

The Impact of a Sternberg Theory-Based Training Program on Secondary School Students' Development of Critical and Creative Thinking Skills

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Abstract

This study aimed to test the impact of a training program based on Sternberg's theory of problem solving on the development of critical and creative thinking skills among secondary school students, using a semi-experimental approach. The sample consisted of 70 students from the first grade of literary secondary school at Al-Baraa bin Malik Secondary School in the Directorate of Education of Naour in Jordan and was divided equally into two groups: experimental and control. The researcher built a training program based on Sternberg's theory of problem solving, known as the 'thinking circle', which consists of seven dimensions: feeling the problem, identifying the problem, representing the problem, choosing or inventing a solution strategy, effectively allocating resources for the solution, monitoring the problem solution, and evaluating the problem solution. The program was implemented during 11 six-week training sessions in the second semester of 2021–2022. The California 2000 Critical Thinking Scale and the Torrens Creative Thinking Scale (A) were also used in both the pre- and post-group assessment processes. To answer the questions of the study, it was found that the average performance of the groups was control and experimental for the pre-measurement of the critical thinking scale (10.55) and (10.75), respectively, while the average performance of the groups was on the dimensional measurement (11.67) and (17.78), respectively. To examine the differences in each of the arithmetic averages, the researcher used the analysis of covariance (ANCOVA) for performance for the total score of the critical thinking scale. The average performance of the control and experimental groups in the pre-evaluation of the creative thinking test was (71.68) and (70.35) respectively, and the average performance of the control and experimental groups in the dimensional measurement was (72.12) and (129.65) respectively, and the common multiple covariance analysis (MANCOVA) was used to test the differences in the arithmetic mean of performance in the sub-dimensions of the creative thinking test. It was found that there were statistically significant differences in the arithmetic mean in the level of significance ($\alpha = 0.05$), and the difference was in favor of the experimental group in critical and creative thinking skills, which confirms that the program has a significant impact on the development of creative and critical thinking skills.

Keywords: *Creative Thinking Skills, Critical Thinking Skills, Sternberg's Model of Problem Solving*

INTRODUCTION

Thinking is one of the important things for humans in facing many challenges in their lives, and it is a mental process that distinguishes humans from other creatures on the face of the earth. Thinking in its broad sense includes the skills of searching and investigating the desired analysis of the experience or situation that a person is exposed to in his life, and this requires him to contemplate the situation or obstacle that he is experiencing. During the past two decades, the interest of specialists and researchers has increased in studying the skills and methods of thinking, especially the complex ones of the individual, and searching for methods to develop and improve them. This is due to the tremendous and rapid developments the world is witnessing in various aspects of this life, and this matter requires intensifying efforts to develop thinking skills in general, as the situations that the individual experiences daily require him to employ his mental skills in an organized manner that is appropriate to the situation and which leads him to solve it in the end (Al-Sayed, 2017).

The problem-solving method is considered one of the methods through which a person can organize both his life and his cognitive processes in understanding or dealing with the situations he faces, especially problems or situations that he has not experienced before and which require training in them in order to be able to solve

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them (Abdul Rahman, 2016). The problems themselves are considered a basis that provides the opportunity for a person to highlight his creative and critical potential, given that our daily life is nothing but an endless series of many and complex problems and situations that require the employment of higher mental skills, as it is always difficult to solve all problems in the same way or ways. This, in turn, requires a person to think in a different and unfamiliar way to reach a solution, in addition to relying on previous experiences and information and using them side by side to take appropriate solutions in order to reach a state of cognitive balance (Al-Subaie, 2020).

Nowadays, educators and researchers believe that training students using the scientific method to solve the problem enables them to strengthen their cognitive structures and helps them adopt diverse frames of reference that lead the student to use divergent thinking, which is considered one of the basics of creative and critical thinking because it helps him delve deeply into the situation and study it. From several sides, which helps him develop his creative abilities in solving and enhances his critical and objective vision of the situation, and thus he has a strong and purposeful motivation to reach the appropriate solution, and gives him a more effective role in participating in the solution, developing his self-confidence, and increasing his love for exploration and striving to confront unknown situations and work to overcome them (Mubaidin, 2016).

The tremendous technical and information development in this century is considered one of the most important reasons that make it necessary for us to keep pace with the development of the modern era, and the necessity of avoiding traditional methods of education that are based on memorization only and without understanding and focusing on developing thinking skills in its various fields, as well as teaching it to students as basic skills within the school curricula with the aim of Helping them keep pace with the times and its developments and solving their problems on their own through scientific methods, helping them prepare for any changes that may occur in the future, and making it easier for them to predict and coexist with them, which requires investing the skills of understanding, application, analysis, and deduction until the individual reaches the proposed and appropriate decisions or solutions (Saada, 2018). Teaching thinking skills requires a direct focus on teaching students and training them to implement clear and specific thinking skills and strategies, especially higher-order skills. This is with the aim of helping them understand academic subjects and raising their level of competence and mastery to raise the level of academic achievement, along with gaining awareness and a sense of confidence while performing life and academic tasks (Youssef, 2019).

Studies and research in the field of teaching thinking confirm the possibility of training students in thinking skills at their primitive and complex levels, as in the study of Miqdadi and Al-Zoubi (2021), the study of Al-Batoush and Al-Khawaldeh (2018), and the study of Alimat et al. (2018), where programs for teaching thinking and training in them are considered important and effective methods and methods that In turn, it seeks to develop students' thinking skills, which in turn leads them to think differently and more complexly to face academic and life situations, problems, and challenges in various ways that meet their needs and inclinations and help them deal with them in a more developed and effective manner (Hassan, 2016). At the end of the last century and the beginning of the current century, international programs for training in higher-order thinking skills appeared, the most famous of which are the TRIZ program for teaching thinking and its skills, the Debono program for teaching creativity in thinking (Six Hats Thinking), the RISK program for processing knowledge with the intelligent system, the Hamilton Program for Teaching Creative Thinking, and other international programs, all of which focused on developing problem-solving, critical, and creative thinking skills. It is noted from these programs that they can be integrated into the study curricula as well as trained on them independently of the academic curriculum (Al-Atoum et al., 2019).

Critical thinking, like other forms of thinking, is considered an acquired and educated skill, and teaching critical thinking is an essential goal that must be pursued at the present time in order to help students address the issues and attitudes facing them and develop their capabilities to explore and solve problems. But critical thinking cannot be self-learned from reading, self-training, or engaging in family activities or comrades, as special programs must be available at the hands of skilled trainers who master critical thinking skills and are able to train students according to organized and purposeful plans. There are many common tests for critical thinking, the most prominent of which are: Thinking Annis-Weir Critical for critical thinking, Cornell Critical Thinking,

California Critical Thinking Skills Test, as well as the Wasseen Test-and-Glasser (Watson & Glaser Test), which is the most widely used test (Al -Atoum and others, 2007).

