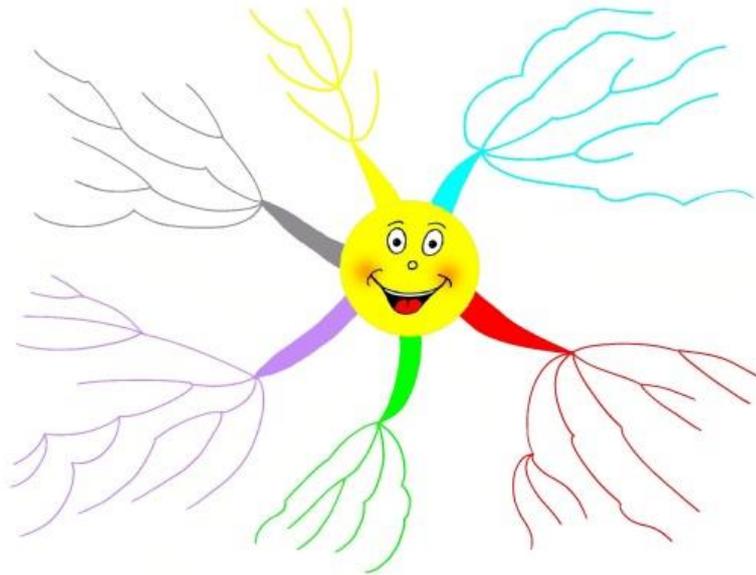
**Appendix (7): Difficulty coefficient and discrimination coefficient in acquisition of electricity concepts**

<b>Statement</b>	<b>Difficulty coefficient</b>	<b>Coefficient of discrimination</b>
1	0.60	0.40
2	0.40	0.40
3	0.70	0.30
4	0.30	0.30
5	0.40	0.40
6	0.30	0.30
7	0.30	0.30

## Appendix (8): Exam on mental models through mind map

### اختبار النماذج الذهنية من خلال الخريطة الذهنية

عزيزي الطالب/ة قم برسم خريطة ذهنية من خلال الاستعانة بالصورة التالية وترتيب الافكار التالية في الخارطة:  
(المصعد، الاعمدة الجافة، الاعمدة الكهربائية، الشحنة الموجبة، الدارة الكهربائية، الشحنة السالبة، التيار الكهربائي، الاعمدة الثانوية، المهبط، المادة الكهربية، الشحنات الكهربائية، السلك)



انتهت الاسئلة

الباحث: ايمن فخر الدين

**Appendix (9): Difficulty coefficient and discrimination coefficient of mental models test.**

<b>Statement</b>	<b>Difficulty coefficient</b>	<b>Discrimination coefficient</b>
1	0.37	0.40
2	0.56	0.20
3	0.62	0.23

### Appendix (10): Validity committee

No.	Name of juror	Place of work	Computer applications	Content	Instruments
1	Dr. Zeiad Qabaja	Al-Quds University	√		√
2	Prof. Afif Zeidan	Al-Quds University			√
3	Dr. Kamel Hashem	Al-Quds University	√		√
4	Dr. Abdulah Erman	Al-Quds University	√		√
5	Dr. Ghassan Sirhan	Al-Quds University			√
6	Dc. Nabeel Abdulhadi	Al-Quds University			√
7	Mrs. Dina Dawani	Santa Joseph School		√	
8	Mrs. Hala N. Bakeer	An-Najah National University			√
9	Dr. Suhail Abu Salha	An-Najah National University			√
10	Dr. Ali Zohdi	An-Najah National University			√
11	Dr. Amneh Barq	An-Najah National University			√
12	Dr. Shadi Abu Qbash	An-Najah National University			√

