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Constructing a Training Program Based on The (S.A.M.R) Model and Its Impact in The Creativity Levels of Mathematics Teachers

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Abstract

The current research aims to construct a training program based on the Substitution Augmentation Modification Redefinition (S.A.M.R) model and find out its impact on the creativity levels of mathematics teachers. To verify the research objective, the following null hypothesis was developed:

"There is no statistically significant difference at the level (0.05) between the average scores of the mathematics teachers of the experimental group who were subjected to the training program based on the (S.A.M.R) model and the average scores of the mathematics teachers of the control group who did not subject to the training program in the creativity levels test". The researchers adopted the experimental research method and experimental design for the control group with the post-test. The program was built and the experiment was applied to a sample of mathematics teachers for the second intermediate grade, which numbered (31) teachers, with (15) teachers for the experimental group and (16) teachers for the control group, for the academic year 2021 -2022. Equivalence was carried out between the two groups of teachers in the variables (exact specialization, years of service, number of training courses, intelligence, creative thinking). The research tool, represented by the creativity levels test, was built, and its validity and reliability were verified, and the teachers of the experimental group were trained based on the training program (S.A.M.R.) model, and after completing the application of the experiment, the research tool was applied to both groups. The results of the T-test for two independent samples showed the superiority of the experimental group teachers over the control group teachers in testing creativity levels. In light of the results, the researchers

concluded that the training program based on the SAMR model had a positive impact in raising the creativity levels of the experimental group teachers. It also contributed to meeting their training needs and improving their ability to prepare daily lessons by applying what they learned during the training sessions. Moreover, the integration of technology into mathematics teaching is in line with recent developments in the educational field and the development of various curricula on the one hand, and the capabilities of teachers on the other.

- **The research problem**

The problem that the researcher finds that there is a shortcoming concerning the creativity levels of mathematics teachers, and the researchers found that the vast majority of them did not have the slightest idea of the concept and its levels, and this prompted the researchers to survey the opinions of several mathematics teachers who have a long experience in teaching middle school. After the term was clarified to them, (85%) of them confirmed that the levels of creativity that some may have are insufficient to advance the educational reality in light of the crises that afflict the educational process. Based on the foregoing, the researchers found that there is a problem that, in essence, reflects a basic assumption that is manifested in the absence of manifestations of investment in creative mental abilities of mathematics teachers, which creates a large gap between teacher preparation programs and what is produced by the data in our time, and here the researchers aimed the need to reconsider the preparation programs teachers by subjecting them to in-service training programs according to electronic that may provide teachers and students with an appropriate learning environment in line with the requirements of our current age. On this basis, the researchers sought to construct a proposed training program based on the (S.A.M.R) model, which is one of the models that is being tried for the first time locally in the teaching of mathematics (according to the researchers' knowledge) in an attempt to find out its effect on the creativity levels of mathematics teachers. Therefore the research problem answered the following question: What is the effect of a training program based on the (S.A.M.R) model on the creativity levels of mathematics teachers?

- **The research importance**

The research importance can be summarized in two main aspects:
the theoretical side:

1- Teachers and supervisors may benefit from using the S.A.M.R model in teaching mathematics.
2- Teachers and supervisors may benefit from how to employ electronic and integrated education in teaching mathematics.

3- It may be useful for researchers to find new strategies in light of the (S.A.M.R) model in mathematics teaching.
4- The research may contribute to improving the creativity levels of mathematics teachers.
5- The attention of those in charge of education is drawn to the necessity of using new models to integrate technology in teaching mathematics.

Application side:

1- Recognizing the effect of a training program based on the (S.A.M.R) model on the creativity levels of mathematics teachers.
2- Teachers and supervisors may benefit from provided by the research in terms of training sessions and models for teaching plans according to the (S.A.M.R) model, as well as testing the creativity levels for mathematics teachers.
3- The research presents a proposed training program based on the (S.A.M.R) model as an alternative to the traditional programs used in (in-service) teacher training.

- **The research purpose**

The current research aims to construct a training program based on the (S.A.M.R) model for mathematics teachers and to know the program's impact on the creativity levels of mathematics teachers.

