Journal of Positive School Psychology
2022, Vol. 6, No. 7, 574–593 http://journalppw.com

The Impact of Training Program Based on Pictorial Research Skills on Development of Thinking Skills

Amjad Joma[1]

Psychology Department,,Faculty of Art and Humanities, A'Sharqiyah University, Sultanate of Oman

Abstract

This study aimed to identify the effectiveness of a training program based on pictorial research skills to develop thinking skills among ninth-grade students according to their zone of proximal development. The study used the quasi-experimental two-group design: one control and one experimental. The study community was all 185 ninth graders in one of Rafah major UNRWA preparatory school, the study sample was 70 students of them. The training was delivered for 35 students as experimental group whereas the other 35 students were the control group. To achieve the purpose, zone of proximal development rating scale was used as well as thinking skills scale. In addition, the main tool was the pictorial research skills training program. The results revealed there were significant differences between the two groups on the thinking skills test in favor of the experimental group. The study recommends more studies and training programs based on research skills be conducted to develop thinking skills among students of other age groups. It also recommends developing teachers professionally on teaching thinking skills.

Keywords: Training Program, Pictorial Research Skills, Thinking skills**.**

INTRODUCTION

Man has made astonishing progress in various fields of sciences which is the result of ongoing scientific research. Quality education cannot be reached in our societies except through research and research skills (Malik, 2018). Students need to be knowledge seekers not recipients. Therefore, schools should be research centers to train students on research, thinking and questioning skills. Students have the willingness to learn research and thinking skills, but they need the teacher who can determine their zone of proximal development in order to develop them by providing the necessary cognitive scaffolding (Margolis, 2020).

The zone of proximal development refers the distance between the actual developmental level as determined by independent problem solving and the potential level of development as determined through problem solving under guidance or in collaboration with more skilled person. Learners, as a result achieve cognitive development and become more integrated into society (Shabani et al., 20102010). A learner's zone of proximal development expands through training by an expert teacher (Kantar et al., 2020) Accordingly, the learner's research and thinking skills develop as the expert teacher provides the necessary support in order to help the learners be independent researcher. Scaffolding refers to the guidance or training provided by qualified adults or peers to enable students accomplish tasks within the zone of proximal development. Support can also be provided directly as instructions as well as indirectly as hits and clues (Murray & Arroyo, 2002).

Research-based learning establishes long-term learning skills such as self-learning, self-assessment, cooperative learning,

learning by research and knowledge transfer. Teaching through research skills also develops higher-order thinking skills including creative thinking and critical thinking (Reed et al., 2021). Previous studies have presented several training programs of teaching thinking such as: cognitive operations programs, metacognitive operations programs, language and symbolic processing programs and learning by discovery programs.

Studies indicate two pathways of thinking training: the first is direct training of thinking as universal skills. Here, thinking skills are presented separately and practiced within general life situations. De Bono was the pioneer of teaching thinking skills like any other subject matter. He believes this pathway is a planned and directed process rather than implied within subject matters. Thus, students thinking skills are more likely to be improved and developed (Qatami and Aranki, 2007). The other direction in teaching thinking skills is integration and implication amongst other subjects' lessons (Mayer &Richards, 1983). Lee (2009) states teachers in high and middle schools do not usually allow students to write their research papers using internet. Teachers fear of plagiarism, cut and paste information without paraphrasing. Teachers also believe students are unable to decide how relevant the information is. Therefore, this study suggested a training program based on pictorial research skills to develop thinking skills according to students' zone of proximal development.

Contribution of the study

The number and quality of published research have become a measure of prosperity and welfare worldwide. Thus, teaching systems are required to train the young in early stages on the best practices and applications of research. These practices include collecting information, classifying and analyzing data. Other skills are inference, scientific conclusion and interpretation. Research is a way of thinking and lifestyle develop over time (Supreme Education Council-Qatar, 2010). These days, traditional teaching methods have proved ineffective, so this requires new teaching methods that meet students' changing educational needs and changing life as well (Qatami, 1998).

Research education creates inquiry-based educational environment that encourages exploration. Research gives learners access to the latest types of knowledge, provides them with thinking and problem-solving skills, and prepares them for leadership in the world of business and public life. Moreover, the current study deals with research and thinking skills for adolescents who are the bridge between childhood and adulthood. This age is very critical as adolescents need extra care to develop their cognitive and research skills. Most studies that dealt with variables similar to the current study focused on older age groups such as university students.

Studying postgraduate students, Harbi (2011) revealed that students did not have good research skills including using library database and assessing resources relevancy. In another similar context, Leggetter & Sapsed (2011) carried out a study to develop research skills among postgraduate students. Their sample was 169 students who were enrolled in a distance learning master of public health in the UK. The results showed students acquired research skills after the program. So, this study suggested a training program to develop ninth graders thinking skills according to their zone of proximal development. In addition, it aimed to prepare a scale of thinking skills for teachers to use.

Research skills taxonomy

There are variety of research skills classifications. Nasr (2004) states three categories: skills related to research procedures, skills related to design, and skills related to the researcher. However, this study targeted pictorial research skills

which the researcher has divided into four groups:

(1) **Cognitive awareness**
(2) which is about problem discovery and planning towards improvements. It includes:
(1.1) Problem identification: the ability to identify problems (Saada, 2006).
(1.2) Planning: the ability to think of activities leading to goals (Damas, 2008).
(1.3) Questioning: the ability to ask direct to the point questions (Saada, 2006).
(1.4) Goals setting: the ability to specifically set objectives (Saada, 2006).
(1.5) Collecting information: the ability to gather relevant data (Saada, 2006).

(2) **Cognitive organization** which includes classification and summarization of information in order to have a meaningful context. It includes:
(2.1) Classification: the ability to group information according to relevancy (Saada, 2006; Amer and Mohammed, 2008).
(2.2) Comparison: the ability to discover similarities between information.
(2.3) Arrangement: the ability to put items in meaningful sequence and order (Amer and Mohammed, 2008).
(2.4) Summarization: the ability to catch main ideas and link them together (Amer and Mohammed, 2008).

(3) **Cognitive discovery** which includes foreseeing and generating hypotheses. It includes:
(3.1) Prediction: the ability to use schema to foresee upcoming events.
(3.2) Hypotheses generation: the ability to set possible solutions.
(3.3) Conclusion: the ability to examine the hypotheses, identify the most effective alternative and have a decision.

