Impact of Creative Problem Solving Program on the Development of Creative Thinking Skills Among University Female Students

Sumaya A. Ahmed  
Associate Professor of Educational Psychology, Faculty of Social sciences, University of Jeddah, Saudi Arabia

Shrooq G. Alzahrani  
Assistant Professor of Cognitive Psychology, Faculty of Social sciences, University of Jeddah, Saudi Arabia

Abstract. The present study aims to investigate the impact of a Creative Problem Solving (CPS) program on improving the creative thinking skills among the third level female students at Psychology Department, College of Education, Jeddah University. Using the quasi-experimental approach, an educational program based on CPS was prepared and applied to a sample of (30) students. Pre-post- and successive tests of Torrance Test of Creative Thinking (TTCT) were conducted. Results revealed that there were statistically significant differences in the skills of fluency, flexibility and originality in favor of the post-test. There were no statistically significant differences in the means of the participants’ scores in creative thinking skills (i.e. fluency, flexibility and originality) and the total score in the post and successive test suggesting the continuity of the positive impact of the program.

Keywords: creative problem solving program CPS, creative thinking skills

Introduction
Using creativity to solve problems is one of the skills that assist the individual in coping with the rapid changes in the community and finding solutions for the problems (Lavonen, Lattu & Meisalo, 2001).

Two approaches have emerged to handle CPS. The first approach addressed the utilization of CPS in creativity development, in general, and problem solving, in particular, such as Wheeler (2001), Grimes (2001) and Johnson (2000) who aimed to develop creative thinking among different age groups and concluded that CPS programs contribute to developing creativity. The second approach revealed that using CPS in practicing and learning is influenced by some factors, such as the applied cognitive and creative methods.

Alex Osborn is the founder of Creative Education Foundation and the developer of CPS method (Isaksen & Treffinger, 2005). He also developed brainstorming method in 1963, which was adopted to encourage classroom creativity (Al-Safi, 1997).

Program designers found in CPS models a way to understand and describe the creative process and its stages. Accordingly, they could procedurally formulate their concepts of creativity and develop obvious practical procedures that stimulate and activate creative abilities (Amer, 2003).

Guilford (in Bower, 2008), argued that CPS relies on divergent thinking, which comprised fluency, flexibility and originality skills. Torrance (in: Whitelaw, 2007), asserted that creativity is a strength that helped students use
fluency, flexibility and originality skills to solve open-end problems. CPS aims to improve learner's creative abilities through the proper guidance of his/her mental abilities (Aziz, 2006).

Qatamy (2008) stated that the development of creative thinking is a practicable process because learner is born with multiple mental capabilities that include various mental processes. In addition, experience and environmental conditions prepare individuals for excellence, so that they can identify the elements of the surrounding environment and changes and reach a clairvoyance. Several methods can develop the learner's creative abilities, including brainstorming which is one of the most adopted CPS methods by various institutions. Brainstorming session aims at generating different thoughts that lead to problem solution (Jarwan, 2002).

Teaching thinking skills involves three fundamental approaches: The first is to teach it as a separate subject; the second is that thinking skills are better developed through the curriculum, and the third is that thinking skills should be independently taught within the courses. It is noteworthy that the first approach enables students to prioritize skill, which will be easily evaluated. Consequently, students will apply the acquired skills to their practical and social life as well as to their ability to make decisions and adapt to environmental changes.

The topic of creativity has been differently addressed in the literature, which emphasized the importance and necessity of teaching creativity in the educational institutions, paying attention to students’ capabilities and delivering information in a method that allows them to think freely. Previous studies also recommended using creative abilities in solving everyday problems, which require various, unconventional and innovative solutions. The individual frequently encounters problems whose solutions are unavailable, so they require new workable ones.

Using CPS in teaching thinking skills contributes to the formulation of the learner's personality. Education substantially endeavors to prepare a more effective individual who can meet personal as well as social requirements. Hence, when the student is trained to unconventionally use mind and thinking skills, s/he can keep pace with the cognitive and technological development.

CPS model is an organized process in which productive thinking tools are used to understand problems, generate creative ideas, as well as evaluate and implement possible solutions. Therefore, the individual has to know the skills of problem solving and creative thinking. Many studies have been aimed to use CPS model in creativity development, including Amer (2003), Welton (2004), Isaksen & Treffinger (2005), Albakr (2005), Alqady (2006), Bowyer (2008), Bakr (2011), Mahmoud (2012); Jarwan and Alabady (2014), Ashour (2015), Rahma and Mekky (2016), Jarad (2017), Balgon (2017), Eltamima, Abu Olwan & Alabed (2018), and Ulger (2018).