- **The research hypothesis**

To achieve the research objectives, the following null hypothesis was developed: There is no statistically significant difference at the level (0.05) between the average scores of the mathematics teachers of the experimental group who were subjected to the training program based on the (S.A.M.R) model and the average scores of the mathematics teachers of the control group who did not subject to the training program in the creativity levels test.

$$H_{\circ}: \mu_1 = \mu_2$$

$$H_1: \mu_1 \neq \mu_2$$

- **The research limits**

1- Human limits: Mathematics teachers for the second intermediate grade in the General Directorates of Education, Baghdad, Al-Karkh, 1-2-3.
2- Spatial limits: the General Directorate of Teacher Training, Training and Educational Development.
3- Objective limits: the first four levels of creativity are represented by creativity (expressive - productivity- inventive - innovative).
4- Time limits: the academic year 2021-2022.

- **Terms definition**

1. Training Program

- (aljizani&other,2017): that a system consisting of a set of educational experiences presented to a group of learners to achieve special educational goals in a specific period (aljizani&other,2017:460).
- (Ibrahim, 2009): It is the preparation and training of the individual in a specific field by providing him with some theoretical knowledge in a particular field or by developing his knowledge for the better or the most recent so that each individual has the appropriate opportunities to go through procedural practical experiences so he does some professional and performing work (Ibrahim, 2009: 203). The researchers adopt a theoretical definition of (Ibrahim, 2009). The training program is defined procedurally as: A selection of applications, procedures and procedures, and expertise is applicable during a specific period and aimed at developing mathematics teachers for the second intermediate grade professional, mental and personal through expanding their recognition, conscience in general and their creativity and not accepting what is used to highlight and use new ideas to solve the problems they face in their professional life.

2. (S.A.M.R) Model

- (Puentedora, 2006): It is a series of technology integration levels in learning environments that encourage and assist teachers in improving the quality of teaching in classrooms by integrating technology. The series consists of four different levels of technological integration, represented by the first letters of the words, Substitution, Augmentation, Modification, Redefinition, and at these specific levels, technology integrates with education to contribute to a higher level of activity and an increase in educational benefit (IRM, 2017: 274).
- (Christina & other, 2019): It is a framework to show the impact of technology on teaching and learning and passes through different stages starting from the basic level of learning in the stage of replacement to the level where learning is transformative (redefining), and it also helps in determining whether technological applications or part of it is useful for student learning. (Christina & other, 2019: 74).The researchers adopt theoretically the definition of (Puentedora, 2006) and define the (S.A.M.R) model procedurally as levels of technology integration in learning environments and include four different levels of technological integration, represented by the first letters of the words, substitution, augmentation, modification (Modification, Redefinition, adopted by the researchers in constructing the training program, which seeks to use the model in integrating technology in the teaching of mathematics for teachers of the second intermediate grade.

3. Levels of creativity

- (Nofal, 2009): as "the five levels that were classified by (Taylor) after the analytical study, which included nearly a hundred definitions of creativity, these levels range between individuals" and as follows:

a- Expressive Creativity
b- Productivity creativity
c- Inventive Creativity
d- Innovative Creativity
e- Emergentive Creativity (Nawfal, 2009: 32-34).

- (Al-Hailat, 2015): it is the “Levels that range in individuals, starting from a normal (expressive) creative level to high creativity (professional) level of first-class (Al-Hailat, 2015: 28).
- The researchers adopt theoretically the definition of (Nawfal, 2009) defines the levels of creativity procedurally as the five levels that progress in individuals and start from a simple expressive level and end with imaginative level, and it is measured by the total degree that the teacher obtains in the test of creativity levels.

- **Theoretical background**

E-Learning and Blended Learning

E-Learning

The relations between humans and technology have produced ideas and concepts that require some analysis and research, and among these concepts is the concept of e-learning, as the literature related to this concept has many definitions, including:

It is a method of education using modern communication mechanisms such as multimedia, computers, networks, electronic libraries, and internet portals, whether that is remotely or inside the classrooms. This is done through the use of different types of technologies to communicate scientific ideas to the learner in the shortest time, least effort, and greatest benefit (Al-Ajrash, 2017: 21).

E-learning philosophy

The philosophy of e-learning stems from several basic principles, the most important of which are:

- Learning is based on students' abilities and aptitudes, referring here to continuous learning, self-learning, individual learning, and others.
- Flexibility in providing educational opportunities.
- Taking into account the principle of individual differences among learners, providing opportunities for learning according to the individual's circumstances and capabilities.

- Equality of opportunities and democracy of learning without discrimination in circumstances, whether social, economic, or other.
- Collaborative (participatory) learning allows for increased exchange of experiences and information handling so that participants benefit from each other (Abdel-Raouf, 2014: 39).