(4) **Rational judgement** which includes the final judgement and reporting. It includes:
(4.1) Interpretation: the ability to understand and explain results.
(4.2) Evaluation: the ability to judge upon results accuracy, research methods effectiveness and procedures appropriateness.
(4.3) Report writing: the ability to sum up information and results coherently and cohesively in a well-organized report (Tahbet, 2011).
(4.4) Presentation: the ability to highlight main points in graphs, charts and concept maps in an arranged way (Shawaheen and Badandi, 2009)

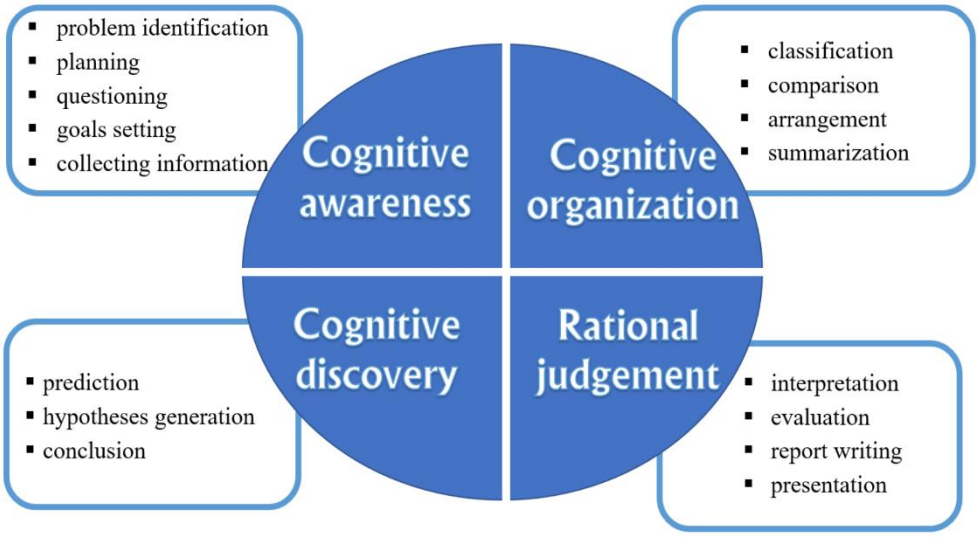

Figure (1) major and minor research skills

Definition of learning by research

Gerges (2010) defines learning by research as a teaching method that helps students to seek information, answer questions and suggest solutions for specific problems in order to make decisions. Nottage and Morse (2005) define learning by research as a series of research steps that involve students in practical activities related to their learning process. Students, thus, become confident, independent and responsible. Shawahin and Badendi (2009) consider learning by research is an opportunity to design experiments and projects related to curriculum.

As mentioned in Qatar Teacher Network (2011), learning by research aims at equipping students with the research skills in order to prepare them to be researchers. It also seeks training students to consider different social and cultural contexts, consider different resources available, and consider varied research methods and tools. As for teachers, learning by research help teachers make decisions upon solid data, develop leadership skills, discover talented students, and improve teachers' ability to coach experiments.

Vygotsky's model for learning by research

Vygotsky's model of learning by research provides students opportunities to search and discover information on their own under supervision. Vygotsky calls the supervision and assistance "scaffolding" which is given by the teacher or an expert based on students' abilities and mental aptitude. Vygotsky's model is suitable for all educational levels as well as most subjects. Therefore, Tolisano (2008) believes that teaching research skills should be included at school in all stages. Teaching research skills should be included in schools' strategic plan as well as teachers' individual plans.

Learning by research is based on Vygotsky's cultural cognitive theory that assumes learner's learning level is determined by his ability to benefit from others' support. Vygotsky's assumption states that each learner has two levels: actual level and potential level. The potential level can be reached by scaffolding. This is called the Zone of Proximal Development; therefore, the learner is determined through the ability to learn, build and process. The learner is governed by his Zone of Proximal Development (Zaza, 2010).

Learning by research strategies (Gillies, 2015**)**

1. **Dialogue and discussion:** The teacher present a problem that needs research, and then he provokes discussion. Students generate alternatives and solutions for the problem.
2. **Reciprocal learning:** The coach designs research tasks that require cooperation between students. Students are then encouraged to exchange experiences to help each other so that the less competent student can learn from the more competent ones.
3. **Modeling:** The trainer or some of the students provide a model in front of the trainee students. The trainer helps students acquire research skill and reach the zone of proximal development. This strategy includes performance modeling by an expert, expressing ideas out loud, and encouraging students to think as researchers.
4. **Cognitive scaffolding:** The trainer transfers knowledge and experiences according to the students' abilities. The trainer equips students with research skills that qualify them to conduct research tasks that are difficult to accomplish independently.
5. **Cognitive Internalization** The trainer presents some research activities and tasks that enhance students' skill. This strategy

encourages research in different social contexts.

Vygotsky's learning by research activities

1. **Research reports:** This is often called a "research paper" or "research report". Students choose a research problem related to curriculum or a life problem like global warming, and then they search for information to present a research report. Gerges (2010) defines it as simplified scientific research to study specific topics such as: (types of soil, harmful insects, services provided by the telephone utility in the village, etc.). Thabet (2011) considers it a report prepared to address a specific topic based on the information collected from various sources such as: books, references, newspapers, interviews, and others. The report usually includes a cover page, the research problem (the main question), the materials and tools used in the experiment, results, and conclusion and discussion. The references such as books and documents used in the project are also stated.
2. **Scientific experiment:** Thabet (2011) states that scientific experiments are projects which follow the steps of scientific research method: 1) choosing research topic, 2) defining the problem, 3) establishing hypotheses, 4) experimenting (carrying out a scientific experiment), 5) analyzing results and 6) drawing a conclusion. After completing the experiment and reaching the results, a report is written which includes the research problem, the materials and tools, and then presenting results and conclusion.
3. **Demonstrations:** This type of scientific project includes clarifying a specific scientific principle such as: explaining the principle of light reflection, light refraction or sound propagation. For example, making a simple electric motor for demonstrating the idea of converting electrical energy into mechanical energy (Thabit, 2011).
4. **Models:** This type of research project involves the construction of models of specific things in order to deeply understand how these things work. Pictures or illustrations can also be used as models. When making a model, a sensible drawing scale is used that suites the original dimensions whether the model is miniature or enlarged. A good example is the solar system model that shows the planets and their orbits.
5. **Collections and classifications:** Gerges (2010) states this type of research includes assigning students to carry out research activities based on collecting and classifying images and objects. This happens by classifying them into specific categories, and then summarizing information. Thabet (2011) mentions a number of examples about this type such as: collecting leaves, rocks, or different seeds and classifying them based on their shapes or sizes.