In this study, the focus will be on the impact of a training program based on Sternberg's theory of problem solving on developing critical and creative thinking skills, as critical thinking, as defined by the American Psychological Association, is a process that leads to making judgments related to the same opportunities through the use of higher mental skills based on... To induction, deduction, guidance, prediction, etc. (Wilson, 2018). As for creative thinking, Torrance (1974) defines it as the process in which a person becomes sensitive to problems or situations, has the ability to understand gaps or deficiencies in information, is able to recognize them, formulate questions and hypotheses about them, test them, and evaluate them to reach a solution or several solutions, and they can be defined in four ways. Key abilities: fluency, flexibility, originality, and eloquence.

PROBLEM OF THE STUDY

Critical and creative thinking skills are complex, higher-level skills. Because of its great and clear importance in helping the student be able to deal with the huge amount of academic and life experiences and issues that he faces in our current era. This requires that focus and attention be given to teaching these skills to them through diverse and thoughtful scientific methods that suit their abilities and inclinations. Considering that these skills fall within the mental skills that can be developed, they require comprehensive training programs on topics and experiences that encourage trainees, which are supposed to be provided in the appropriate classroom environment (Al-Ramamanah, 2015). The researcher in this field finds that it is necessary to develop and train the thinking and skills of students, especially the creative and critical, because of their great importance in helping them adapt to and solve the problems and situations that they encounter in normal daily and scientific life, which require great efforts to solve them. These skills, if trained, help the person. It helps him solve his problems and overcome them better, and it helps him get rid of the difficulties he faces and achieve the goals he seeks.

Successful intelligence consists of three components or includes three types of intelligence, namely: Analytical Intelligence is the ability to analyze, issue judgments, criticize, compare, and evaluate; creative intelligence is the ability to innovate, discover, imagine, and make assumptions, and practical intelligence Practical Intelligence It is the ability to solve problems The well -defined life outside the school that can have several solutions and several ways to reach these solutions. (Stenberg, 1997), and from the educational applications of the theory, Sternberg agrees with many researchers in that it is generally acceptable that there are some ingredients inherited in intelligence, but at the same time there are many things that constitute intelligence other than the effects of heredity, and although it is not possible He made a late-growth individual talented or genius, as Sternberg believes that we can increase our mental skills, and this is evident in a study (Sternberg, 1986). Sternberg developed a program for teaching mental skills in higher schools and institutes, and he also conducted this with young children. Sternberg believes that it is not necessary to develop students' intelligence through separate courses or programs (Sternberg, 1985).

Sternberg defends his theory and its practical applications in terms of its suitability for use in detecting gifted people on the one hand and designing educational programs and assessment methods appropriate for them on the other. He also points out that traditional intelligence tests and school and academic tests revolve primarily around analytical intelligence and are not linked to experiences. The individual's life, as it is not linked to creative experiences, and therefore the well-known curricula are largely linked to school experiences of an academic nature, are not suitable for measuring practical intelligence and creative intelligence, which are considered extremely important for success in practical life, as well as competence in dealing with real-life situations It relies on tacit knowledge that is practical rather than academic in nature and is not taught directly or regularly (Sternberg, 1986).

Sternberg (1997) also confirms that the methods of thinking must be taken into account, just as mental and motivation, when directing the individual in the appropriate education and work, as well as the features of the

professional and functional future, depending on the students' awareness of the truth of their tendencies, capabilities, and preparations.

From the researcher's interest in developing thinking skills and reviewing educational literature, he found that there is a necessity for this study due to the need for the educational field in general and teachers in particular to develop the thinking skills of their students in order to know the degree to which students possess such skills. There is an educational necessity for thinking, which is considered one of the necessary requirements for life. It makes students more positive and interactive in the learning process and enables them to face the requirements of the future and adapt to changing situations.

There are many studies and research projects interested in the field of thinking and its development that recommend conducting more research related to programs for teaching thinking (Al-Dabbas, 2018; Al-Tayeb, 2021; Roldan D. Atienza, MA, 2019). Such studies recommended the importance of developing different types of thinking skills. There are studies that focus on studying Sternberg's theory (Karima & Al-Arabi, 2017), and studies that are conducted on the Jordanian environment (Al-Maayta & Al-Tarawneh, 2021), and ensuring its impact and effectiveness in developing thinking and its skills in general, and both the critical and the creative in particular, and this matter requires us to, as researchers and specialists, reconsider some of the programs that aim to develop thinking and its higher skills and work to modify them to suit the requirements of the current era. This is because teaching higher thinking skills is considered one of the most important goals of advanced and modern education in this century to help students adapt to the new requirements and developments of the era. Currently, many Arab and international countries are seeking to implement advanced and different training programs to achieve this goal (Abdel-Haqq & Al-Ajili, 2018). Hence, this study aimed to determine the effect of a training program based on Sternberg's theory of problem solving on developing critical and creative thinking skills among students in the first year of literary secondary school. Specifically, this study aims to answer the following questions:

Are there statistically significant differences at the level ($\alpha = 0.05$) in the average total scores of the two groups: the experimental and the control groups on the California 2000 Critical Thinking Scale among first-year literary secondary school students before applying the used program?

Are there statistically significant differences at the level ($\alpha = 0.05$) in the average total scores of the two groups: experimental and control on the California 2000 Critical Thinking Scale for first-year literary secondary school students attributable to the program used?

Are there statistically significant differences at the level ($\alpha = 0.05$) in the average total grades of the two groups: experimental and control over the Torring scale for creative thinking—verbal version (A) among first-grade literary secondary students before applying to the program used?

Are there statistically significant differences at the level ($\alpha = 0.05$) in the average total scores of the two groups: the experimental and the control groups on the Torrance Scale for Creative Thinking—Verbal Version (A) among the students of the first year of literary secondary school due to the program used?

OBJECTIVES OF THE STUDY

This study aims to determine the effect of a training program based on Sternberg's theory of problem solving on developing critical and creative thinking skills among students in the first year of literary secondary school. Critical and creative thinking skills as well as higher-order thinking skills are covered by this model, which includes in its dimensions these skills and helps to develop them.

SIGNIFICANCE OF THE STUDY

This study helps confirm the basic assumption that indicates the possibility of developing critical and creative thinking skills through exercise and training. In addition to the lack of Arab and foreign studies—according to the researcher's knowledge—that included the effectiveness of Sternberg's theory in solving problems, despite the fact that the dimensions of the model develop these skills, it is one of the few studies that investigate the effect of a training program based on the "Thinking Circle" model, and it can be considered a new contribution. To research its effectiveness and as a catalyst for conducting new studies on this topic.

STUDY SITE AND DURATION

Study Duration

Time: The second semester of the year 2021-2022.

Location: Al-Baraa Min Malek Secondary School for Boys in the Directorate of Education, Naour District.

Human Participants: Students of the first year of literary secondary school in Al-Baraa Min Malik School, affiliated with the Directorate of Education, Naour District, numbering 70 students.

LIMITATIONS OF THE STUDY

The study is limited to using a training program based on Sternberg's theory of problem solving, "the Thinking Circle," and knowing the extent of its impact on developing critical thinking skills as well as creative thinking skills.