Blended learning

The term blended learning refers to the process of merging traditional learning tools and methods with e-learning tools and methods. It is an application of old educational strategies with a vision and technological innovations in the classroom, where more than two important and distinct methods of education are combined, one of which is concerned with teaching in the classroom, and the other is concerned with teaching methods through technological innovations and the internet (Ismail, 2009: 98). Blended learning is one of the most prominent developments that characterize the twenty-first century, because of its ability to deliver learning to all regardless of their circumstances and the many barriers that stand in the way of achieving their ambitions, as it provides learning everywhere, whether it is in school, work or the university or the home, and the strength of this type lies in its ability to mix different learning styles in proportion to the students' capabilities and circumstances, thus allowing to overcome the negatives and obstacles of each learning style. It helps in finding solutions to most of the problems that traditional education and e-learning suffer from. In many regions of the world, it is impossible to maintain the traditional pattern during exceptional circumstances such as wars and natural disasters, in addition to the successive economic crises that cast a shadow on the educational process through the lack of budgets allocated to schools with the increase in the student numbers, which is accompanied by pressure on educational institutions to do more in terms of improving their outcomes (Al-Shurman, 2015: 38-39).

Commentary on the theoretical background related to (e-learning and blended learning)

The two researchers agree with the educational views that indicate that it is not possible to rely on e-learning and consider it a new educational pattern as an alternative to the traditional ones and that technological innovation cannot be ignored or dispensed with, which led to finding another integrative approach in reference here to blended learning, as it is an application of old educational strategies with a vision and innovations, and this vision seeks to deliver learning to all, regardless of the obstacles that stand in the way of achieving their ambitions. As for the four meanings of blended learning, it seeks to integrate the educational process in terms of different theories (behavioral, cognitive, and structural) and the different teaching methods that emanate directly or indirectly from these theories, as well as mixing forms of technology and with the means of traditional learning to contribute to the generation of new teaching innovations that seek to influence the harmony between learning and work. As for the values related to the development of blended learning models, the complex model is concerned with the diversity of delivery channels and information sources and their presentation, it is concerned with the best methods

and sources without regard to their abundance. This is consistent with the (S.A.M.R) model that will be recognized in the next axis.

(S.A.M.R) Model

There are many keys to integrating technology in education, one of the most important of these keys is the (SAMR) model that seeks to integrate technology with education through the use of interactive tools and programs to carry out the educational task. (Puentedora, 2006) mentioned this as a reaction to Harvard University's experiences in the field of Educational technology from kindergarten to university education, the model allows the technology evaluation used and allows designing tasks that develop higher-order thinking skills for students and help them engage in new scientific experiments, as well as provide teachers with a general framework for integrating technology strongly in the field of education (Klaus, 2019: 63). The SAMR model contains in its details four stages of technological integration, but the goal is not to reach all of these stages in every lesson. The main role of the teacher is to change the lessons to obtain technological integration according to the model steps, and the student role goes beyond the method of receiving information in an attempt to reach the assessment and reproduce the content (Adrian, 2015: 186).

The model includes four different stages, and these stages are categorized into two levels, as follows:

First: Enhancement: in which technology is used as an alternative tool to the traditional tools used without making a functional change in tasks. These alternative tools can also be used with improving the functional use of technology and it contains two stages: (Roman et al., 2009: 170).

- Substitution: Substitution is the first stage of the model, in which technology is used as a simple alternative to a traditional educational tool. At this stage, there is no change in the process or results, so technology is introduced into the activity or the method of teaching, and the benefits that students get are modest and may provide a new benefit such as lower costs. Students can read a book on the computer or portable devices instead of carrying the book and reading it, and here the book remains the same, but the method is different. The teacher can display the book on the interactive whiteboard without using traditional blackboards of different types or using multiple programs for drawing instead of manual drawing (Dina & levon, 2019:234). The Information Resource Management Association in the United States of America states that although this type of activity enhances and encourages student learning, the level of technology integration is very low. It is just performing tasks using technology instead of performing them without it. It is just substituting the thing with itself again but with the use of technology (I.R.M.A resources, 2017:278). (Alev & other, 2019) indicated that the main objective here is to encourage students to use technology to address the task, taking into account that the task remains the same (Alev & other, 2019: 229).
- Augmentation: Augmentation is the second stage of the model in which the model is used to enhance student learning through making the functional change of education so that it provides benefit to students. Here, the view at the previous level is enhanced with a recorded clip or link when clicked

on it, you can expand that term or mislead the main points in the lecture (Dina & levon, 2019:234). It is also possible to use many programs that enable text formatting, making additional formats, making cards, taking pictures, recording videos, and expressing videos using their image. Furthermore, the task has not changed, but it has been reinforced with additions that develop technological fluency among students, and it can be referred to as (improving work by adding a new feature) (Sarah et al., 2015: 108).