Teaching research skills through mental imagery

Imagery is the most common pattern in cognitive representations, and it is not only visual, but also verbal, or auditory. Signs and images are the basis of memory. They are used to encode and transfer information to long-term memory (Qatami and Arniki, 2007).

Zagol and Zagol (2008) define mental imagery as a reflection for objects, knowledge and experiences, including research and thinking skills, in a sensory manner. This reflection is closely linked to the original experience. For example, when we are asked a question about the number and the description of a house windows, we often recall a mental picture of the house so

that we can mentally wander through the rooms, count the windows and determine their sizes and shapes. Qatami (1998) defines mental imagery as using mental images to represent information and retain some of perceivable sensory qualities. Ahsen (1986) in Shaqifi (2008) describe mental imagery as vital images containing some information that has been encrypted in different forms. Mental imagery is a natural phenomenon in both children and adults, and it can be improved through effective training and practice.

Allan Pavio develops a theory of long-term memory known as "Dual Coding Theory" in which Pavio believes that information in long-term memory is stored in two different but interrelated systems. The first system is linguistic or verbal encoding and is dedicated to processing and representing verbal information, while the second system is pictorial coding and is dedicated to spatial information (Zagol and Zagol, 2008). Pavio believes physical information is easier to remember and encode than abstract information, since physical words have visual symbols and mental imagery. Therefore, abstract coding is less effective (Qatami and Arnik, 2007). Mental imagery can help training in research and thinking skills for several reasons (Zagol and Zagol, 2008):

- They facilitate information storage of longer periods
- They facilitate retrieving information related to research and thinking.
- They facilitate linking information together in memory.

Mental Imagery Strategy

Qatami (1998) considers mental imagery a good strategy for remembering through images, charts, drawings and graphics. Qatami mentions the learners' roles in mental imagery:

- The learner keeps vital and active.
- The learner receives visual, sensory and mental stimuli.
- The learner links past experiences to new images.
- The learner employs new senses to recall expertise when needed.
- The learner personalizes the new concept by recalling his own images.

Shawish (2012) says mental imagery strategy enables to recall images when thinking, and it also empowers the ability to imagine different mental images about different experiences. This pictorial ability is very important for research and thinking skills because it enables to establish assumptions and put probabilities. Mental imagery strategy helps learners go beyond existing environment to realize other dimensions and possibilities of the situation. Consequently, mental imagery leads to creativity and innovation.

The use of images and drawings in teaching research and thinking skills is not new as it was used in the past and even before the invention of the alphabet. People of old ages used to describe their lives events by drawing on cave walls and stones. They used graphics to tell stories about their lives and to deliver messages (Clagget & Brown,1996).

Images are an essential source of visual knowledge, for they provide the contextual clues needed for decoding. Images can also help explain other images or other non-visual information such as texts or spoken words (Les & Les,2008).

Vygotsky's Zone of Proximal Development (ZPD)

Vygotsky introduced the concept of Zone of Proximal Development as a critique for the psycho-educational measures used in Russian schools which were examining the learners' actual level at a specific time without considering the potential level of performance that a child can reach (Shabani, et al., 2010). This means psycho-educational measures were only measuring the child's aspects that had fully developed without considering the incomplete or underdeveloped aspects and skills that can be developed through an experienced teacher.

Qatami (2009) defines the Zone of Proximal Development as the distance between a child's current level of performance determined by independent problem-solving method, and the highest level of performance determined by problem solving dependently by experienced teachers or peers. An experienced person helps the child move from the current level of performance to the level he or she can achieve.

Siegler and Alybaly (2010) define the Zone of Proximal Development as the distance between what a child can do independently, and what he or she can do with support by an adult or an experienced colleague. Children can think more sophisticatedly, and they can practice more complex skills when they receive assistance and guidance. Children learn little when they do tasks alone, and they do a lot of tasks by collaborating with someone who is more efficient. The child's skills, therefore; continue to develop but require guidance and support from adults. This socio-cultural cognitive trend is dynamic and interactive between children and adults. These justifications have motivated the researcher of the current study to adopt Vygotsky's model in research and thinking skills training among ninth graders.

Several studies have tackled research skills and thinking skills assessed research skills among university students. (Keresha & Safadi, 2001; Reyami, 2002; Shuqier & Abu Shabban, 2006; Demircioglu, 2008; Gilmore & Feldon, 2010; Kszura & Tuttle, 2010) Results were not discrepant as they all found several factors affecting research skills. They all agreed students research skills need to be addressed in depth.

Previous studies have showed that several factors and skills contribute to students' research awareness such as: personal values, practical practices, reporting skills, English language skills, search engines skills and databases and electronic libraries skills (Al Harbi, 2011; Gilmore & Feldon, 2010; Kszura & Tuttle, 2010).

It was also noted that most previous studies on research skills were limited to research skills among university students at different levels except the study of Al-Busaidi (2000) which focused on research skills among high school students.

Al-Busaidi (2000), Zoby (2003), Hadabi & Al-Jaji Study (2011), Shaqifi (2008) and Leggetter and Sapsed (2011) aimed to explore the impact of training in developing thinking and research skills among students at different levels. Generally, their results showed the effectiveness of training programs in developing research skills. The results of these studies revealed students can acquire research skills by training.

Other studies indicated a positive correlation between thinking skills and achievement and students' personal competencies (Mansour, 2011; Al-Masaeed, 2011; Saadi, 2004; Afana & Nabhan, 2003). Afana and Nabhan (2003) showed the effectiveness of many methods and strategies to teach and develop thinking skills including group learning and individual research, collaborative learning method (Saadi, 2004; Burke & Williams, 2008), 2008), conceptual thinking (Shaqifi, 2008), modeling style (Chiou & Yang, 2006). Shaqifi (2008) showed a positive correlation between conceptual thinking, creative thinking skills and emotional thinking skills.

Research question

What is the effect of a training program based on pictorial research skills based on the zone of proximal development on developing thinking skills for ninth graders?

METHODS AND PROCEDURES

The study used quasi-experimental design. The community of the study were all 185 ninth graders in Rafah Preparatory boys UNRWA school. The sample was 70 students: 35 experimental and 35 control. The pre-test post-test control and experimental group design was adopted in the study as follows:

The Study Design

Group	Pre-test	Intervention	Post-test
EG	O1	X	O2
CG	O3	-	O4

EG is the experimental group, CG is the control group. O1 is the pre-test for the experimental group, O2 is the post-test for the experimental group. O3 is the pre-test for the control group, O4 is the post-test for the control group. X is the experimental variable which is the training program.