## Appendix (11): Computer applications





كتاب المترجم

# الكهرباء المتحركة

الوحدة السادسة

الفصل الأول

التيار و الجهد الكهربائيين

الفصل الثاني

المقاومة الكهربائية

الفصل الثالث

الأمدة الكهربائية و طرق توصيلها

الفصل الرابع

القدرة الكهربائية

خروج

رجوع للخلف

فصل ١

# التيار والجهد الكهربائيين

المعهد العربي للفصل الأول

فيديو تعليمي للفصل الأول

تجارب للفصل الأول

التقديم التكراري للفصل الأول

رجوع

خروج

التيار والجهد الكهربائي

الشحنه الكهربائيه : تتكون الاجسام من شحنات موجبه وسالبه في الوضع الطبيعي و الاجسام المشحونه في شحن بتوزيع من الشحنات اما موجبه او سالبه ويمكن شحن الاجسام بطرق متعدده

1. ذلك 2. المس 3. التثثير

وتتكون الشحنات المكتسبه دائما سالبه والشحنات المفقوده موجبه

ووحده الشحنات الكهربائيه هي الكولوم والذي يساوي على النحو التالي  $1 \text{ كولوم} = 1.6 \times 10^{-19}$

---

التيار الكهربائي :تسمى حركه الشحنات الكهربائيه باتجاه محدد خلال زمن معين بالتيار الكهربائي ويسري التيار الكهربائي في الفلزات نتيجة حركه الالكترونات بينما يسري في المحاليل الكهربائيه نتيجة حركه الايونات الموجبه والسالبه.

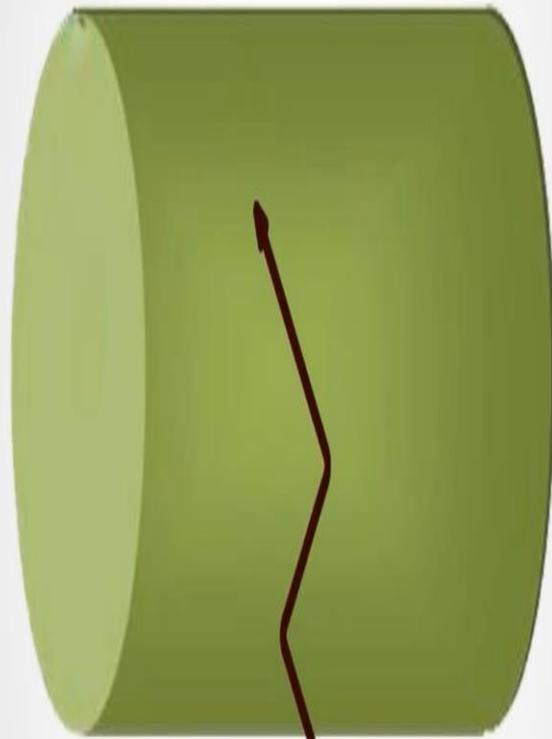
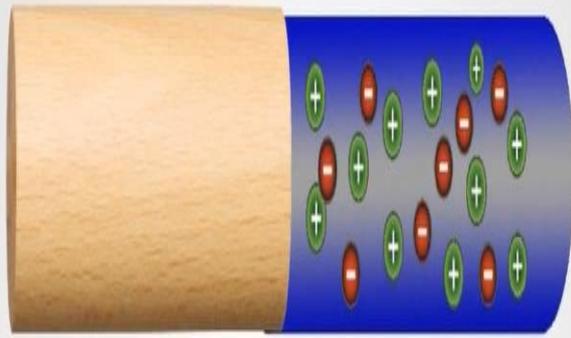
ويحسب التيار الكهربائي حسب القانون  $q = It$  حيث ان  $1 \text{ كولوم} = 1 \text{ امبير} \cdot \text{ثانيه}$