Kabanoff and Rossiter (1994) contend that brainstorming is one of the means used to solve problem, as it helps identify the problem, figure out possible solutions, evaluate these solutions and select the optimal one. It is also used as a teaching method that develops the learners' ability to solve problems creatively because they have the opportunity to generate many ideas spontaneously and freely. Then, they evaluate these ideas and select the optimal solution (Zayton, 2003). Alateby (2002), Hamdan (2003), Alqaumy (2002), Salama (2005), Aziz (2006); Alashqar (2007), Alqahtany (2008), Almahous (2009), Tashman (2010) and Omar (2012) confirmed that brainstorming is one of the appropriate strategies, which helps develop the skills of creative thinking.
The present study recommends teaching thinking skills as a separate subject because it develops learners' mental skills and improves their performance in the various educational tasks. Thus, they will be capable of facing the different challenges of the highly competitive and rapidly changeable world. Moreover, they will be mentally well and tremendously creative, so they can harmonize with the environment (Abu Jado & Noufal, 2007).

Statement of the Problem
Shabe (2004), Cho & Kim (2006), Kandemir (2009), Scheinholtz (2009), Chiu (2009) and Lin (2010) indicated a decline in CPS skills despite the emergence of several developed programs in this field. Furthermore, researchers focus on the theoretical rather than the practical aspect of creativity. In addition, training programs that use thinking skills as an independent subject to teach creative thinking skills in the Arab psychological literature, are scarce. Accordingly, the author conducts the present study to overcome the gap between practice and theory. Statement of the problem is defined in the following two questions:

1. What is the impact of a CPS program on developing creative thinking skills among the participants?
2. What is the impact of a CPS program on developing creative thinking skills among the participants after one-month application?

Objectives
1. The study aims to identify the impact of a CPS program on developing creative thinking skills among the participants.
2. The study aims to identify the impact of a CPS program on developing creative thinking skills among the participants after one-month application.

Significance
- Investigating creativity in relation to problem solving is one of the most important issues that attracts the attention and interest of researchers, because it provides the individual and the community a great opportunity to deal with problems in a new and effective way.
- The approach of problem solving-based learning represents one of the most important developments in the field of education. It is actively employed in numerous western universities because of its distinct characteristics that makes it effective, unframed and active learning. It also permits trying learning methods consistent with the nature of the problem in question.

Concepts
Educational program: a number of theoretical and practical experiences as well as activities prepared according to CPS model using mind maps and graphic organizers for skillfully generating possibilities depending on the strategy of brainstorming in (12) sessions (two sessions per week), a 50-minute session throughout (6) weeks.
CPS: An organized process uses techniques and tools to creatively solve the problems. The present study refers to it with the total score, which the student obtains in TTCT. It represents by the total scores of fluency, flexibility and originality.
Creative Thinking Skills: A number of mental skills that address the information (inputs) related to the problem in order to find creative solutions. They comprise originality, flexibility and fluency.
1. Fluency: It means generating numerous ideas or responses appropriate for a problem solving. It involves three types:
1-1 Ideational Fluency: The individual's consciousness of the problem and providing several solutions in a definite time.
1-2 Associational Fluency: The individual's ability to describe a situation or an event and to identify its details and the relationships that connect its aspects in addition to the concepts and the meanings that reflect these relationships. Moreover, his ability to create other alternative ideas that reflect such relationships.
1-3 *Expressional Fluency:* The individual's ability to define the concept of a situation using his current experiences, to generate consistent ideas that reflect it, to identify its precise features using these ideas, and to create various expectations relevant to the situation.

2. **Flexibility:** The individual's ability to create multiple alternatives to solve a problem spontaneously, to change his thinking course on solving it, to classify the solutions proposed into categories, and to propose other solutions to be involved in these categories.

3. **Originality:** The individual's ability to create a number of unfamiliar, scarce, and novel solutions as well as ideas.

**Limitations**

**Objective limitations:** CPS program (independent variable) and creative thinking skills (dependent variables).

**Spatial Limitations:** Kingdom of Saudi Arabia, Jeddah, Jeddah University, College of Education.

**Temporal Limitations:** First semester of the academic year 2017/2018.

**Literature Review**

**First: Creative Problem Solving**

Albakr (2005) distinguishes between the method of familiar problem solving and CPS. He claims that the first aims to familiarly find a proper solution to the problem and does not require originality, while the second aims to find proper novel solutions and requires that the learner has the potential to master the essential skills of creative thinking (fluency, flexibility, originality, elaboration, and sensitivity to problems).

There are numerous theoretical approaches on problem solving, including the cognitive approach whose authors and supporters see the problem as an imbalance in the cognitive sphere, which must be addressed through rebuilding or reshaping it in a balanced form. They also emphasized the necessity of proper thinking, which helps find the problem possible solutions (Jamal, 2001).