The study is limited to the first secondary literary students at Al-Baraa School from Malik in the district of Raising and Teaching Naour Brigade.

The results were determined by the validity and reliability of the tools used in the study.

STUDY TERMS AND DEFINITIONS

The Thinking Circle Program: It is a training program based on Sternberg's theory of problem solving, known as the "Thinking Circle," which includes seven main dimensions: sensing the problem, identifying the problem, representing the problem, choosing or devising a strategy to solve the problem, and identifying sources effectively to solve the problem. Monitoring the solution to the problem and evaluating the solution to the problem.

Critical thinking is a complex mental skill characterized by high sensitivity to the situation or problem, includes rules and self-controls for correction, and relies on certain criteria until a judgment or solution is reached far from bias, traditional opinions, and external and internal influences (Abu Mahdi, 2011, p. 9). The procedural definition in this study is the mark or grade that a first-year literary secondary school student obtains when applying the Arabic version of the California 2000 Critical Thinking Test.

Creative thinking is a complex and purposeful mental activity guided by a strong desire to search for solutions or reach original results that were not previously known. It is characterized by comprehensiveness and complexity because it involves overlapping cognitive, emotional, and moral elements that constitute a unique state of mind (Jarwan, 2013, p. 77).

The operational definition in this study is the mark or grade that a student in the first year of literary secondary school obtains for both the total score and the sub-scores for the dimensions (fluency, flexibility, and originality) when applying the Arabic version of the Torrance Scale for Creative Thinking, Verbal Version (A).

THEORETICAL FRAMEWORK AND RELATED STUDIES

Thinking is a symbolic activity that uses symbols and meanings that replace things and uses symbolic strategies and activities such as reasoning and meaning as substitutes for truth and reality. It is one of the manifestations of human activity, just like any behavioral activity that a person practices in a situation or problem, and it is considered a complex structure that is inferred through the presence of variables or intermediate mental skills such as abstraction, generalization, and classification (Emerson, 2018).

Researchers and specialists who have studied the thinking topics agree that teaching thinking skills and creating opportunities for their emergence are considered very important matters in educational situations and that teaching thinking should be one of the important goals of educational institutions and bodies, in addition to focusing on teaching higher thinking skills, of which the most important are problem solving and critical and creative thinking (Al-Atoum et al., 2019).

Critical Thinking

Critical thinking is one of the higher thinking skills, which is considered one of the most important skills within human life in all its fields because it helps to think clearly within a specific and known logical field and helps to solve problems in a scientific and rational manner. This type of thinking contributes to keeping pace with the rapid developments taking place at this time in a flexible and effective manner. Critical thinking helps in developing creativity skills in solving problems by opening the way to unleash various skills and ideas related to the issue or problem to be solved. It also provides an important means of developing and refining the individual's personality through the effective strategies it provides to the individual that are appropriate to his inclinations, abilities, and needs (Al-Batoush, 2017).

Garton (2016) defines critical thinking as “a complex mental process characterized by discipline, order, and understanding of the dimensions of the situation with complete objectivity, helps to assimilate information, and is characterized by accuracy, consistency, depth, the presence of correct evidence, breadth, and justice p106.” It is also defined as:

a set of complex skills that a person acquires in order to help him objectively analyze various information, situations, and experiences so that he becomes able to distinguish between facts and hypotheses in a clear, systematic, and comprehensive way, far removed from whims and irrational and illogical thoughts (Moumani, 2017, p. 191).

There are multiple definitions of critical thinking, and the researcher finds that they differ depending on the specialist's point of view, but they agree that they are higher mental skills that help a person understand the situation or problem that he faces in all aspects of his life, and they also agree that they include the following skills and elements (Gavronskaya, 2022).

Interpretation: It means the ability to understand the phenomenon or situation, know its details, and analyze it in a logical and rational manner.

Analysis: This means the ability to test existing hypotheses, opinions, and data and work to organize, analyze, and verify them in preparation for finding an appropriate solution.

Evaluation: This means carrying out the process of evaluating the evidence and arguments and their effectiveness in the solution that has been reached.

Reasoning: It is the ability to track the effectiveness of evidence and possible alternatives that lead to arriving at conclusions or decisions.

Explanation: It is the ability to announce, present, and justify results by explaining the actions taken to confirm the arguments and evidence.

Self-regulation: It is the ability to self-evaluate and correct.

Critical thinking skills are acquired skills that can be developed and can be trained and developed. Teaching them to students is one of the important goals that must be achieved in order to help them face different situations and develop their ability to explore and solve problems. Researchers believe that the low level of critical thinking among students in general is due to the lack of giving or transferring information by teachers, as their focus is on what to think, while the correct method is how to think. Therefore, it is necessary to provide special programs and trainers specialized in teaching thinking skills. Critical and able to train students within organized, clear, and purposeful plans. (Beyer, 2012).

Critical thinking methods can be developed through various exercises and activities that are carried out within a series of organized stages, so that success in the first stage paves the way for success in a later stage, and so on. The most important of these stages are: observation, facts and concepts, inference and conclusion, building assumptions, opinions and trends, and evaluating arguments. Evidence, purposeful, and critical analysis. There are many international tests that aim to teach and train on the methods and techniques of critical thinking, such as the Annis-Wire test, the Cornell test, the California test, and the Watson-Glaser test, which is the most widely used test internationally (Nawafleh, 2015).

Pekdogan and Korkmaz (2019) believe that teaching critical thinking through different branches and fields of knowledge is characterized by several characteristics, including that critical thinking is considered a learnable skill and its scientific courses are more activities, skills, and duties than academic content or traditional lectures. Problems, questions, and issues are sources of learners' motivation to learn and solve the problem, and each of the solution methods, goals, and evaluation focus in their entirety and objectives on how to deal with the content itself more than on acquiring it. Writing, training, and cooperation with peers and colleagues are considered among the most important means of developing critical thinking skills.

It is clear that critical thinking skills are skills that can be developed, learned, and trained and can be taught through systematic and extracurricular activities and events. Hence, it is necessary to help students acquire them by giving them organized and purposeful sessions to raise their levels of critical thinking so that they can solve their problems on their own and in the correct ways. Within their levels and abilities, this study came to teach students to acquire critical thinking skills through the "Thinking Circle" program, which includes in its dimensions the most important critical thinking skills to help them grow and develop them.

Creative Thinking

Interest in studying creative thinking began in 1950 when Guilford suggested his model known as the structure of the human mind, through which he explained that humans have two types of thinking: convergent and divergent, where convergent thinking is defined as thinking that can be measured through traditional and usual tests. As for divergent thinking, it is measured through higher-order thinking tests, such as tests of creative and critical thinking and problem solving (Abu Al-Wafa, 2017).

Creativity is a human phenomenon that aims to build individuals and create them in a way that makes them creators of a life and a civilization that benefits humanity, and this is what contributed to the emergence of creative and talented individuals who, over successive decades, contributed to transforming the lives of societies for the better in multiple styles and forms (Al-Shakhatra, 2022). The tremendous development taking place in the current century has increased the basic requirements and needs of society, which necessitate the presence of mental and intellectual ability based on thinking in general, and creative thinking in particular. For this reason, many researchers and specialists have given their attention to the topics of creative thinking in order to target the cognitive and cognitive potentials and abilities at their maximum levels, with the aim of helping the individual obtain a creative and innovative personality through the presence of an environment rich in experiences and suitable for that. (Wolf, 2016).