The procedures of implementing the experiment group were as follows:

- A preliminary meeting was held with the students to inform them about the objectives of the experiment and the tasks assigned to them during the implementation.
- Administration of the pre-tests for both experimental and control groups.
- Pre-tests were assessed, and score were statistically analyzed.
- Implementation of the training program to the experimental group.
- Administration of the post-tests for both experimental and control.
- Post-tests were assessed, and scores were statistically analyzed.
- Data were statistically treated and analyzed.
- Conclusion was reached, and research report was written.

The study tools and their psychometric characteristics

1. Thinking skills scale

A thinking skills scale was developed in accordance to the following steps:

- Reviewing educational and psychological literature on the subject of thinking skills to identify the thinking skills. One study is Al-Masaeed (2003) which aimed to illustrate the impact of an educational program on the development of basic thinking skills and achievement in geography. Another study is Arnki (2007) which aimed to examine the impact of a training program according to Marazano model on thinking and achievement of students of Engineering. Many references were also used to prepare the scale, including the Teacher's Guide to the Development of Thinking skills (Al-Otaibi 2007), Teaching Thinking skills (Saada, 2006), as well as Developing Thinking skills (Otom & others, 2007).
- Reviewing many measures and tests of thinking skills such as the Thinking Skills Scale (Mansour, 2011), the Thinking Skills Scale (Hadabi & Jaji, 2009), and the Scientific Thinking Capabilities Scale (Amour, 2009) in order to identify major and minor thinking skills to be included and defined.
- The researcher developed eighty (80) items of thinking skills, divided into 4 main skills: (cognitive awareness skills, cognitive organization skills, cognitive discovery skills, rational judgement skills) which were also divided into 16 sub-skills. The items were then refereed by a group of educationalists, psychological experts and educational measurement specialists, and then the necessary adjustments were made.
- The scale first draft was then administered on a sample of 20 ninth graders in order to determine the appropriateness of the scale and the clarity of items and instructions. The items of the thinking skills scale were divided as follows:

(1) **Cognitive awareness** (2) **Cognitive organization**

(1.1) problem identification: items (1-5)	(2.1) classification: items (26-30)
(1.2) planning: items (6-10)	(2.2) comparison: items (31-35)
(1.3) questioning: items (11-15)	(2.3) arrangement: items (36-40)
(1.4) goals setting: items (16-20)	(2.4) summarization: items (41-45)
(1.5) collecting information: items (21-25)	
(3) **Cognitive discovery**	(4) **Rational judgement**
(3.1) prediction: items (46-50)	(4.1) interpretation: items (61-65)
(3.2) hypotheses generation: items (51-55)	(4.2) evaluation: items (66-70)
(3.3) conclusion: items (56-60)	(4.3) report writing: items (71-75)
	(4.4) presentation: items (76-80)

Thinking scale scoring

- The scale consists of (80) questions divided into 4 key skills.
- Each item weighs one score, the total scale weighs (80) scores.
- A score is given on each correct response, and (zero) is given on the wrong response and on items that have no response.

Thinking scale validity and reliability

The scale's face validity was verified by a group of experienced referees in Palestinian and Jordanian universities. Agreement among referees reached over 80% indicating the scale was valid. Some adjustments were made including the increase of time allocated from 60 minutes to 90 minutes. Students of the pilot sample, who attempted the Scale initial administration, asked for more time.

In addition to face validity, the construct validity was verified by calculating the correlation coefficient between the score of an item and the overall scores of the scale. The correlation coefficients ranged between (0.30 - 0.88) which are statistically significant at the level of significance (α = 0.05).

For reliability, test-retest strategy was used. The scale was administered on a pilot sample, homogenous with of the study community, of (20) ninth graders who were randomly selected and then excluded from the study sample. Three weeks later, the scale was re-administered, and then the correlation coefficient between scores of individuals of the two scales were calculated. Pearson's correlation coefficient between the scores of the first and the second administration was 0.91. This means the correlation coefficient is directive indicating reliability.

For emphasis, the researcher examined internal consistency using alpha Cronbach formula which reached 0.90 indicating high reliability. A matrix of correlation coefficients among all items was also developed. Those coefficients were all greater than 0.30 indicating high reliability, too.

2. Zone of proximal development rating scale

To achieve the goal of the study, the researcher developed a tool to estimate the zone of proximal development according to the Vygotsky's model which is the distance between the actual level of independent performance and the potential level of dependent performance. No tool was found to identify and measure the zone of proximal development, so the researcher built the scale in accordance to the philosophy of Vygotsky theory.

The assumptions state the learner's level of learning is determined by his or her ability to benefit from assistance and to learn in social contexts. Vygotsky's theory says each learner has two levels: the current level of performance and the possible level of mental development that he or she can reach after receiving assistance. Thus, the learner is determined by the Vygotsky's model on his ability to learn, and build to reach the zone of proximal development (Zaza, 2010).

The zone of proximal development rating scale aims to reveal the current level of knowledge and skills a student has about research skills. As a result, the researcher can estimate the assistance and mental support necessary to reach the possible performance level which enables a student to master research skill independently. This level of mastery is preceded by collaborative learning under the supervision of an adult or in cooperation with a competent peer. In summary, the scale aims at:

1. Identify the tasks students can perform independently.
2. Identify the tasks students can perform under guidance of others.
3. Determine the support that trainee students need from the teacher or an experienced colleague which enables them to complete the tasks independently.
4. Identify tasks that students cannot accomplish alone or even with the help of others, which are linked to other factors such as maturity. These tasks are out of the zone of proximal development.

The zone of proximal development rating scale consists of (16) cards. Each card targets a research skill: (problem identification, planning, questioning, setting goals, collecting information, classification, comparison, arrangement, summarization, prediction, hypotheses generation, conclusion, interpretation, evaluation, report writing, presentation).

Each card contains three tasks related to research skills and measures a particular component of the skill as follows:

1. Task one measures the student's awareness of what the skill is.
2. Task two measures the student's ability to explain the skill with examples.
3. Task three measures the student's ability to apply the skill in different situations.

The allocated time for the tasks of each card is (5) minutes. Each card is applied individually before starting the skill training. The zone of proximal development rating scale has been validated by referees from Palestinian and Jordanian universities, as well as some experts working in the field of education. The card helps dividing students into groups in the next meeting so that each group includes an expert student, a competent student and a lower-level student. The following table shows the scale devides students into three categories.