Explanation of information processing approach to solve problems is based on its original concept, namely the assumption that there is a similarity between the cognitive processes the individual adopts in solving problems and the processes the computer carries out to process information. Both receive and handle the information or the external stimuli using specific cognitive strategies and create final responses which subsequently represent solutions to the problem (Brightman, 1990).

Models that explain creativity and its connection to problem solving are similar to the model developed by Wallas in (1926), the first model to explain the process of creative thinking. Parnes, Naller, Bundi, Isaksen and Treffinger proposed a model consisting of five stages: searching for information, defining the problem, creating ideas, finding a solution or solutions and accepting the solution. Whereas, Basadur, Graen and Green defined three stages of creativity and problem solving: defining the problem, solving the problem, and implementing the solution; in Hegan, 1999). CPS models have relied on the definitions of the creative process that emphasize the similarity between the stages of problem solving and the stages of access to creative outcome. They differ in that in the case of creativity the outcome should be novel and appropriate. Torrance (1972) confirmed that the solution is creative if it is new and valuable for both the individual who thinks as well as his culture. It should not be conventional, i.e. it modifies or rejects the formerly accepted thoughts. In addition, they require accuracy in defining the problem as well as detecting the relationships and ideas necessary to achieve creative outcomes (Alkanany, 2005).

CPS requires both convergent and divergent thinking. The process of generating ideas to reach various options requires divergent thinking, while the process of evaluating
options and making a decision requires convergent thinking (Van-Gundy, 2005). Amer (2003) demonstrated a positive correlation between the competence of problem solving and the individual's creative method as well as awareness of his/her creative processes, whether they are related to the general creative competence of problem solving (represented by the total score) or to the qualitative indicators of competence (problem detection, fluency, originality, and elaboration).

Albakr (2005) addressed the impact of problem solving on the development of creative abilities (fluency, flexibility, originality, elaboration) among the six-grade primary pupils in Riyadh. Results showed no statistically significant differences in the abilities of fluency and flexibility in favor of the experimental group. Moreover, there were no statistically significant differences in the abilities of originality as well as elaboration between the two groups. Alqady (2006) aimed to investigate the effectiveness of a future problem-solving program modified for creative abilities development in Bahrain (originality, flexibility, fluency, and elaboration) as well as high thinking skills (composition, analysis and evaluation). Results revealed statistically significant differences between the means of the experimental and the control groups in the abilities of (fluency, flexibility, elaboration, and total score) in the post-test in favor of the experimental group, while originality achieved no statistically significant differences. Jarwan and Alabady (2014) investigated the impact of CPS program on the development of creative thinking skills among the talented students with learning disabilities. Results showed differences in the means of the experimental and control participants in the skills of fluency, flexibility and originality in favor of the experimental group.

Eltamima, Abu Olwan & Alabed (2018) aimed to identify the effectiveness of CPS program in the development of mathematical abilities among the eighth grade students in the light of their mathematical achievement. To achieve that, a program was designed to help the students employ CPS strategies in a number of activities and mathematical problems involved in algebraic expression unit. In addition, mathematical ability test was designed to measure the students' pre and post-performance. Results revealed a statistically significant difference in the means of the participants' scores in mathematical ability test in favor of the experimental group.

**Second: Brainstorming Strategy**

Osborn (1938) is the developer of brainstorming strategy, which is the most widely used in the field of education to develop creative thinking. Brainstorming means the use of the mind to actively address the problem and it is one of the methods, which stimulates thinking as well as creativity. Al-Safi (1997) states that brainstorming is creative ideas and opinions generated by the individuals and groups to solve a certain problem. Osborn (1963) defined four basic rules of brainstorming, as follows:

**No criticism:** Criticism of ideas are withheld during the brainstorming session as the purpose is on generating varied and unusual ideals and extending or adding to these ideas. Criticism is reserved for the evaluation stage of the process. This allows the members to feel comfortable with the idea of generating unusual ideas.

**Welcome unusual ideas:** Unusual ideas are welcomed as it is normally easier to "tame down" than to "tame up" as new ways of thinking and looking at the world may provide better solutions.

**Quantity Wanted:** The greater the number of ideas generated, the greater the chance of producing a radical and effective solution.
Combine and improve ideas: Not only are a variety of ideals wanted, but also ways to combine ideas in order to make them better. Zyad (2006) referred to the potentiality of using brainstorming strategy with its various stages in problem-based learning to identify the problem and to discover and create ideas or alternative solutions, as follows:
- Problem formulation stage
- Problem development stage
- Brainstorming of an item or more of the problem items that have been developed. This stage also involves the stimulation of several thoughts.