بالتالي الامبير هي وحده التيار الكهربائي

ويقاس التيار الكهربائي عبر جهاز جلفانو ميتر الموجود بالصوره



التالي



شبه موصل

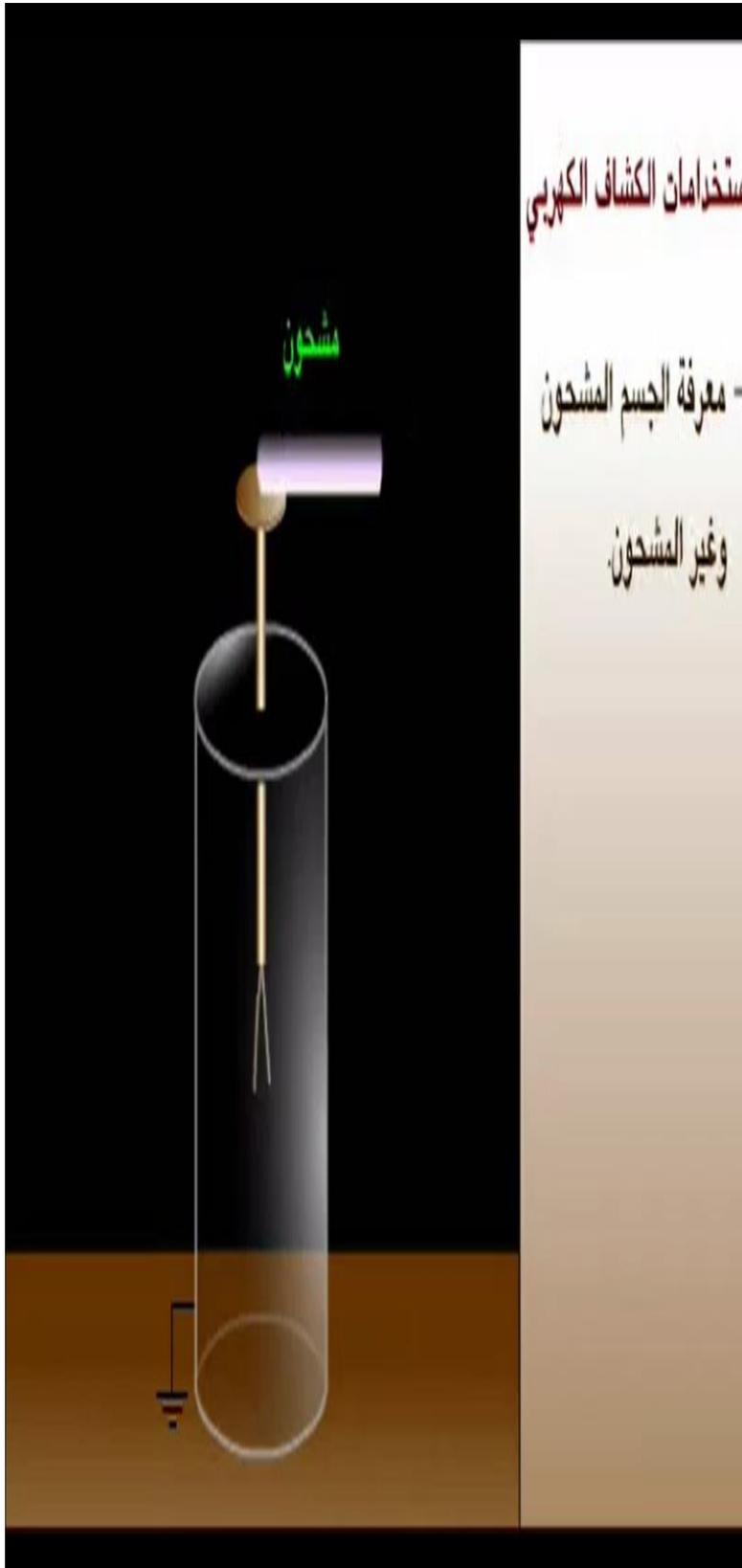
00:35



## ستخدامات الكشاف الكهربائي

- معرفة الجسم المشحون

وغير المشحون.