	Rating Levels (1-3)			
Skill Component	**Lower-level (1)**	**Competent (2)**	**Expert (3)**	**Rate**
1. What the skill is.	Unable to define the skill.	Can define the skill.	Define the skill in multiple substitutes.	
2. Explain the skill in exapmles.	Cannot give demonstrating examples for the skill.	Give demonstrating examples for the skill.	Give multiple contextual demonstrating examples for the skill.	
3. Apply the skill in different situations.	cannot apply the skill.	Can apply the skill.	Can apply the skill accurately in different contexts.	

3. The training program based on pictorial research skills

The researcher developed a training program designed to train students research and thinking skills according to their zone

of proximal development. It included (34) training sessions, (45) minutes each. It was delivered on an average of three training sessions per week. The program is mainly about four major skills: Cognitive awareness, Cognitive organization, Cognitive discovery and Rational judgement. These skills are taught through pictures, charts, graphs and illustrations that work as activators and organizers.

The program is based on Vygotsky model which studies the distance between the actual level of independent performance and the potential level of dependent performance. Vygotsky's theory says each learner has two levels: current and potential. Thus, the learner is determined by his ability to learn, and to build to reach the zone of proximal development (Zaza, 2010).

The program aims at developing pictorial research skills among ninth graders in accordance to Vygotsky's model. The process of skills training is built on four stages: skill presentation, guided skill training, skill mastery and unassisted practice, skill internalization. The program activities aim at developing research skills including: problem identification skills, problem description skills, questioning skills, planning skills, information collecting skills, classification skills, comparison skills, summarizing skills, concluding skills, analyzing skills, reporting skills, results presentation skills. The program adopts several training strategies including: dialogue and discussion, brainstorming, reciprocal learning, modeling, cognitive scaffolding and cognitive internalization.

The research sample was 70 students: 35 control and 35 experiment. The program was delivered to the experiment group students from the ninth grade of the main refugees' preparatory boys' school in Rafah. The experiment group received three training sessions weekly, (45 minutes) each. The sessions were held in the school library and science lab.

The researcher studied previous studies and literature related to research and thinking skills in order to compile main topics of the training program. He focused on four major research skills: Cognitive awareness, Cognitive organization, Cognitive discovery and Rational judgement.

Some school and life research issues, not associated with any school curriculum, were identified. Students role was to identify, understand and examine these real-life situations to develop appropriate solutions. These problems were presented through illustrating images collected through the Internet. Some references were used to prepare good research situations including The Independent Research Program (Notage & Morris, 2005), The Skills Development Program for Young Researchers (Killet and others, 2008), Thinking Skills Guide: 100 Thinking Skills (Hussein & Fakhro, 2002) and Teaching Thinking Skills (Saada, 2006). 34 training meetings were designed, as a result, to train students on pictorial research skills.

The training sessions procedures were determined in accordance to Vygotsky's socio-cultural cognitive theory. The program procedures are as follows: (1) skill presentation, (2) guided skill training, (3) skill mastery and unassisted practice, (4) skill internalization.

The researcher prepared a trainer guide and a trainee guide. The trainer guide includes the training session title, major and specific objectives, time needed for the session, materials needed, training strategies, training procedures, the role of the teacher and the role of the student, worksheets, evaluation procedures. The trainee guide includes worksheets for each skill.

The training program validity was checked by a group of referees. It was confirmed the program achieves the objectives for which it was developed for. Referees were told to check general and special objectives, training procedures and worksheets. Some adjustments were made in accordance.

An approval was obtained by the Education Program in UNRWA to apply the program in the selected school. Three weekly sessions were assigned, for ten weeks, 45 minutes each session. The pre-tests were administered on 22nd March 2012. Then, the training program was launched on 24th March till 27th June 2012. Upon completion of the training program, the researcher managed a ceremony for the students who participated to evaluate the training program from their point of view. After the application of post-tests, scores were treated statistically to answer study questions.

The following table is a summary of the training program:

No.	**General topic**	**Sessions number**	**Session's order**	**Session objectives**
1	Program presentation	**1**	**1st**	**1. Get to know the group of students and break the ice, introduce the program and its objectives.**
2	Cognitive awareness	**10**	**2nd – 11th**	2. **The skill of problem identification:** developing the skill of identifying the problems that need research. **3. Planning skill:** training students on preparing in advance for what needs to be done by searching for information related to the problem. 4. **The skill of asking questions:** providing students with skills for formulating good direct questions. 5. **Goals setting skill:** developing the skill of identifying learning outcomes that are expected to be achieved after going through learning experience. **6. Information collection skill:** training students to effectively access sources of information related to research problem using the various tools of information collection.
3	Cognitive organization	**8**	**12th – 19th**	**7. Classification skill:** developing the skill of classifying information based on common characteristics such as colour, size, shape. 8. **Comparison skill:** developing the skill of identifying similarities that help learners organize and store information in a way easy to retrieve. 9. **Arrangement skill:** developing the skill of arranging related concepts, objects or events in sequentially according to a particular criterion. **10. Summarizing skill:** developing the skill of expressing key ideas briefly and clearly.
4	Cognitive discovery	**6**	**21st – 25th**	11. **Predicting skill:** developing students' ability to use previous knowledge to link with existing knowledge. **12. Setting and testing hypotheses:** developing the ability to think of solutions to a problem, test effectiveness and analyse results. **13. The skill of conclusion:** developing the ability of using data or information to reach a conclusion.

5	Rational judgement	**8**	**26th – 33rd**	**14. Interpretation skill:** developing students' ability to make sense of experiences, information and results reached. 15. **Evaluation skill:** developing students' ability to judge the accuracy and adequacy of results, goals achievement, methods appropriateness, the effectiveness of research plan and implementation procedures. 16. **Report Writing skill:** developing students' ability to provide a logical, cohesive summary of the information, facts reached and the procedures carried out at the end of the research. **17. Presentation skill:** developing the skill of presentation in a coherent manner through drawings, images, charts or conceptual maps.
6	Program finishing	**1**	**34th**	**18. Holding a ceremony, evaluating the program, and applying the post-tests.**

RESULTS

The current study aimed to investigate the effect of a training program based on pictorial research skills to develop thinking skills according to the zone of proximal development amon ninth graders by answering the following research question:

- Are there statistically significant differences at the level (α = 0.05) between the mean scores of the experimental and control groups in developing thinking skills after applying the training program on the experimental group?

The research hypothesis is there are no statistically significant differences at the level (α = 0.05) between the mean scores of the experimental and control groups in developing thinking skills after applying the training program on the experimental group.

To test the study hypothesis, averages and standard deviations were calculated. The Analysis of Covariance (ANCOVA) was also used to adjust the impact of pre-tests. The following tables show the results of statistical tests

.