Brainstorming is a modern educational method that motivates creative thinking as well as CPS and develops the students’ latent capacities freely and respectfully. Brainstorming sessions are educationally beneficial, as they create the opportunity for creative group effort, motivate learning and distinct achievement, lead to creative ideas that solve problems, develop students' communication, leadership skills and awareness of time importance, help the teacher manage the classroom, motivate mind openness and creative thinking, create collaborative classroom, respect other viewpoints and provide students-centered teaching. They also help employ classmates thinking power to reach ideas on a particular topic using high mental abilities, such as analysis, combination and evaluation within a definite time (Khedr, 2006).

Brainstorming has proved success in different situations that require creative solutions because it enables learners to think freely with no evaluation or criticism, which may inhibit thoughts and make the learner frightened or concerned with the quality rather than quantity (Nbhah, 2008). Alateby (2002) explored the effectiveness of brainstorming strategy in the development of creative thinking abilities among the first grade intermediate students compared to the conventional method. Results showed a positive impact of brainstorming strategy on the development of creative thinking abilities among the experimental group participants. Alqaumy (2002) handled the effect of brainstorming strategy used in teaching history on the development of creative thinking among the first secondary grade students in Oman. Results indicated that the experimental group, which adopted brainstorming strategy, outperformed the control group, which used the traditional method, in the total creative ability as well as the skills of fluency, flexibility and originality.

Aziz (2006) aimed to identify the effect of the brainstorming program on the development of creative thinking. Results revealed statistically significant differences in the means of creative thinking between the experimental and the control group students in favor of the experimental group.

Third: Creative Thinking Development
Some authors have attempted to date the design of training programs aimed at creative thinking development since 1930s, especially Crawford who attempted to design a program for creativity development in 1931 in the United States. In 1962, Mednick developed a program that stimulates connection among conflicting elements. It is based on reaching the individuals' rare responses in normal situations relevant to free association of independent words. It also stimulated the other individuals, who were trained on thinking creatively to associate those rare responses with the original stimuli.

Programs of developing creative thinking development and its skills have been varied according to the theoretical and experimental approaches that addressed it. De Bono Thinking Program (Cognitive Research Trust) to teach thinking skills, handles creativity as a natural part of the thinking process, so students can learn and train on it. Davis's Program of creative imagination applied to the seventh grade students in America (1986). Results
showed that students in the experimental group generated 65% of the divergent ideas in the three assignments, which is much higher than that of the control group. Productive thinking program is a self-programmed learning and one of the most addressed and evaluated programs. Studies showed that the students used the program in creatively solving problems excelled the control group. In addition, results of other pilot studies demonstrated that the participants of the experimental group applied what they have learned several months after practice (Albakr, 2007).

Raml (2010) aimed to investigate the effectiveness of enrichment activities in the development of creative thinking (fluency, originality, flexibility and elaboration) and the achievement of mathematics among the fifth primary grade students in Mecca. Results revealed that the participants of the experimental group outperformed those of the control group in the means of creative thinking skills (fluency, originality, flexibility and elaboration) and achievement.

Khedr (2015) aimed to investigate the effectiveness of enrichment activities in the development of creative thinking (fluency, originality and flexibility). Results showed that employing enrichment activities in teaching geography leads to the development of creative thinking skills, in general, and sub-skills (fluency, flexibility and originality), in particular, among the eighth primary grade students.

Hamdy and Alsoror (2016) aimed to investigate the effect of the right intelligent system of knowledge “RISK” program on developing the creative and critical thinking skills among high school students in Jordan. Results indicated differences between the participants of the experimental and the control groups in the skills of originality and flexibility as well as the total score in TTCT in favor of the experimental group. Furthermore, there were no statistical differences in originality skill between the two groups.

Literature review indicates that the researchers have given great concern to the development of creativity and its skills. Results demonstrated the importance of CPS programs in the development of creative thinking in different samples. The present study addresses creativity and its skills practice using an educational program that handles teaching thinking skills as an independent subject in thinking strategies course for the third level students at Psychology Department in the females’ College of Education. Moreover, brainstorming strategy was adopted in the program sessions. Furthermore, the present study is one of the psychological researches concerned with the development of creative thinking skills among university students.

Hypotheses

- There are statistically significant differences in the participants’ mean scores in TTCT (i.e. fluency, flexibility and originality) and the total score in the pre- and post-test due to the utilization of CPS program.
- There are no statistically significant differences in the means of the participants’ mean scores in TTCT (i.e. fluency, flexibility and originality) and the total score in the pre-test and the successive test after one-month application of CPS program.