Second: Transformation: in which technology is used to complete tasks that allow effective and effective re-design of those tasks, as well as designing new and innovative tasks that were not possible in any of the previous stages. It contains two stages:

- Modification: Modification is the third stage of the model, in which technology is used to bring about a significant change in the educational process, where technology facilitates the redefinition of instructional tasks and assessments so these tasks allow students to analyze their work and learning through the use of a technology lens, in which multimedia can be added (Alev & other, 2019: 230). It is also possible to form creativity using various interactive programs and filmmaking and changing the book into an interactive multimedia book, or digital story programs, or any program that can change the task and add personalization to the work and can be referred to as (a change in work) (Ruzzaman & other, 2016: 45). The Information Resources Management Association in the United States of America states that the goal of this stage is to make major changes in the task as well as training in the use of the internet, where technology works to change how the student learns so that he can link what he has learned in class to the real reality, which gives students skills, such as making decisions and solving problems inside and outside the classroom (IRMA, 2016:697).
- Redefinition: redefinition is the fourth and final stage of the model, in which a new constructor request is used to complete the task. This level falls within the levels of analysis, evaluation, and innovation of the modified Bloom levels. (Alev & other 2019: 230). The teacher can change the content using the available technology and software, and they can conduct discussions through interactive books and communicate with scientists around the world. It also helps students to search for additional and new information, share with their colleagues, and communicate with their peers, and they can use a lot of advanced software to reach the highest stage of communication and cooperation with others, as well as the use of new software and designs different from the previous tasks, to bring the student to the level of technological innovation. It can be referred to as (redefinition, a completely new task) (Ruzzaman & other, 2016: 45-46).

The importance of the S.A.M.R model

The (S.A.M.R.) model is one of the most famous models of integration that helps teachers think about finding the best and optimal ways to integrate technology and use it in the best way to bring

students to transitional learning that is impossible to reach without the use of technology. Its importance lies in two main aspects:

1. For the teacher:

- Supports teachers and enables them to design, develop, tasks for integrate technology into education.
- Create tasks targeting the higher skills of the pyramid (Bloom).
- Helps move from a low level of technology integration to a higher level.
- Designing tasks that improve students' outcomes and give them creative and innovative skills, and through which teachers can evaluate the technology used and follow up on its impact on learning and teaching (Alev & other, 2019:229).

2. For the learner:

Students are the focus of the work and the primary goal is to prepare them for the future. The importance of the (S.A.M.R) model for students can be illustrated through the International Association for Technology in Education Standards (Carver, Atkins, 2021: 22). The document (Iste, 2016) clarifies the skills and knowledge that students need for their progress and growth to contribute to an interconnected and ever-changing global society, as follows:

- Empowered Learner: Technology gives students broad influence to play an active role in selecting, achieving, and demonstrating competence to achieve their educational goals through their scientific knowledge.
- Digital Citizen: Students learn about their rights, duties, and opportunities to live, learn and work in an interconnected digital world, where they act in safe, legal, and ethical ways.
- Knowledge Constructor: collects, critiques, and organizes a variety of sources through the use of digital tools to build knowledge, create a creative product, and obtain a meaningful scientific experience.
- Innovative Designer: Students use a variety of techniques within the design process to identify and solve problems by creating new and useful methods.
- Computational Thinker: Students develop and use strategies for understanding and solving problems through methods that demonstrate the influence and technology power in developing and selecting solutions (Iste, 2016).

Misconceptions about the S.A.M.R model

Despite its widespread, it faces a lot of criticism from some educators, some see that it lacks many details, and this can lead teachers, specialists of professional and technological development centers, and others in charge of the educational process to interpret the model and represent it in different ways, and the most prominent of these criticisms are:

1- Absence of context: The availability of context is important in most educational research and practices related to education and technology, although the model does not contain an agreed

context, the context elements of infrastructure, technological resources, availability of physical capabilities and others are not clear (Al-Far and Shaheen, 2017: 11-12).

2- The rigid structure: the model classifies technology integration processes in the form of gradual levels and as a result obliges teachers to use technology in predetermined ways, it reduces the importance of using technology in traditional ways to enhance learning and teaching.