Researchers in the field of creative thinking find it a complex and purposeful mental activity guided by a strong desire and motivation to search for causes and solutions to a problem, situation, or phenomenon and reach different and original solutions that were not previously known. This method of thinking is characterized by being comprehensive; It includes cognitive components, emotional and moral elements that interact with each other to form a unique mental state. It is complex and purposeful and is directed by a strong desire or motivation to search for a possible solution or reach an original idea that was not there before. Creative thinking is characterized by complexity and comprehensiveness. This is because it contains cognitive, moral, and emotional elements and components that interact with each other to form a unique state of mind that is characterized by productivity and complexity and is unlimited (Saada, 2018).

Jarrar (2020) confirms that creativity is considered one of the most important features of challenges and developments alike, as it appeared in the educational fields long ago, as it describes the mental state included in its goals to find means, ideas, and unfamiliar ways and is characterized by originality and grandness. Creative thinking existed from the beginning of mankind, as a person was inventing solutions to different problems and situations so that he could adapt to life and its developments and then re-evaluate what he created until he was consistent with everything that surrounds him and used everything that was available to him within his capabilities so that he could raise his life for the better and make it easier, simpler, and far from difficulty and complexity.

There are many definitions of creativity, which varied according to the point of view of the specialist and researcher, as Jarwan (2015) defines it as a comprehensive and complex mental process that includes cognitive, emotional and moral factors that interact with each other to form an active and unique state, and this process does not occur apart from higher thinking skills; Because it requires a series of complex mental procedures such as planning, monitoring, evaluation, forecasting, etc., and thus it is considered purposeful behavior and does not occur in vain, but rather through the presence of cognitive content rich in experiences and aims to reach unusual and original solutions to problems and situations that exist in one of the cognitive fields and aspects of human life.

There is another definition of creative thinking, which is a thinking process that a person uses with the aim of arriving at new ideas that differ from the usual and aiming to link ideas that are not related to the original. It expresses the individual's ability to explore new and unfamiliar relationships and solutions characterized by novelty and flexibility, as well as his ability to produce the largest number of original ideas and develop innovative ideas and activities among the majority of students to varying degrees. This is thinking that is characterized by having unique and creative results that are far from stereotyped (Youssef, 2019).

Creativity represents a different and unique phenomenon, as it works to stimulate students' motivation for science and helps in attracting and recalling new information and transforming it into different and rare ideas. Therefore, it is considered one of the highest thinking skills because it is based on studying the problem or phenomenon in a way that is unusual from what is normal and is viewed in a different way. Different from the rest of the explanations and data presented, it requires the presence of a high, efficient, and effective mental capacity that allows for proposing an infinite number of explanations and solutions to a phenomenon or a problem (Jarrar, 2020).

Many researchers agree that creativity is the production of high-quality, original, and different solutions to problems that have been described as complex, strange, disorganized, and lacking structure. It is noted that the majority of their definitions and viewpoints were based on Torrence's ideas and principles. They also agree among themselves that creativity has four main elements, which are: creative work, creative process, creative attitude, and creative solutions (Al-Ramamanah, 2015).

Creative Thinking Skills

Researchers and specialists agree that creative thinking consists of a number of sub-skills that together constitute the phenomenon of creativity, and these skills can be summarized as follows (Abu Al-Wafa, 2017; Al-Huwaiti, 2018; Huang & Tian, 2017; Uzuno, 2018):

- Originality: It means excellence in an individual's ability to think in a different way and his ability to move on to unfamiliar and direct ideas.
- Fluency: It is the individual's ability to produce many different ideas, whether verbal or performative. These ideas are characterized by their endings being unclear, open, and difficult to describe. They are of four types: verbal fluency, idea fluency, form fluency, and procedural fluency.
- Flexibility: It is the individual's ability to change his mental state as experience or situation changes. It is of two types: automatic and adaptive.
- Problem sensitivity: It is the individual's awareness that there are needs or obstacles facing him and is determined by his ability to know the strengths and weaknesses of the situation, as well as his ability to notice the problem faster than others and his ability to link current data to his previous experiences.

Stages of Creative Thinking

The majority of researchers agree that creative thinking skills go through several important stages, which are (Abu Mahdi, 2015; Al-Muqabla & Dokme, 2015; Duran & Imran, 2016):

First: The preparation stage: This means collecting data, conducting research, and unleashing the mind to contemplate. During this stage, previous information can be consulted in order to come up with inspiring and original ideas.

Second: the incubation stage, in which the idea is left for a period and distanced from it before acting on or embodying it. This stage is considered very important because the idea is being heated and clearly visualized.

Third: The lighting stage: Here the bright idea that has been reached is put into practice, where the ideas that have been reached are collected to come up with a solution, that is, it is considered the stage of the appearance or seeing the light.

Fourth: Evaluation stage: Within this stage, thinking is done about the validity of the idea, choosing the appropriate alternative or solution from among other alternatives that were proposed, and knowing the extent of its compatibility with the initial vision of the problem. Here, a judgment can be given to the solution that was reached as to its effectiveness.

Fifth: Verification stage: In this stage, the solution or idea that has been reached is announced and shared with external science. It is the last stage of creative thinking and constitutes a starting point for other creative ideas.

It is noted from the above that both critical and creative thinking skills are consistent with Sternberg's theory of problem solving. This is because Sternberg's problem-solving stages, known as the "thinking cycle," are based primarily on critical and creative thinking skills. Below is a presentation of the model and training program.

Sternberg's Theory "Thinking Loop" for Problem Solving

Scientist Sternberg presented a problem-solving model and called it the 'thinking loop', and explained that the idea of the model is that effective and correct thinking to solve problems is continuous circular thinking, where its rings communicate with each other during and after the solution, and that reaching a solution is a process that leads to the beginning of a new problem and so on. The model includes seven main dimensions (Abdulrahman, 2016; Sternberg, 2003):

Sense of the problem (identifying): It is the awareness of the individual of the existence of a problem, and the important criterion at this stage is the presence of a sense of the problem in addition to curiosity to know the situation, and this stage is one of the most important stages in the problem-solving cycle and is considered the basis for it.

Defining the problem: At this stage, the problem is identified, defined, and formulated in a procedural manner that can be solved and applied on the ground by knowing the initial state of the problem and the planned goal to be achieved, as well as the rules, challenges, and restrictions that must be adhered to.

Represent the problem: Here the problem is embodied on the ground and represented in a visual way in the form of a scheme or image, as well as represented and drawn in a clear and logical scheme and converted into a meaningful image and linked to a previous problem similar to it, and at this stage the scheme is known to be used to understand the problem. This stage is highly sensitive because the way the problem is represented and its correct procedures weaken the possibility of misrepresenting it.