Methodology & Procedures

The quasi-experimental approach; pre- and post-test of the inequivalent control group is adopted.

Sampling

The sample consists of (30) third level female students (aged 19-21) at the Department of Psychology, College the female section of college of Education, Jeddah University.

Tools

I. Torrance Test of Creative Thinking (TTCT):

It is prepared by Torrance in (1998) and comprises the three following activities:
Activity 1 (Picture Construction): The person constructs a picture using a pear shape or jelly-bean shape as a stimulus on the page. The shape must be an integral part of the composition. This activity gets at the tendency to find a purpose for something that has no definite purpose and to elaborate it so that a clear purpose emerges. The picture measures the skills of originality and elaboration. Originality, in this activity, is estimated by response degree, while elaboration is measured by estimating the number of different ideas and details of the response.

Activity 2 (Picture Completion): This activity requires a person to use 10 incomplete figures to make and to name (label) an objector picture. It calls into play the need to structure integrate and present an object, scene or situation. It measures the four creative skills (i.e. fluency, flexibility, originality and elaboration). Fluency is estimated by the number of figures the person creates, flexibility is estimated by the different categories of his/her responses, originality is estimated by the less frequent responses, and elaboration is estimated by the details he/she adds to the main idea.

Activity 3 Lines and Circles (repeated figures): This activity consists of three pages of lines or circles; the person makes objects or pictures using the lines or circles and adds titles or names at the bottom of each picture. It requires an ability to return to the same stimulus again and again, perceiving it differently each time, disrupting structure to create something new. It measures the four creative skills (i.e. fluency, flexibility, originality and elaboration).

Fluency is estimated by the number of figures the person creates, flexibility is estimated by the different categories the person makes for each figure, originality is estimated by the less frequent responses, and elaboration is estimated by the details the person adds to his or her main idea.

TTCT psychometric characteristics:
Validity: Consistency among the test items was (0.40-0.89). Estimating the factor analysis of the test items (fluency, elasticity, originality and elaboration) showed that they were not independent factors. Correlation coefficient among the items of the figural and verbal test was (0.05-0.26), which is low and statistically insignificant. This indicates that one test could not measure creative ability, but it requires the utilization of verbal and figural creative thinking as well as academic achievement, which revealed insignificant relationship.

Reliability
A random sample of the participants' responses (20) was selected after grading. Another colleague experienced in creative thinking skills graded the responses. Correlation coefficient of the two methods of grading was estimated and showed statistically significant results at the level of (0.01). They were (0.92, 0.92, 0.95) for the skills of creative thinking (i.e. fluency, flexibility and originality), respectively. They are high values indicating that it is a highly reliable scale.

II. Learning Program
The program is based on Guilford Three-Dimensional Model of Intellect Structure, which handles the factors of diverging thinking. Thinking Strategies Course, which the participants study as an independent course, was selected because it involves the whole aspects that made it appropriate for the development of creative thinking skills, as quoted by Logan & Logan, 1971 in Al-Safi (1997):
- It enhances individual differences and excellence among students.
- Its various content motivates students to learn.
- Its practices address students' problems as well as requirements and meet the community needs of the teachers who have creative thinking skills.
- It is associated with the other courses because it teaches them how to think.
- It is an effective method of interaction between the teacher and the student and involves the other feature developed by Learning Unit at the University of Wales in 1985, as follows:
  - The course develops the abilities of creative students through raising their interest in the environment and motivating them to discover it.
  - It provides self-learning.
  - It evaluates teamwork and comprises relevant practices.
  - It delivers the approach of problem solution as a method of thinking that handles the subjects of the course.

*Program general objective*

The program aims to develop creative thinking skills using CPS.

*Program Special Objectives*

- The trainees should use CPS when solving the problems presented within the sessions.
- They should use brainstorming strategy to generate ideas and solutions to the problems proposed.
- The student should share ideas with the teamwork.
- The trainees develop the ideas to become practical and generate new ones.
- The trainees evaluate the proposed ideas to get the ideas appropriate for problem solution.
- The impact of training appears on solving the environmental problems.

*Means of achieving the objectives*

To achieve the objectives, the following means were adopted:
- The course content and the experiences involved were defined to be consistent with the program objectives and to include the whole objectives.
- The program adopted the strategy of brainstorming, cooperative learning and discussion.
- Group and individual activities.

The following seven factors, suggested by Rubin and Beckhard (1984), are the fundamental for teamwork success, including clarity of objectives, clarity of each member internal and external role, participation in decision-making, clarity of communication methods and models among the members, leadership and availability of the rules and regulations that regulate the teamwork (Kolb et al., 1991).

*Organizing the program content*

The program content was organized in (8) educational sessions.