تجربة الكتروليم



00:00

تجربة الجلفانومتر

استخدام الكشاف الكهربي

- معرفة الجسم المشحون
- وغير المشحون
- معرفة نوع الشحنة



00:12

تجربة الكشاف الكهربي

رجوع

خروج



00:00

تجربة الفولتميتر



## الأعمدة الكهربائية وطرق توصيلها

المحوى التعليمي للفصل الثالث

مخبري تعلمي للفصل الثالث

الأعمدة الكهروكيميائية: والتي يطلق عليها المصطلح التجارتي البطاريات وتتألف من نوعين:  
أولا الأعمدة الجافة:



ويتكون العمود الجاف من الأجزاء:

1. المصدر: وهو الب السالب (الزنك)
  2. المهبط: وهو القطب الموجب (الكربون)
  3. المادة الكهروكيميائية: مزيج من كلوريد الألمنيوم وكلوريد الزنك
- ثانيا: الأعمدة للتأويه (المركم):

تجارب للفصل الثالث

التأويه الكهروكيميائي للفصل الثالث

رجوع



خروج

نهاي

# القدرة الكهربائية

المحتوى التعليمي للفصل الرابع

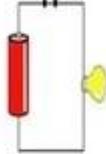
محتوى تعليمي للفصل الرابع

تجارب للفصل الرابع

التكويد التكويني للفصل الرابع

رجوع

خروج



طاقة كهربائية: الكهرباء لا تخلق ولا تستحدث ولكنها تتحول من شكل الى اخر

ووحدة الطاقة الكهربائية هي الجول ونحسب حسب المعادلة الرياضية: الطاقة الكهربائية

$$P = I^2 \times R \times t$$

ملاحظة: I: التيار الكهربائي

R: المقاومة الكهربائية

t: الزمن (ثانية)

القدرة الكهربائية والتي يتم حسابها حسب العلاقة الرياضية: القدرة = ج x ت

ووحدة القدرة الكهربائية هي الواط

ومن طرق السلامة الكهربائية هي:



فاصل التيار او متتابع نفس التيار (أوتوما تيكي)