Groups	Mean	Standard deviations	Number
Control group	52.2571	11.4078	35
Experimental group	73.3429	5.16745	35
Total	62.8	13.78573	70

From the table, it is apparent that there was a difference between mean scores of the members of the two groups. The mean scores of the experimental group members on the posttest were 73.3429, while the mean scores of the control group on the posttest were 52.2571.

The reason behind choosing the analysis of covariance maybe the inability to randomly divide the samples. The two study groups were chosen based on the division managed by the school in advance as the school administration did not allow the re-division of the sample members in a random manner for research purposes.

The lack of control over the groups equivalence or over extraneous variables is another rationale for using the Analysis of

Covariance (ANCOVA). Statistical control was managed as a result.

The table shows a significant difference between the mean scores of the experimental and control group members on the post-test

.

Covariance Source	Sum of Squares	Degrees of freedom	Mean Square	F	Significance level
Corrected model	12232.280[a]	2	6116.14	465.174	0
Intercept	840.177	1	840.177	63.901	0
Pre-test	4451.651	1	4451.651	338.578	0
Groups	2546.161	1	2546.161	193.653	0
The error	880.92	67	13.148		
Total	289182	70			
Corrected total	13113.2	69			

a. R Squared = .933 (Adjusted R Squared = .931)

As a result, the null hypothesis is rejected. In other words, there is a difference between the mean scores of the experimental and control group members due to the (Training program) after statistically control the pre-test effect.

In addition, the value of R2 = 0.933 and this indicates that about 0.93 of the variances in the dependent variable (thinking skills) is only resulted by the independent variable (the training program). This percentage statistically proves the impact of the training program on developing thinking skills among ninth graders.

DISCUSSION

The results showed that the training program contributed in developing thinking skills among the members of the experimental group. This was clear due to the difference between the mean scores of the experimental and control group members in favor to the experimental group. This difference happened as a result of the program activities variety and good organization which consequently led to objectives accomplished easily and in short time.

The training strategies adopted in the training were also a reason behind the difference that happened due the training program. The discussion strategy, for instance, greatly helped students develop thinking and research skills. Discussion and dialogue were main strategies in all sessions to encourage learners to interact and reflect till reaching a conclusion that led to internalization. This accordingly led to knowledge and skills transfer to real-life situations. Games strategy created a funny training atmosphere, so students happily enjoyed. The games were purposefully selected leading to training skills especially problem-solving skills. Brainstorming, moreover, contributed in stimulating students to generate ideas and think of alternatives.

Reciprocal learning was another training strategy that had an effective impact in the program because it allowed students to help each others. One student took the role of a trainer and the others as trainees. This, later, widened the zone of proximal development. This agrees with the results of the Burke and Williams study (2008) which aimed to determine the effectiveness of explicit thinking skills teaching to children aged (11-12) using more than one method including cooperative learning. The results showed that there were statistical significances at the level of (α = 0.05) for all the methods used as they proved effective in teaching thinking skills. The

results also revealed that the greatest effect was in favor to the cooperative learning method.

The modeling strategy enabled students to master research skills and to reach their zone of proximal development. Modeling strategy included modeling the performance of the expert, expressing ideas out loud, and encouraging students to think like researchers. In addition, it also included cognitive scaffolding which was the most important strategy in the training program. Cognitive scaffolding supported the transfer of experiences and knowledge by the trainer who provided students assistance to accomplish tasks that were normally difficult to accomplish individually. Mental internalization was the last major strategy in the program. It included activities and training tasks that enhanced the transfer of skills in different social and real-life situations.

Moreover, the prolonged duration of the program greatly contributed in stimulating research and thinking skills among students. The program constituted of 34 sessions, 45 minutes each. This sufficient training period gave the students the opportunity to enough practice research skills that helps achieve internalization, as a result.

Besides, the implementation procedures were specific and clear, as well as the role of the trainer and the role of the trainee. The trainee had the biggest role, while the trainer was a facilitator, a guide and supporter. The procedures of a session included (1) skill presentation, (2) guided skill training, (3) skill mastery and unassisted practice, (4) skill internalization.

The age group targeted by the training program (ninth grade students) is very vital, between childhood and adulthood bridging to adolescence. This stage has the potential to learn research and thinking skills. This is what the researcher felt during the training sessions. There were good interactions among experimental group members which supported the development of thinking skills.

The use of images and shapes, the design and layout of the training program and the training activities all also helped in provoking attention, perception, remembering, visualization and imagination among students. They stimulated motivation towards training tasks completion. As a result, this developed thinking skills. This matches with some studies in this field such as the study of Wooleys (1979), which showed the importance of mental imagery in cognitive and psychological development of a child as well as the development of thinking and intelligence. Lutzker's study (2002), in addition, showed that mental imagery is of great importance in shaping knowledge since images are an effective educational tool.

The high flexibility of training activities and tasks provided students opportunity to think away from complexity. Therefore, the training activities and the illustrated pictorial research skills positively assisted students to use more than a method to solve a problem. Another factor, the training atmosphere was friendly and democratic. It was understanding and respectful. This was a motive for students to communicate freely, participate actively and internalize the skills faster than they used to. The assignments given at the end of each session and followed up the next session also had an impact on developing students' thinking skills.

Besides thinking and research skills, the training program developed other skills among the experimental group members such as dialogue and discussion skills, silent thinking, thinking out loud skill, group thinking, accepting others opinions, good listening and problem-solving skills. This can have a good long-term impact on students' self-esteem and self-confidence.

All the above-mentioned training strategies and training procedures widened the zone of proximal development among ninth graders and consequently developed thinking skills. Therefore, there were statistically significant differences between

the mean scores of the experimental and control groups in developing thinking skills after applying the training program based on the illustrated research skills in favor of the experimental group.

The results of the current study agree with the results of Afana and Nabhan study (2003) which aimed to investigate the impact of learning by research on developing thinking in mathematics among the ninth-grade students in Gaza. The study found statistically significant differences between the two groups, experimental and control group in favor to individual and group research method. The current study results also match with the results of Sanz et al. (2009) which showed statistically differences in favor to the experimental group that was trained in thinking skills among high school students.

The results also agree with Sokol et al. (2008) whose results indicated that experimental group developed innovative thinking skills. This study also agrees with Burke & Williams study (2008), the Al-Masaeed study (2003), the Saadi study (2004), the Khader and Bishara study (2011), and the Al-Otaibi study (2007).

The current study, moreover, corresponds with the general educational trend towards explicit training of research and thinking skills rather than implicit teacher clues and textbook hints. In addition, it also corresponds with the trend of research and thinking skills inclusion in curricula of the different stages. This greatly supports in developing students cognitively, emotionally, behaviorally and morally as research skills encourages students to face the different challenges of life.