*Program sessions design*

The researcher adopted the method based on thinking maps and graphic organizers to generate probabilities skillfully. The following figure illustrates the topics of thinking skills learning courses as well as the system of sessions within the program (Swartz & Parks, 2005). The long-term practice that consisted of a number of sessions was adopted, whereas each session involved definite tasks and goals. This type is prolonged, valuable and effective (Oxford, 1996).

<table>
<thead>
<tr>
<th>Session components</th>
</tr>
</thead>
<tbody>
<tr>
<td>An introduction to the content and process of thinking skill.</td>
</tr>
<tr>
<td>The researcher's comments on proposing the content objectives.</td>
</tr>
<tr>
<td>The presenter identifies the student's prior knowledge of the content in question and defines its significance as well as relevance to the content of the session.</td>
</tr>
<tr>
<td>The researcher's comments on thinking process and its significance.</td>
</tr>
<tr>
<td>The presenter stimulates student's former knowledge of thinking process skill, reviews the skill or process of thinking, and clarifies the value as well as the importance of thinking skillfully.</td>
</tr>
<tr>
<td>The introduction represents the basis of the thinking process and emphasizes the benefits of doing it</td>
</tr>
</tbody>
</table>
skillfully.

Active thinking
Thinking that involves verbal instructions and charts.
The main activity of the researcher is to connect and create thinking skill clearly and specifically. Consequently, the students are directed to charts and verbal instructions involved in thinking skill and easily comprehend the content as well as the objectives of the session.

Reflection on Thinking
Disconnected activities that assist students to reflect on the process of thinking. The researcher asks the students direct questions on their thinking. Meta-cognition map leads to the elements of the questions. Students reflect on their thinking method, the plan they have adopted and the effectiveness of their thinking.

Thinking Practice
Activities, including the student's spontaneous adoption of the skill in other examples, transfer the impact of practice. Two areas comprise these activities: divergent and convergent activities that follow the subject of the session. Within the subsequent reinforcement throughout the program, those two types involve less intervention by the researcher in the thinking process than in the active thinking section.
Direct transference of practice impact.
Close transference of practice impact.
Distant transference of practice impact.
Application of the process within the same session or to a content similar to the session in the future.
Application of the process within the same session or to a content different from the session in the future and reduce the researcher's intervention in thinking process.
Subsequent reinforcement.
Application of the process to a content different from the session within the semester and reduce the researcher's intervention in thinking process.
Evaluation of the student's thinking skills.
Oral or written assignments and projects that demonstrate the effective use of the skill or thinking process.

Figure (1) Training Sessions Design

Program validity: Six specialists in education and psychology reviewed the program to check its validity, relevance, objectives, sessions and methods. Then, it was modified according to their views.

Procedures of implementing CPS session:

The CPS session was implemented using brainstorming strategy as follows:
- Discussion of the session topic to present a five-minute theoretical introduction of the skill that will be learned. This stage is considered an introduction to thinking skill.
- Delivering mind map and graphic organizer of the skill.
- Delivering a problem to be solved in the active thinking session as a practice of employing the skill.
- Explaining how to use the skill and reminding the participants of brainstorming rules for (5) minutes.
- The team leader writes the ideas on a sheet and displays it to the students, and then the researcher writes these ideas on the blackboard as soon as all groups finish presenting their ideas.
- The researcher stimulates the participants when they stop generating ideas. She, for instance, asks them to identify and develop the unfamiliar idea to use it. She also asks them to connect and reflect on the presented ideas to obtain a new idea.
- She discusses the presented ideas to be evaluated and classified into:
  - Original, beneficial and applicable ideas.
  - Beneficial and indirectly applicable ideas that require further research.

Table (1) Differences between pre- and post- TTCT, total score of creative thinking and effect size.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Arithmetic Mean</th>
<th>Standard Deviations</th>
<th>Freedom Degree</th>
<th>T value &amp; Significance</th>
<th>Effect Size 2η</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pre-tests</td>
<td>post-test</td>
<td>pre-test</td>
<td>post-test</td>
<td></td>
</tr>
<tr>
<td>Fluency</td>
<td>16.13</td>
<td>32.76</td>
<td>3.78</td>
<td>7.86</td>
<td>29</td>
</tr>
<tr>
<td>Flexibility</td>
<td>6.63</td>
<td>16.30</td>
<td>3.17</td>
<td>4.72</td>
<td>29</td>
</tr>
<tr>
<td>Originality</td>
<td>2.46</td>
<td>6.33</td>
<td>1.19</td>
<td>1.47</td>
<td>29</td>
</tr>
<tr>
<td>Total Creative Thinking</td>
<td>25.23</td>
<td>55.40</td>
<td>4.88</td>
<td>11.02</td>
<td>29</td>
</tr>
</tbody>
</table>