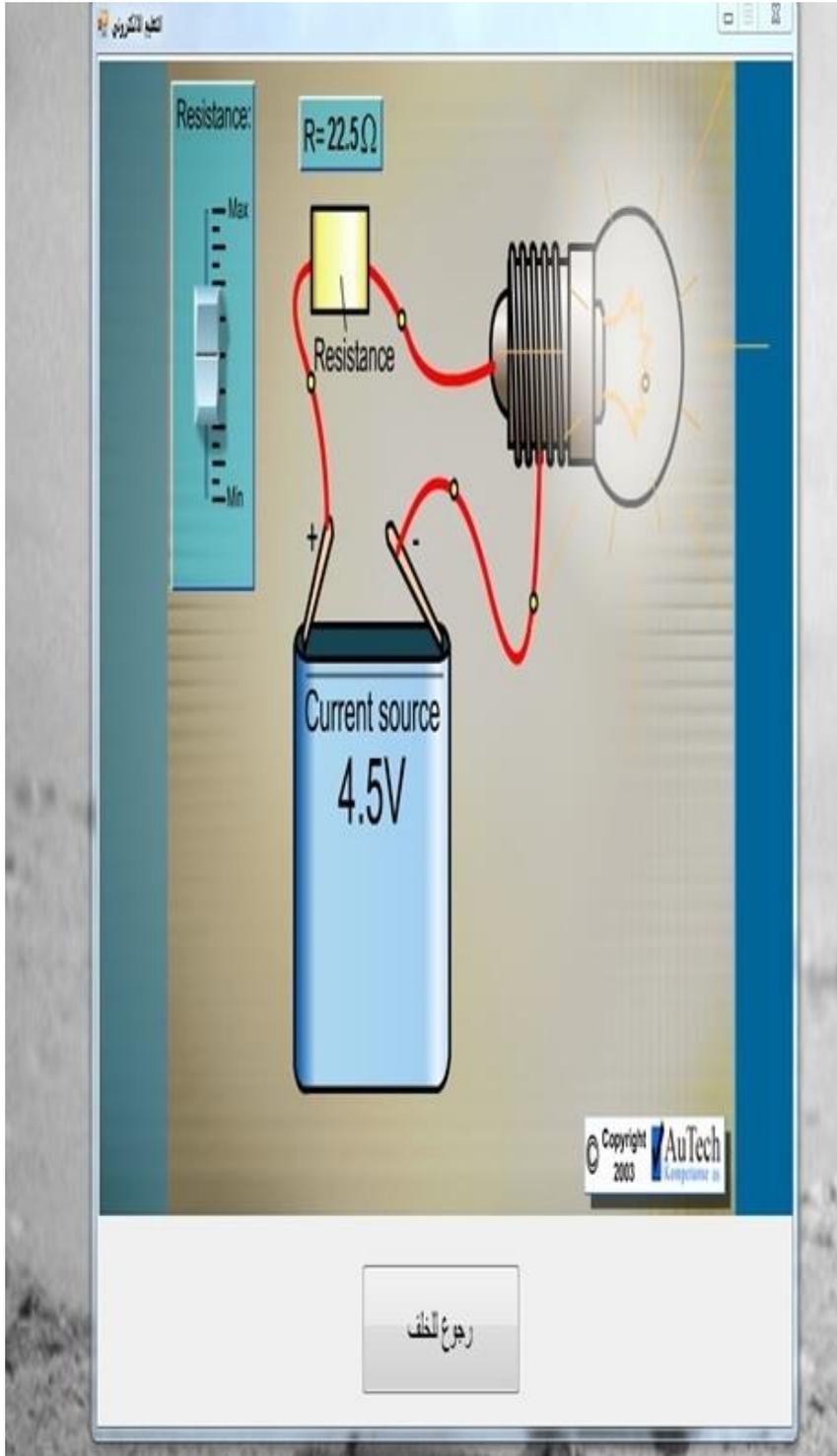
الامن الكهربائي

(قاطع نصف التوماتيكي):

المنصير الكهربائي:

التاريخ:





## المواد الموصلة والعازلة للكهرباء

### مواد موصلة للكهرباء



### مواد عازلة للكهرباء



للشركة

رجوع للخلف

## Appendix (12): Evaluations Findings

The researcher presents in this section the results of the formative evaluation and final evaluation. The findings of the results are presented according to the Test programmed instruction.

The researcher has calculated the results through statistical treatment (SPSS), using arithmetic averages, standard deviations, and paired samples statistics, to compare different groups.

**Table (6.1) shows the results of mean scores and paired samples correlations between formative evaluation and final evaluation in electricity unit:**

Methods of teaching		Mean	N	Std. Deviation	Std. Error Mean
BIL	Formative evaluation	12.8889	36	1.76923	0.294870
	Final evaluation	13.3611	36	1.51474	0.252460
BCL	Formative evaluation	13.3103	29	1.71346	0.318180
	Final evaluation	13.6552	29	1.44608	0.268530

And also, the researcher calculated the difference between the two methods: blended individual learning (BIL), and blended collaborative learning (BCL) in formative evaluation and final evaluation of electricity unit. The results were in favor of BCL. It was 0.866 in the two evaluations.

**Table (6.2) shows the differences between learning methods:**

Paired Samples Correlations		N	Correlation	Sig.
BIL	Formative and final	36	0.858	0.00
BCL	Formative and final	29	0.866	0.00

Table 6.1 shows the difference between the two methods: blended individual learning (BIL), and blended collaborative learning (BCL) in formative evaluation and final evaluation of electricity unit. The results were in favor of BCL. It was 0.866 in the two evaluations.