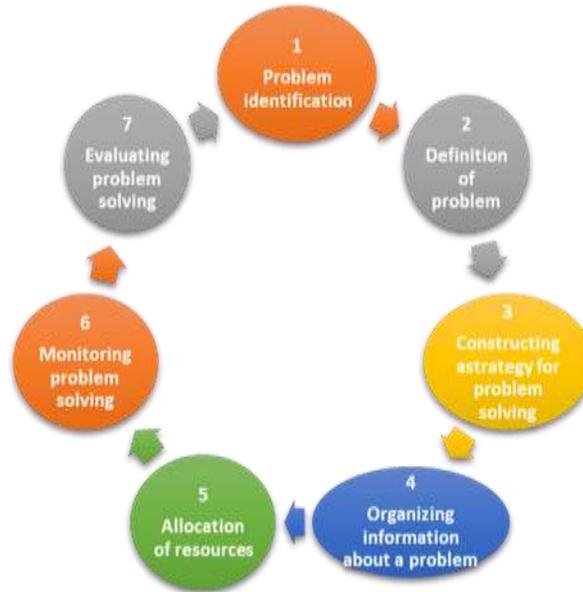
Choosing or inventing a strategy to solve the problem (creating or selecting): At this stage, the individual must think well about the process of choosing or selecting strategies that suit solving the problem, and this requires referring to previous experiences and benefiting from them and knowing their effectiveness so that he can think in the right direction. The selection process is controlled by several factors, including the individual's needs, tendencies, preferences, and previous experiences.

Identifying sources effectively to solve the problem (allocating resources): This stage requires the availability of many sources, the most important of which is the time and effort that the individual needs to reach the solution, and also requires investing them effectively within a known and specific timeline, as well as taking into account the material capabilities, necessary materials, and other needs.

Monitoring the solution of the problem: Here the individual reviews what he has done in order to avoid stumbling or error during the procedures for obtaining a solution, and it lies in monitoring the process of

managing time effectively, not wasting it, and working to avoid defect or error, away from feeling frustrated and despair, and thinking positively about the solution that has been reached.

Evaluating the solution: This stage includes the process of verifying the effectiveness of the procedures used in the solution, and this process occurs after reaching the solution and aims to give the individual feedback on his capabilities and the effectiveness of the solutions he reached, as well as his ability to face and solve similar problems in the future and benefit from them. The following diagram shows Sternberg's problem-solving cycle:



The steps of the problem-solving cycle include problem identification, problem definition, strategy formulation, organization of information, allocation of resources, monitoring, and evaluation. Sternberg, R. (2003). Cognitive Psychology p430

The researcher has built a training program that includes in its content the dimensions of this model and presents it to experienced arbitrators to express the necessary opinions and observations to come up with the program in its current form, and then the training sessions were conducted in proportion to each dimension in the form according to the following table:

| | Dimensions | Number of sessions | Time |
|---|--|--------------------|-------------|
| 1 | Sense of problem | 2 sessions | 90 minutes |
| 2 | Fixing the problem | session | 45 minutes |
| 3 | The problem represents | 2 sessions | 90 minutes |
| 4 | Choose or devise a strategy to solve the problem | 2 sessions | 90 minutes |
| 5 | Effectively sourcing to solve the problem | session | 45 minutes |
| 6 | Monitor problem solving | session | 45 minutes |
| 7 | Assessment Problem Solving | 2 sessions | 90 Minute |
| | Total Training | 11 Session | 495 minutes |

RELATED STUDIES

In this section, the studies related to the subject of this study and its variables will be presented, and they will be presented from the latest to the oldest.

Listikowati (2022) conducted a study aimed at studying the impact of the venture-based semester of the project based on the project (PJBFC) on learning through the Internet through simultaneous and coinciding strategies on the critical thinking of students. The methods used in the study were WhatsApp and the application of Zoom, and the research topics included from Geography Education Study Program for students who take the subject of research methods in geography at a university in Indonesia. Thirty students were divided equally into experimental and controlled groups, and the Watson-Glaser scale was used for critical thinking in the pre-evaluation, as well as post-evaluation, the experimental group was trained on the project-based flipped learning

method (Jam et al., 2012). The results showed that the PjBFC model in online learning using synchronous and asynchronous strategies had a significant impact on the development of critical thinking methods among students and that this strategy is considered advanced to develop critical thinking skills theoretically and practically.

Yesilda and Guner (2022) conducted a study aimed at knowing the impact of the method of the curriculum based on inquiries and discussion on the problems of academic achievement and contemplative and creative thinking on students. The sample included 41 students from the seventh grade in a secondary school in northeastern Turkey, divided into two groups: experimental (21) students and control (20) students. The researcher applied the pre-evaluation and post-testing tests, the measure of contemplative thinking, and the scale of creative thinking to the two groups and the training of the experimental group through the method based on inquiries and discussion, and the results showed that there were significant differences in the average performance in recitation and contemplative and creative thinking in the post-evaluation and the preference for the experimental group, which is due to training in the program.

The experimental group was taught using the differentiated education strategy and the control group in the normal way, and at the end of the experiment, the Torrance verbal test for creative thinking and the trend scale were applied to the experimental and control groups, and the results showed that there were statistically significant differences between the averages of the scores of the students of the experimental and control groups in the dimensional application of the Torrance test for creative thinking in each of the three creative thinking skills and on the test as a whole, and the scale of attitudes towards the mathematics course for the benefit of the experimental group students, as it was found that there were no statistically significant differences between the averages of the scores of the students of the experimental and control groups due to the gender variable.

The study of Abkal and Al-Ottili (2018) aimed to find out the impact of a computerized program for the Osborne model on the development of creative thinking to solve problems in the achievement of English and the development of verbal fluency among tenth grade students using the semi-experimental approach on a soft sample of 100 students in the tenth grade from a secondary school in Ma'an, Jordan, and divided equally into groups: experimental and control. The experimental group was taught using the computerized Osborne model, while the control group was taught using the traditional method. The results showed that there are differences in the average performance of the two groups in the dimensional measurement, whether in achievement or verbal fluency, in favor of the experimental approach attributed to the program.

Ozyabrak (2017) conducted a study aimed at examining the impact of Scamper's model on developing creative thinking techniques among middle school students. The Torrens Creative Thinking Test—Performance Picture was applied to a sample of 14 middle school students in a private school in Turkey in pre- and post-assessment, and the group was trained for processing within an eight-week training program using the Scamper model. The results showed that there are differences in the average creative thinking methods of students on the dimensional measurement, and the impact is due to the program used.

Al-Otaibi (2007) conducted a study aimed at identifying the impact of using the CORT program (expanding the field of Perception and interaction) in developing critical thinking skills and improving the level of achievement of class students. The first secondary in Riyadh and the researcher used the semi-experimental approach, and a random sample was selected. The cluster consisted of (40) students from the first grade secondary students in Riyadh in the Kingdom of Saudi Arabia and divided into two groups experimental and control and found that there are significant differences between the two groups (experimental and control) in critical thinking skills in favor of experimental, and it turned out that there are significant differences between the pre- and post-measurement of those skills in favor of the dimensional, and it turns out that there are no significant differences between the two groups in the level of academic achievement.