**Significant at 0.01

Table (1) shows statistically significant differences at the level of (0.01) in favor of the post-TTCT (i.e. fluency, flexibility and originality) using CPS. The result is consistent with that of Amer (2003), Welton (2004), Isaksen & Treffinger (2005), Albakr (2005), Alqadi (2006), Bowyer (2008), Laurie (2009), Bakr (2011), Mahmoud (2012), Jarwan and Alabady (2014), Ashour (2015), Rahma and Mekky (2016), Jarad (2017), Balgon (2017), Eltamima, Abu Olwan & Alabed (2018) and Ulger (2018) in the positive impact of CPS programs that are used in the development of creative thinking skills.

The result also confirms the positive impact of using brainstorming strategy in developing

Results and Discussion

To verify the first hypothesis, arithmetic means, standard deviations and T-test of two means were estimated to find the differences between the mean scores of the participants in pre- and post- TTCT (i.e. fluency, flexibility and originality).

(2η) square was used to identify effect size of the independent variable. As indicated in Table (1), (2η) values show a variance rate caused by the CPS treatment of the dependent variable (creative thinking skills), as (79, 69, 95 and 91). This rate shows the high impact of CPS treatment. Abu Hatab & Sadek (1996) claim that the impact is high when it interprets 15% or above of the total variance.

To verify the second hypothesis, arithmetic means, standard deviations and T-test of two means were estimated to find the differences between the mean scores of the participants in the post- and the successive TTCT (i.e. fluency, flexibility and originality).

Table (2) Differences between the post- and the successive TTCT and total score of creative thinking.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Arithmetic mean</th>
<th>Standard deviation</th>
<th>Freedom degrees</th>
<th>T value &amp; Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>post-test</td>
<td>successive test</td>
<td>post-test</td>
<td>successive test</td>
</tr>
<tr>
<td>Fluency</td>
<td>32.76</td>
<td>32.07</td>
<td>7.86</td>
<td>7.54</td>
</tr>
<tr>
<td>Flexibility</td>
<td>16.30</td>
<td>16.30</td>
<td>4.72</td>
<td>5.3</td>
</tr>
<tr>
<td>Originality</td>
<td>6.33</td>
<td>6.53</td>
<td>1.47</td>
<td>1.53</td>
</tr>
<tr>
<td>Total Creative Thinking</td>
<td>55.40</td>
<td>54.033</td>
<td>11.02</td>
<td>11.03</td>
</tr>
</tbody>
</table>

Table (2) indicates that there are no statistically significant differences in the participants’ mean scores in the post-test as well as the successive test of creative thinking skills (i.e. fluency, flexibility and originality) after one month of the program application.

Discussion

Results revealed the positive impact of CPS program on the development of creative thinking skills among the participants. Views that see creative thinking skills as a number of skills the person can learn support these results. Several researchers proved the potentiality of developing creative thinking skills because creativity is not restricted to some persons, but all people can learn and develop them.

Results are consistent with Fleiss (2005) who claimed that CPS provides students with experience and develops their mental abilities, Torrance who proposed that creativity increases student fluency, originality and flexibility when solving the open ended problems, and Guilford who stated that CPS is based on divergent thinking which involves fluency, originality and flexibility (Bowyer, 2008). It improves learner's creative abilities through a proper guidance for his/her mental abilities (Aziz, 2006).

Effectiveness of the program is based on adopting brainstorming strategy, which is one of the most important strategies used to develop creative thinking because it lays more emphasis on thinking development rather than instruction and stimulates students to develop several novel ideas as well as solutions for the problem. As a result, the whole students participate in the thinking process. They are trained to be clear and specific when presenting their ideas, to increase their awareness of life problems that they can solve and to think freely and out of the box (Almahous, 2009). In addition, it highly attracts their attention.
Activities and practices involved in the program assist the trainees to benefit from their creative abilities in solving their actual problems. The teacher for instance, develops a situation, and then s/he uses the concepts of training as well as CPS aspects to find an appropriate solution. Thus, they gain the experience of using CPS skills to solve problems by themselves.

The researcher also attributes these results to the training environment, which provided numerous theoretical and practical experiences that helped the trainees employ CPS and provided them several cognitive, social and emotional skills. Moreover, they participated in the program sessions and freely interacted with one another to create and develop the ideas to reach the optimal solution.

The students benefited because the creative problems solution (CPS), focused on promoting the purposeful learning through providing the trainees the opportunity to reach the solution themselves, associate their present experiences with the former ones, practice loud thinking and discuss the problems effectively and constructively. Consequently, they could create numerous solutions that resulted in the development of creative thinking as confirmed by Ozbel (Abu Zena, 1997).