Research skills also provided trainee students with the opportunity for social learning and reciprocal learning. The less competent student can benefit from those who are more competent. Consequently, this expands the zone of proximal development. In addition, the training activities and worksheets included in the training program were similar to life experiences, and thus they simulated problems that students face on a daily basis. Regarding teachers, the current study emphasizes on the necessity of developing teachers' abilities both knowledgeably and professionally with regard to research and thinking skills throughout training programs similar to the program proposed, so that they can help students develop their thinking skills.

Furthermore, the results of this study correspond with Vygotsky's theory on which the current study is based. Vygotsky's theory assumes learners internalize knowledge through interaction within different social contexts which develop ideas, concepts and thinking skills. The theory also states a learner has a zone of proximal development that expands through scaffolding provided by the expert teacher or competent peers. This zone is the distance between the real level that is determined by the learner's ability to solve a problem independently, and the potential level that is determined by the learner's ability to solve the problem under guidance of adults or in partnership with peers who are more capable. This is exactly what happened in the training program.

This study, also, agrees with the results of the Gilmore and Feldon study (2010) whose results revealed several factors contributed to the development of students' awareness of research skills, most importantly was the practical practice of research and thinking skills. Kszura and Tuttle (2010), in addition, aimed to identify research skills from the perspective of undergraduate students at the University of New England. Their results revealed differences between the acquired research skills in favor to information gathering skills, followed by writing and presentation skills, and then specialized professional skills.

Another corresponding study is Al-Busaidi (2000) that aimed at identifying the effectiveness of using cooperative learning strategy in teaching history to develop historical research skills (the skill of chronological and locational arrangement

of historical events, and the skill of deducing relationships between the causes and results of historical events). Al-Busaidi's results showed differences in favor to the experimental group that studied history using cooperative learning strategy.

CONCLUSION

The current study aimed to investigate the effectiveness of a training program based on pictorial research skills in developing thinking skills among ninth graders in accordance to their zone of proximal development. Results proved the training program was effective in developing thinking skills due to the difference between the mean scores of the experimental and control group members in favor to the experimental group.

The varied program activities variety and training strategies contributed in the program success. The training adopted the discussion strategy and the dialogue strategy in all sessions to encourage interaction and reach internalization. Reciprocal learning strategy also had great impact since students help each other. One student was the trainer and the others as trainees. This widened the zone of proximal development.

The program constituted of 34 sessions, 45 minutes each. This sufficient training period gave the students the opportunity to enough practice research skills that helps achieve internalization, as a result. The procedures of a session included (1) skill presentation, (2) guided skill training, (3) skill mastery and unassisted practice, (4) skill internalization.

The findings correspond with Vygotsky's theory which assumes learners internalize knowledge through interaction within different social contexts. The theory states a learner has a zone of proximal development that expands through assistance provided by the teacher. This is what happened in the training program as competent learners helped less competent ones.

In the lights of the results, the study recommends more studies be conducted to reveal the effectiveness of the training program based on pictorial research skills to develop thinking skills for other age groups. It also recommends more studies be conducted on thinking skills and research skills with some other variables other than those in the current study. The researcher recommends curricula of different stages include thinking and research skills as well as professionally develop teachers on thinking skills and research skills.

Acknowledgment

The research leading to these results has received funding from Ministry of Higher Education, Research and Innovation (MoHERI) of the Sultanate of Oman under the Block Funding Program. MoHERI Block Funding Agreement No MoHERI/BFP/ASU/01/2020"

REFERENCES

1. Al-Busaidi, S. (2000). The effect of Using Cooperative Learning Strategy in the Development of some Historical Research Skills Among the Third Preparatory School Students. Unpublished master thesis. Sultan Qaboos University, Sultanate of Oman.
2. Al-Masaeed, A. (2011). Relationship of Scientific Thinking skills with General Self Efficiency for the Student according to some variables, Islamic University Journal, Social Studies series, 19th Vol (1), p. 679-707.
3. Al-Masaeed, A. (2003). The effect of an educational program on the development of basic thinking skills and on achievement in geography for sixth graders. Unpublished Phd dissertstion. Amman Arab University, Jordan.
4. Al-Otaibi, R. (2007). Teacher's Guide for developing thinking

Skills (2nded.). Ministry of Education, KSA.
5. Amer, T. & Mohammed, R. (2008). Teach your child how to think. Dar Al Yazory for publishing, Amman.
6. Burke, L. A. & Williams, J. M. (2008). Developing Young Thinkers: An Intervention Aimed to Enhance Children's Thinking Skills. Thinking Skills and Creativity, 3, 104-124.Retrived in 15th Oct. 2021. https://doi.org/10.1016/j.tsc.2008.01.001
7. Chiou, W. & Yang, C. (2006), Teachers modeling advantage and their modeling effects on college students learning styles and occupational stereotypes: a Case of collaborative teaching in technical courses. Adolescence, Vol. 41, No. (164): 723-737.
8. Clagget, F. & Brown, J. (1996). Drawing Your Own Conclusions. Boynton/Cook publisher. U.S.A.
9. Damas, M. (2008). Thinking skills. Dar Gaida for publishing, Amman.
10. Demircioglu, I. (2008). Learning How to Conduct Educational Research in Teacher Education: A Turkish Perspective. Australian Journal of Teacher Education, Vol. 33, No.1, January.
11. Gerges, A. (2010). Learning by research. Care international committee. Retrieved in 15th Oct. 2021. http://www.edutrapedia.illaf.net/arabic/show_article.thtml?id=725
12. Gilmor, J. & Feldon, D. (2010). Measuring graduate teaching and research skills through self-report: Descriptive finding and validity evidence. Paper presented at the Annual Meeting of the American Educational Research Association. Denver, CO, April 30 – May 4.
13. Habib, M. (2007). Recent trends in teaching thinking (independent strategies for the new millennium) (2nd ed.). Cairo: Dar Elfekr Elaraby.
14. Hadabi, D. and Al-Jaji, R. (2011). The effect of training in building and programming robots on the development of creative thinking and scientific thinking skills among a sample of gifted students. Paper presented in 8t Arab Scientific Conference for Gifted and Talented, 15th – 16th Oct., Arab Council for Gifted and Talented.
15. Harbi, S. (2011). The availability of information sources search skills through internet in postgraduate female students in the Education Faculty of Umm Al-Qura University from their point of view. Unpublished master thesis. Umm Al-Qura University, KSA.
16. Hussein, T. and Fakhro, A. (2002). Thinking Skills Guide: 100 Thinking Skills. Dar Juhaina for Publishing & Distribution, Amman.
17. Kazura, K. & Tuttle, H. (2010). Research based learning approach: students' perspective of skills obtained. Journal of Instructional Psychology, Vol. 37, No. 3.
18. Killet, M. and others (2008). Developing the skills of young researchers: a course in teaching the basics of research for upper primary students to secondary stage: a teacher's guide. Supreme Education Council, Qatar.
19. Lee, Tonia. (2009). Teaching Research Skills to Students for the Twenty-First Century. Retrieved April 7/2011 from http://teachingskilledu.blogspot.com/2009/05/teaching-research-skills-to-students.html
20. Leggetter, S. & Sapsed, S. (2011). Developing, enhancing and sustaining research skills in a diverse population of students undertaking a Masters in Public Health: an action research study. E-Leader Singapore.