Moreover, Al-Abdallat (2003) conducted a study aimed at investigating the impact of a training program based on learning problems on developing critical thinking skills among tenth grade students in Jordan. The study sample consisted of 112 male and female students who were selected randomly and were divided into two

groups: one experimental group consisted of 50 male and female students, and the other control group consisted of 62 male and female students. The training program was prepared independently of the subjects dealing with life problems characterized by reality and applied to the members of the experimental group. To measure the effectiveness of the training program, the California test for critical thinking skills was applied as a pre- and post-measure for the members of the experimental and control groups. The results showed significant differences in favor of the experimental group members on the California Critical Thinking Skills Test, and the results did not show significant differences due to the gender variable and the interaction between sex and the group.

It is noted from the studies that have been presented above that they deal in their topics with the variables of the study directly, and also confirmed that the methods of critical and creative thinking can be developed, and that modern training programs help to develop them and have a positive impact, and it is also noted that the programs used varied according to the direction on which the researcher was based, including those prepared by the researcher himself, as in the study (Abu Obaid, 2019), and some of them used different techniques in education, such as the study of Abdalat (2003), as well as the Studies used international programs and models such as (Listiqowati, 2022); (Yesilda * Guner, 2022); Abkal and Al-Ottili, 2018); Ozyabrak, 2017) (Al-Otaibi, 2007), and there are studies that used the Sternberg model as a study and through research the researcher found that Sternberg's theory was not used in solving problems and knowing its impact and effectiveness in developing methods of critical and creative thinking The goal of the current study, therefore, may be considered among the new studies that adopt this model, which can be considered one of the most effective models for the development of critical thinking methods And creative and this provides a new addition to researchers in this field.

METHODOLOGY AND DESIGN

The study methodology is the quasi-experimental approach (design), which requires the availability of groups (experimental and control) in which the effectiveness of the independent variable represented by training in Sternberg's "Thinking Circle" program is examined in the dependent variable, which are the two critical thinking skills and creative thinking.

Study Population and Sample

The study population consisted of first-year secondary school students in the Directorate of Education of Naour District in Jordan. The study sample consisted of students of the first literary secondary school, sections (A) and (B), at Al-Baraa bin Malik Secondary School for Boys, which is one of the government schools affiliated with the Directorate of Education of the Jordanian Naour District. The study sample consisted of 70 students, 35 students from the first year of secondary school (A), who represented the experimental group, and 35 students from the first year of secondary school (B), who represented the control group. The school was chosen intentionally because its administration demonstrated its readiness to cooperate in implementing this study in the second semester of the year 2021/2022.

Study Tools

The study sought to determine the effect of a program based on Sternberg's "Thinking Circle" model on both critical and creative thinking methods among students in the first year of literary secondary school. The California Scale (2000) for critical thinking, the Torrance Scale for Creative Thinking—Verbal Version A, was used. A training program based on Sternberg's theory of problem solving is known as "Circuit Thinking."

The study population consisted of students in the first year of literary secondary school in the Directorate of Education of the Naour District in Jordan, and the sample consisted of 70 students from the first year of literary secondary school in Al-Baraa bin Malik Secondary School in the Directorate of Education of Naour District in Jordan, which is one of the government schools affiliated with the District of Liwa. Hemophiliacs were divided equally into two groups: experimental and control. The school was chosen intentionally because the school administration expressed its willingness to cooperate in implementing this study in the second semester of the year 2021/2022. The study sample members were randomly divided into two groups, control and experimental;

Section (A) represented the experimental group, numbering 35 students, and Section (B) represented the control group, numbering 35 students.

Targeted Variables in the Study

The study includes dependent variables: critical and creative thinking skills, and one independent variable, which is training in a program based on Sternberg's theory of problem solving.

Implications of the validity and reliability of the Jordanian picture:

California Critical Thinking Skills Test (CCTST), 2000:

Experimental Validity and Stability of the Test

The experimental validity of the test was verified by applying it to a survey sample consisting of 25 students from the research community, after which the clarity of the test items and their linguistic integrity for the students were confirmed, as well as the time needed to answer all the test items. The time scale was set at 60 minutes. The stability of the test was verified by repeating it over a period of two weeks and on a sample of 20 students from outside the research sample by calculating the Pearson correlation coefficient, as shown in Table 2:

| Skill Number | Skill | Number of Paragraphs | Reliability Coefficient |
|--------------|------------------|----------------------|-------------------------|
| 1 | Analysis Skill | 6 | 0.82 |
| 2 | Induction Skill | 6 | 0.81 |
| 3 | Deduction Skill | 4 | 0.78 |
| 4 | Reasoning Skill | 12 | 0.85 |
| 5 | Evaluation Skill | 6 | 0.83 |
| Overall | | 34 | 0.85 |

Table (2) shows the values of reliability coefficients for the skills of the California Critical Thinking Test, the Jordanian version, and the total grade using the repetition method:

Torrance Test for Creative Thinking Verbal Image (A)

Validity of the Jordanian Image from the Torrance Test

Indications of collinear validity. The significance was provided through the correlation between the performance of the subjects on the test on the one hand and their level of performance in the teachers' rating lists on the other hand, where the value of the correlation coefficient was (0.73), as for the validity of the construct, it was calculated by finding the value of the correlation coefficient between the scores of the subjects on the sub-dimensions of the test and the total score of the test, where the values of the correlation coefficient ranged between

(0.86-0.39), and the value of these coefficients is considered statistically significant at the level (α). =0.05 (Al-Shanti, 1983).

Reliability of the Test in its Jordanian Version

Abu Jado indicated in his study (2003) that there was a reliability coefficient for the Torrance Test for Creative Thinking, where the reliability coefficient for the fluency dimension was (0.62), for the flexibility dimension (0.58), and for the originality dimension (0.70), while the reliability coefficient for the total score was (0.67), and these coefficients were statistically significant at the significance level ($0.01 \geq \alpha$). Al-Shanti (1983) also indicated the availability of indications about the stability of the Jordanian image from the Torrance test using the test-re-test method, where the value of the correlation coefficient reached 0.70 at the significance level ($0.01 \geq \alpha$).

Study Procedures

The following are the procedures that were taken during the preparation of this study:

Obtaining official approval from the Directorate of Education of Naour District to conduct the study.

After obtaining approval, Al-Baraa Bin Malik Secondary School for Boys was chosen to conduct the study on the students of the first year of literary secondary school. The administration cooperated with the researcher and facilitated his task by providing halls equipped to implement the program, as well as coordinating the classes in a way that did not conflict with the interests of the students.

The pre-evaluation was conducted on the experimental and control groups, with a 45-minute session for each group and each variable, meaning that the measurement took two sessions for each group.