<b>Methods of teaching</b>		<b>Mean</b>	<b>Std. Deviation</b>	<b>Std. Error Mean</b>
<b>BIL</b>	<b>Formative and final</b>	0.4722	0.90982	0.15164
<b>BCL</b>	<b>Formative and final</b>	0.3448	0.85673	0.15909

One concludes from table (6.3) that the use of the software program had a significant impact on improvement of students' achievement. There was an increase in their Formative and final tests through the use of new teaching methods.

اثر استخدام تكنولوجيا معلومات الاتصالات على طلبة الصف التاسع الاساسي في اكتساب مفاهيم الكهرباء والنماذج الذهنية، و التفكير الابداعي.

اعداد الطالب: أيمن حسام فخرالدين

اشراف الدكتور: كامل هاشم

### ملخص الدراسة

ان استخدام تكنولوجيا المعلومات والاتصالات اصبح امرا ضروريا ومهما في عملية التعليم والتعلم، ومن هذه الاهمية صمم الباحث برنامجا محوسبا من اجل قياس اثر تكنولوجيا المعلومات والاتصالات من خلال تطبيق الطرق التعليمية (التعلم المدمج التعاوني ، والتعلم المدمج الفردي) على اكتساب مفاهيم الكهرباء والنماذج الذهنية والتفكير الابداعي لدى طلبة الصف التاسع الاساسي.

لقد استخدم في الدراسة التصميم التجريبي حيث تكونت عينة الدراسة من طلبة الصف التاسع الاساسي في مدرستي راهبات مار يوسف ومدرسة كلية الروضة واللذان تتبعان لمديرية تربية وتعليم مدينة نابلس، حيث شملت العينة (90) طالبا وطالبة انتظموا في ثلاث مجموعات من كل مدرسة، مجموعتين في مدرسة راهبات مار يوسف احدهما درست بطريقة (طريقة التعلم وجها لوجه (المجموعة الضابطة)، والتعليم المدمج التعاوني (مجموعة تجريبية))، ومجموعة في مدرسة كلية الروضة درست بطريقة (التعليم المدمج الفردي (مجموعة تجريبية)).

وقد تكونت ادوات الدراسة من اختبار اكتساب المفاهيم الكهرباء، واختبار النماذج الذهنية، واختبار التفكير الابداعي. وتم التحقق من صدق وثبات ادوات الدراسة عن طريق تطبيقهم على عينة استطلاعية، ومن ثم تم تطبيقهم على عينة الدراسة، وقد تم استخدام المتوسطات الحسابية و (One- way ANCOVA) لمقارنة متوسطات اداء الطلبة في اختبار اكتساب المفاهيم، والنماذج الذهنية، والتفكير الابداعي.

وقد خرجت الدراسة بجملة من النتائج واهمها:

وجود فروق دالة احصائيا في اكتساب مفاهيم الكهرباء تعزى الى طرق التدريس (طريقة التعلم وجها لوجه، التعليم المدمج التعاوني ،والتعليم المدمج الفردي) لصالح طريقة التعليم المدمج الفردي.

وجود فروق دالة احصائيا في النماذج الذهنية تعزى الى طرق التدريس (طريقة التعلم وجها لوجه، التعليم المدمج التعاوني ،والتعليم المدمج الفردي) لصالح طريقة التعليم المدمج التعاوني.

وجود فروق دالة احصائيا في التفكير الابداعي تعزى الى طرق التدريس (طريقة التعلم وجها لوجه، التعليم المدمج التعاوني، والتعليم المدمج الفردي) لصالح طريقة التعليم المدمج الفردي.

في ضوء نتائج الدراسة اوصى الباحث ،الى الحاجة الى توظيف هذه الاساليب في التعليم وتعلم العلوم والمفاهيم الفيزيائية، كما انه ينبغي ان تقدم برامج التدريب للمتعلمين على استخدام تكنولوجيا معلومات والاتصالات، واجراء المزيد من الدراسات في تأثير تكنولوجيا معلومات الاتصالات على متغيرات متعددة.