21. Les, Z and Les, M. (2008). Thinking, Visual Thinking, and Shape Understanding, Studies in Computational Intelligences (86),1-45.
22. Malik, R. S. (2018). Educational challenges in 21st century and sustainable development. Journal of Sustainable Development Education and Research, 2(1), 9-20.
23. Mansour, G. (2011). Achievement in mathematics and its relationship with thinking skills achievement in mathematics and its relationship with thinking skills among 6th graders in Damascus. Damascus University Jurnal, 27 (3), P. 19-69.
24. Margolis, A. A. (2020). Zone of Proximal Development, Scaffolding and Teaching Practice. Cultural-Historical Psychology, 16(3), 15-26.
25. Mayer, W.H., & Richard, E. (1983). Thinking problem solving congnation. 2nd .Freeman and Company, New-York.
26. Murray, T. & Arroyo, I. (2002). Toward Measuring and Maintaining the Zone of Proximal Development in Adaptive Instructional Systems. The International Conference on Intelligent Tutoring Systems**.** Retrieved April 22/2011 from **http://centerforknowledgecommunication.info/publications/pubs6/ZPDOperationalITS.pdf**
27. Nasr, M. (2004). The role of reading in developing research skills in finding solutions for some educational problems. The Egyptian society for reading and education, the 4th scientific conference 7-8 July, 1th vol. Ein shams University.
28. Nottage, S. & Morse, V (2005). The independent research program: teacher's guide. Translated by King Abdul-Aziz institution for talented, KSA.
29. Otom, A., Beshara, M. & Jarrah, A. (2007). Developing Thinking skills. Dar Al-Maseera for distributing and publishing. Amman.
30. Qatami, Y. (2007). Teaching children thinking (1st ed.). Dar Al Massira for Publishing and Distribution. Amman.
31. Qatami, Y. & Aranki, R. (2007). Marzano's model of teaching thinking for university students (1st ed.). Debono for Publishing and Distribution, Amman.
32. Qatami, Y. & Qatami, N. (1998). Classroom teaching models. 1st ed. Dar Al shourouq, Amman.
33. Qatami, N. (2009). Children thinking and intelligence. Dar Al-Maseera for distributing and publishing. Amman.
34. Qatar Supreme Education Council (2010). Research as learning tool for learners. Retrieved in 13th Nov. 2012. **http://www.sec.gov.qa/Ar/Media/News/Pages/NewsDetails.aspx?NewsID=7527**
35. Reed, S. S., Mullen, C. A., & Boyles, E. T. (2021). Problem-Based Learning in Elementary School. Springer International Publishing.
36. Reyami, A. (2002). An evaluation study of some historical research skills necessary for students of the History Department in Colleges of Education in the Sultanate of Oman. Unpublished master thesis. Sultan Qaboos University, Sultanate of Oman.
37. Saada, J. (2006). Teaching thinking skills. 1st ed, Dar Al shourooq for publishing, Amman.
38. Saadi, I. (2004). The effect of training female students on cooperative learning skills on their understanding of scientific concepts and scientific thinking. Unpublished Phd dissertstion. Amman Arab University, Jordan.
39. Sanz, L. Sanz, T. Goicoa, T. and Cordelle, M. (2009).

Enhancement of Thinking Skills: Effects of Two Intervention Methods. Thinking Skills and Creativity, Vol.4, No.1, p30-43.

40. Shabani, K. Khatib, M. and Ebadi, S. (2010). Vygotsky's Zone of Proximal Development: Instructional Implications. Canadian Center of Science and Education**,** Vol. 3, No. 4.
41. Shaqifi, M. (2008). The Effectiveness of Imaginary Thinking Training Program on Developing Creative Thinking and Emotional Intelligence on Skills for a Sample from Sixth Graders in Jeddah City-Kingdom of Saudi Arabia. Unpublished PhD dissertation. Jordanian University, Jordan.
42. Shawaheen, K. & Badandi, Sh. (2009), Developing thinking skills for children (empirical applications). Dar Al Musayyer for publishing, Amman.
43. Shawish, A. (2012). The effect of thinking on cultural construction. Dar Al-Mofradat for distributing and publishing. Ryyad.
44. Shuqier, M. & Abu Shabban, S. (2006). The impact of the use of WebCT on the development of the skills of scientific research among students of the Faculty of Education at the Islamic University of Gaza. The First Bahrain Conference for E-Learning, Bahrain.
45. Sokol, A., Oget, D., Sonntagb, M., & Khomenkob, N. (2008). The development of inventive thinking skills in the upper secondary language classroom. Thinking Skills and Creativity,Vol.3, Issue No.1, April 2008, Pages 34-46.
46. Thabet, Z. (2011). Learner's guide for research. Ministry of Education: Gaza.
47. Torrance, E. P. (1993). Interpreting the nature of creativity as manifest testing, In R. J. Sternberg (Ed), The nature of creativity**,** Cambridge Ma: Cambridge University press.
48. Tolisano, Silvia (2008). How to Do Research. Retrieved May 20/2011, from http://langwitches.org/blog/2008/12/.../print
49. Zagol, R. & Zagol, E (2008). Cognitive Psychology. Dar Al-Shorouq for distributing and publishing. Amman.
50. Zoby, T. (2003). The relationship between the use of concept maps in teaching research methods in education and psychology for education diploma students and their acquisition of research skills. Derasat Jurnal, Jordainian University, 30 (2), P. 369 – 385.
51. Zaza, H. (2010). Cognitive behavioral learning. In Qatami, Y. Educational Psychology in theory and application (p.147 – 206). Dar Wael for publishing. Amman. http://langwitches.org/blog/2008/12/.../print