The training sessions were implemented with the experimental group during 11 training sessions, except for the pre-post measurement sessions, which were 4 sessions. The implementation was carried out at a rate of three sessions per week over a period of five weeks. This period extended from 3/6/2022 until 4/9/2022 in the second semester of the year 2021-2022

The post-measurement was conducted for the two groups in a 45-minute session for each group and for each variable, meaning that the measurement took two sessions for each group.

Main Program Axes

The training program included two main axes:

Theoretical axis: where the dimensions of the model were presented to the students and explained to them, as well as the nature of creative and critical thinking skills. This included introducing the model and its author, as well as introducing the applied procedures for the skills specific to this program, and then moving to each dimension in the model and training the students on it.

Practical axis: It included training on employing the dimensions of the model in organized, deliberate, and interactive steps through group and individual activities that achieve the goal of each session.

Program Application Procedures

The program was implemented through the following steps:

The training program includes seven specific sub-skills from Sternberg's theory of problem solving, known as the "thinking loop."

Formulating the objectives of the session to ensure achieving what is required of each dimension in the model.

Choosing the necessary tools and means to implement the procedures, such as PowerPoint, cardboard, and the educational methods and tools necessary for training on each dimension in the model.

Commitment to the chronological distribution of the session time, and that in that it begins with an introduction by presenting activities prepared by the researcher to stimulate creative thinking as well as critical thinking, and then defining the skill during its presentation, using interesting examples and pictures, and explaining how to apply it.

The methods of participatory education and peer training, as well as individual activities, were adopted in accordance with the objectives of each session. And access to the largest possible number of ideas.

Evaluation of each session directly after the presentation and application, and a summary of the skill that was implemented with the students by the researcher.

Statistical Analyzes

To answer the main questions of the study, appropriate statistical analyses were used to analyze the data, which are:

Inferential and descriptive statistics are represented by an arithmetic mean as well as a standard deviation of performance for pre- and post-evaluations.

Analysis of covariance (ANCOVA) to determine the difference in the average achievement of the experimental and control groups for the post-measurement of the critical thinking test for the total scores.

Multiple covariance analysis (MANCOVA) to control the pre-test differences in evaluating the variables in the study as well as to find out the difference between the performance averages of the groups for the post-evaluation of the Creative Thinking Scale for the total and sub-scores.

RESULTS OF THE STUDY

Below is a presentation of the results that were achieved within the current study:

The result related to the first and second questions: Are there statistically significant differences ($\alpha = 0.05$) in the average total scores of the groups (experimental and control) on the California 2000 scale? Is the critical thinking among students in the first year of literary secondary school attributed to the program used?

The arithmetic mean of the answer to the question, as well as the standard deviation of the two groups' performance on the California Critical Thinking Scale (2000) in both the pre- and post-measurements, were found and are explained below in Table No. 3.

Table No. 3: Shows the arithmetic means and standard deviations of the two groups' performance on the California (2000) Critical Thinking Scale in the pre- and post-measurements.

| Group | Pre- | | Post | |
|--------------|-----------------|--------------------|-----------------|--------------------|
| | Arithmetic Mean | Standard Deviation | Arithmetic Mean | Standard Deviation |
| Control | 10.55 | 4.233 | 11.67 | 4.984 |
| Experimental | 10.75 | 4.523 | 17.78 | 4.265 |

It is noted from the table above that the arithmetic mean of the study sample's performance within the control group on the California test (2000) in the pre-measurement reached 10.55 and a standard deviation of 4.233, and the post-measurement reached 11.67 and a standard deviation of 4.984. The arithmetic mean of the experimental group's performance in the evaluation in the pre-measurement was (10.75) and a standard deviation of (4.523), and in the post-measurement it was (17.78) and a standard deviation of (4.265). Accordingly, it was found that there were clear differences in the average performance on the scale for the two groups, and to know the significance. This difference was used by one-way analysis of covariance (ANCOVA), and is explained below in Table 4.

Table (4) presents the results of the one-way analysis of covariance (ANCOVA) for the post-measurement on the California (2000) Critical Thinking Scale for both groups.

| Sources | Sum of squares | Degrees of freedom | Mean squares | value (F) | Significance level | Explained variance η^2 |
|-------------------|----------------|--------------------|--------------|-----------|--------------------|-----------------------------|
| Pre-test (common) | 351.225 | 1 | 351.225 | 27.865 | 0.000 | .3110 |
| Group | 620.258 | 1 | 620.258 | 51.668 | 0.000 | .5020 |
| Error | 613.021 | 67 | 10.252 | | | |
| Total | 1165.768 | 70 | | | | |

*Statistically significant at ($\alpha=0.05$)

It is clear from Table 4 that the value of F indicates the differences amounted to (51.668), which is a significant value at the level of 0.000. This means that there are statistically significant differences ($\alpha = 0.05$) in the average total scores between the two groups for the California 2000 Critical Thinking Test. For students in the first year of literary secondary school, it is attributed to the training program. To determine the size of the effect, the Eta square (η^2) was used, as it turned out that the effect size for the measurement was 0.5020. Thus, we can interpret that 50% of the difference in performance between the two groups is due to the use of the training program, meaning that the program was effective for developing critical thinking skills.

2- The result related to the third and fourth questions: Are there statistically significant differences ($\alpha = 0.05$) in the average total scores of the groups (experimental and control) on the Torrance Scale for Creative Thinking, Verbal Version (A) among the students of the first year of literary secondary school due to the software used?

The arithmetic average was calculated to answer the question, as well as the standard deviation of the performance of the two groups of the Torrance scale for creative thinking—verbal image (A) and its sub-dimensions in both pre- and post-evaluation—and the next clarification within Table No. 5.

Table No. 5 shows the arithmetic means and standard deviations of performance for two groups on the Torrance Scale for Creative Thinking, Verbal Version A, in the pre- and post-measurements.

| Group | Experimental | | | | Control | | | |
|--------------------------|-----------------|--------------------|-----------------|--------------------|-----------------|--------------------|-----------------|--------------------|
| | Pre | | Post | | Pre | | Post | |
| Creative Thinking Skills | Arithmetic mean | Standard deviation |
| Fluency | 35.66 | 10.329 | 49.47 | 18.225 | 34.96 | 12.005 | 36.96 | 10.658 |
| Flexibility | 28.73 | 10.233 | 42.25 | 12.768 | 28.89 | 10.774 | 29.88 | 9.223 |
| Authenticity | 14.95 | 8.789 | 43.36 | 14.663 | 13.06 | 7.698 | 13.84 | 7.238 |
| Total | 70.35 | 26.825 | 129.65 | 47.021 | 71.86 | 27.558 | 72.12 | 28.967 |

It is clear from Table (5) that the arithmetic mean of performance on the scale used for the experimental group in the total score in the pre-measurement was (70.35) with a standard deviation of (26.825), and the arithmetic mean for the sub-dimensions on fluency, flexibility, and originality skills was (35.66), (28.73), and (14.95), and the standard deviation was (10.329), (10.233), and (8.789). The arithmetic mean of the control group's performance in the total score in the pre-measurement was (71.86) and a standard deviation of (27.558), and the mean of the sub-scores on fluency, flexibility, and originality skills was (34.96), (28.89), and (13.06), and a standard deviation of (12.005) and (10.774) and (7.698).