The positive impact of the program is constant because using creative solution has helped the trainees become more fluent, flexible and authentic. They also have become more receptive to the challenges due to the development of creative thinking skills that help the individual encounter problems as well as the increase of their motivation and positive attitudes towards CPS, which requires resilience.

The results are also interpreted according to the transference of learning impact, which is one of its substantial foundations. It is based on experiences, knowledge and information stored positively among the participants from a situation to another. The process of transferring the positive impact of learning is not confined to the content sameness, but the same method and rules of solving the problems.

Furthermore, the trainees benefited from deploying CPS, which involves several characteristics (Treffinger, Selby & Isaksen, 2008). For instance, it matches the automatic activity of the brain when solving problems and thereby enhances the effectiveness of the cognitive processes, creates equilibrium and integration between diverging thinking and converging thinking and adopts a systemic approach and thereby the individual can start from any point within each stage. It also helps the individuals and the groups identify and benefit from the available opportunities, face the challenges and overcome the difficulties. In other words, it emphasizes that the individual is able to use CPS competently.

Results also reveal that thinking skills teaching programs play a pivotal role in developing the individual's creative thinking skills. As a results, he/she uses creativity in solving problems and invests his/her energies and creative abilities which enable the positive interact with the surrounding challenges.

Therefore, it can be said that any individual with normal intelligence can invest his/her creative abilities to identify the problems, find the appropriate solutions, assist the best options and positively reflect on the community. This result is consistent with what the psychologists confirmed; creativity is a skill that can be developed.

Accordingly, the present result is the outcome of the participants' training on using creative thinking skills while implementing the program. It also confirms the most important psychological principles of behavioral training, which have been
derived from the literature of psychology, its schools and applications relevant to learning, training and the development as well as the modification of behavior, as follows:
- Teaching through the adoption of practice and application is more effective than indoctrination and theoretical lectures.
- Methods of learning knowledge and theoretical information are not appropriate for learning skills and developing practical and applied abilities.
- What the individual learns and searches for personally remains much longer than what he/she just receives.
- Most people have the abilities and mental readiness to be distinct and creative if they have the appropriate opportunity and environment of learning and training (Alkabsey, 2004).

**Recommendations**
1. Providing teachers and faculty members with training courses that address methods of developing thinking skills, in general, and creative thinking skills, in particular.
2. Redesigning the curricula in a method that permits the application of the principles of creative thinking, in general, and problems solution, in particular, as well as facilitates the circumstances that create free association and creativity.

**References**


Impact of Creative Problem Solving Program on the Development of Creative Thinking Skills


Raml, G. (2010). *Effectiveness of enrichment activities in improving creative thinking achievement in mathematics among the fifth primary grade students in the governmental schools in Mecca* (MA. thesis). Umm Al-Qura University, Mecca.


Whitelaw, L. (2007). An evaluative study of teacher creativity use of the heuristic diagnostic teaching process and student
Sumaya A. Ahmed, Shrooq G. Alzahrani


أثر برنامج حل المشكلات الإبداعي على التنمية مهارات التفكير الإبداعي لدى طالبات الجامعة
سمية أحمد وشروق زهراني

مستخلص: هدف البحث الحالي إلى التعرف على أثر برنامج تعليمي قائم على الحل الإبداعي للمشكلات في تنمية مهارات التفكير الإبداعي لدى طالبات كلية التربية، ولتحقيق هذا الهدف تم إعداد برنامج تعليمي طبق على عينة قوامها (30) طالبة بالمستوى الثالث بقسم علم النفس بكلية التربية بجامعة جدة في الفصل الدراسي الأول من العام الدراسي 1440هـ/2018م، وطبق عليهم اختبار تورانس للتفكير الإبداعي الشكلي قبليا وبعديا وتبنيا بعد مرور شهر من الانتهاء من التطبيق؛ وأسفرت نتائج البحث عن وجود فروق دالة إحصائياً لصالح القياس البعدي في مهارات الطلاقة والرونة والأصالة والدرجة الكلية للاختبار لدى أفراد العينة؛ في حين لم توجد فروق دالة إحصائياً بين متوسطات درجات أفراد العينة في القياس البعدي ومتوسطات درجاتهن في القياس التبعي في مهارات التفكير الإبداعي (الطلاقة، الرونة، الأصالة) والدرجة الكلية للاختبار بعد مرور شهر من انتهاء البرنامج مما يدل على استمرارية الأثر الإيجابي للبرنامج المستخدم.

الكلمات المفتاحية: برنامج تعليمي قائم على الحل الإبداعي للمشكلات - مهارات التفكير الإبداعي.