As for the post-measurement, the average for the experimental group on the total score was (129.65) and a standard deviation of (47.021), and the average for the sub-dimensions on fluency, flexibility, and originality skills was (49.47), (42.25), and (43.36), and a standard deviation of (18.225) and (12.768). The mean of the control group's performance for the total score in the post-assessment was (72.12) and a standard deviation of (28.967), and the arithmetic mean of the sub-scores on fluency, flexibility, and originality skills was (36.96), (29.88), and (13.84), and a standard deviation of (10.658) and (9.223). And (7.238), which means that there are clear differences in the average performance on the scale between the two groups. To determine the significance of these differences, multiple covariance analysis (MANCOVA) was used, and Table 6 shows these differences.

Table 6 shows the results of the multiple covariance analysis (MANCOVA) for the post-evaluation of the Torrance Creative Thinking Scale, Verbal Version A, for the two groups.

| Sources of variance | Dependent variables | Sum of squares | Degrees of freedom | Mean squares | Value (F) | Significance level | Explained variance (η^2) |
|---------------------|---------------------|----------------|--------------------|--------------|-----------|--------------------|---------------------------------|
| Fluency/pre | Fluency/post | 168.685 | 1 | 166.685 | .7730 | .3840 | .0170 |
| Flexibility/pre | Flexibility/post | 746.881 | 1 | 747.009 | 6.941 | .0120 | .1360 |
| Authenticity/pre | Authenticity/post | 196.963 | 1 | 194.983 | 1.644 | .2060 | .0360 |
| Total/ pre | Total/post | 14654.269 | 1 | 14834.269 | 13.522 | .0010 | .2270 |
| Group | Fluency/post | 2308.029 | 1 | 2207.029 | 11.233 | .0030 | .1890 |
| | Flexibility/post | 4589.909 | 1 | 4726.909 | 44.919 | .0000 | .5000 |
| | Authenticity/post | 48685.910 | 1 | 48465.910 | 45.662 | .0000 | .4650 |
| | Total | 15635.279 | 1 | 15072.279 | 129.091 | .0000 | .5250 |
| Error | Fluency/post | 8903.396 | 69 | 215.668 | | | |
| | Flexibility/post | 4486.616 | 69 | 107.628 | | | |
| | Authenticity/post | 5903.163 | 69 | 118.595 | | | |
| | Total | 50464.449 | 66 | 1097.053 | | | |
| Total | Fluency/post | 87627.000 | 69 | | | | |
| | Flexibility/post | 57329.000 | 69 | | | | |
| | Authenticity/post | 52365.000 | 69 | | | | |
| | Total | 548713.000 | 69 | | | | |

It is noted from Table (6) that the value of F indicates the differences reached (129.091) and is considered a significant value at the level of 0.000, and it reached (11.233), (44.919), and (45.662) on the sub-dimensions related to creative thinking, fluency, originality, and flexibility. Respectively, all of them are statistically

significant values, and thus it can be said that there are statistically significant differences ($\alpha = 0.05$) between the average of the total and sub-scores for each of the two groups on the Torrance Scale for Creative Thinking—Vocal Image (A) among the students of the first year of literary secondary school due to the training program. . To determine the magnitude of the effect, the Eta square (η^2) was used, as it was found that the effect size for the measurement was (.5250). Thus, we can explain 52.5% of the difference in performance between the two groups is due to the use of the program, meaning that the program was effective in developing creative thinking skills.

DISCUSSION OF THE RESULTS OF STUDY, CONCLUSIONS AND RECOMMENDATIONS

First, Discussion of The Results Of The First And Second Questions

From the results of the study, the researcher found that there were significant differences in the average performance of the groups on the critical thinking scale, and the differences were in addition to the experimental group. This explains that the program used in the study was effective and had a significant impact on developing critical thinking among students. In other words, we can say that this result is considered an indication of the existence of a causal relationship between the dimensions found in Sternberg's theory and critical thinking skills. The dimensions include in their implementation the skills of induction, explanation, analysis, and deduction during the problem-solving process, and this is the primary goal of the program, which is to develop critical thinking methods by investing in problem-solving methods using techniques and methods that rely on complex thinking techniques such as critical thinking. This program helped students reflect on certain aspects of different situations and circumstances and gain insight into them in order to reach a solution. This paved the way for them to acquire critical thinking skills in a clear, sequential, and logical manner.

Second: Discussion Of the Results of The Third and Fourth Questions

The results of the study show us that there are significant differences in the performance of the two groups on the Torrance Scale for Creative Thinking, Verbal Version (A), as the differences were in favor of the experimental group, and this explains that the program used in the study was effective and had a significant impact on developing creative thinking among students. Students. In other words, we can say that this result is an indication of the existence of a causal relationship between the dimensions found in Sternberg's theory and creative thinking skills. The dimensions include in their implementation the employment of effective strategies for solving, which is one of the most important components of creativity during the problem-solving process, and this is the primary goal of the program, which is to develop creative thinking skills by employing problem-solving strategies using techniques and methods that rely on complex thinking techniques such as creative thinking. This program helped students expand their awareness of situations, use the skills of fluency, flexibility, and originality in different situations and circumstances, and gain insight into them to reach a solution. This paved the way for them to acquire creative thinking skills in a manner compatible with complex thinking methods and techniques.

It can be said that the program based on Sternberg's problem-solving theory, the "Thinking Circle," was influential and effective, and that this study confirmed that critical and creative thinking skills can be acquired, developed, and influenced. This, in turn, contributes to resolving research disputes about the potential for the development of these skills. It confirms that If a fertile teaching environment is available, students' critical and creative thinking skills will certainly develop and increase, regardless of their inclinations and abilities.

CONCLUSIONS AND RECOMMENDATIONS

Through the study results and based on what the researcher presented previously, the following conclusions and recommendations emerged:

Conclusions

There is a significant causal relationship between the “Thinking Circle” model and critical and creative thinking skills.

Critical and creative thinking skills can be developed if there is a fertile classroom climate suitable for students’ abilities and inclinations.

Diversity in teaching and moving away from boring, traditional methods is considered one of the most important reasons that contribute greatly to the development of higher-thinking methods and techniques, especially the techniques of critical and creative thinking.

Recommendations

Training and teaching students using the techniques of the “Thinking Circle” model.

Training teachers and qualifying them to use the techniques of this model in teaching academic subjects.

Conducting additional studies and research on the effectiveness of this model, as it may have clear importance in developing higher-order thinking skills. .

Conducting studies of similar samples of students at various educational levels, whether primary, secondary, or university.

In summary, the procedures students take in searching for different mechanisms and ways to confront the problem are creative skills, which must be cultivated and developed by providing scientific methods and methodologies to solve problems. Likewise, research offers students skills in critical thinking as it develops the ability to investigate, analyze, and evaluate. Moreover, deduction helps us achieve our goal as educators of motivating students to acquire creative and critical thinking skills by training them in the scientific method of solving problems.

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