3- The productive is based on the educational process: the educational process is the focus of educational goals and educational outcomes, while the model simplifies the process of integrating technology and the goal is to improve the product (educational activity) and not the same learning process (Issa, 2020: 249). Moreover, (Janatham, 2019) indicates that technology in the twenty-first century is continuous and existing tools may change and evolve, furthermore, the current teaching tools that it may use with the model may become a burden in time soon, so teachers do not need to train them on specific ICTs, but rather on how they can apply any of them in their classrooms (Jonnathan, 2019: 11).

Commentary on the theoretical background related to the third axis (S.A.M.R model)

The (S.A.M.R) model is one of the models for integrating technology into the educational process, and the main objective of using it is to make the science of teaching methods lead the technology, and it differs from digitization in that digitization talks about how to apply modern means compared to traditional methods. As for the model, it provides an ideal use of how to move from one level to a higher level than it, the model contains in its details four stages of technological integration. It can suggest a new name for the SAMR model depending on its basic levels, so it can be called (E.T) model as a reference here to the first letter of the word (Enhancement) and the first letter of the word (Transformation) and the boundary between them.

Creativity and its levels

Creativity

The changes entrusted to the role of the school as a result of recent educational developments made creativity an urgent need that must be met by all teachers, and this, in turn, reflects positively on the students and their personality, to be able to research, creativity and innovation and achieve their integrated growth in various fields of knowledge, emotional and skill (Al-Ajeez and Sheldan 2010: 6). As a result of reviewing the literature and previous studies related to creativity, the researchers must summarize the definition of creativity by adopting two main parts: language and terminology.

- Creativity as language: It is derived from the verb (innovate) in something, which means invented or created.
- Creativity idiomatically: The definitions of creativity are many and different and many researchers have classified it into four main dimensions as follows:
  - First dimension: creativity based on production:

Among the definitions of this dimension is the definition of (Piers), which considers the ability to avoid the usual and routine ways of thinking provided that there is a new or uncommon production that can be implemented (Al-Darini, 1982: 163).

- Second dimension: Creativity based on the characteristics of the creative personality:

One of the definitions of this dimension is the definition of (Guilford), which thinks an open framework has a unique feature, which is the multiplicity of answers provided (Zaytoun, 1987: 81).

- Third dimension: creativity based on the process:

Among the definitions of this dimension is the definition of (Torrance), which considers the process of perceiving the difference in information, changes, missing elements, evidence, and influences, setting hypotheses about them, finding solutions to these hypotheses (Torrance, 1963: 454).

- Fourth dimension: Creativity based on the creative environment:

It is related to all the different factors, circumstances, and situations that help in developing the creative abilities of the individual (Al-Mawwajdeh, 2010: 34).

It is divided into two main sections:

1. Public: which is related to society and its culture in general (Torrance, 1980: 165-173).
2. Special: It is related to the climate that must be available in the school, including conditions and possibilities for developing the creative abilities of learners (Al-Darini, 1982: 166).

Creative thinking levels

Most of the literature and sources related to creativity levels, including (Nawfal, 2009), (Al-Hailat, 2015), (Zayer and Al-Bayati, 2020) agree that in an analytical study conducted by (Taylor) that included an analysis of nearly a hundred definitions of creativity, that the creative levels, in theory, is classified into five levels of creativity, as follows:

1- Expressive creativity
2- Productive creativity
3- Inventive creativity
4- Innovative creativity
5- Emergent creativity

(Nawfal, 2009: 32-34), (Al-Hailat, 2015: 28-30), (Zayer and Al-Bayati, 2020: 170-171).

These five levels are arranged hierarchically, starting from the least creative and most common levels and ending with the most creative, least common, rare, and often non-existent in most individuals.

1- Expressive level: in which originality and efficiency are of little importance and ideas are developed regardless of their quality or originality. Creativity may be irrelevant to the topic. This type of creativity can be developed through multiple strategies. This level is based on rules. The main feature that this level characterizes is spontaneity (Zayer and Al-Bayati, 2020: 170).

2- Productive creativity: This level is related to the development of a machine, a product, or the design of a painting, for example, in which individuals move from abstract creativity to productive creativity (Al-Maghazi, 2015: 39).
3- Innovative creativity: At this level, the individual shows ingenuity in employing or using materials, and developing them for new uses without the availability of original contributions in generating basic ideas.
4- Innovative creativity: This level includes generating new functional uses for known existing things or old things through the creation of new creative ideas (Goran, 2002; Nawfal, 2009: 34).
5- Emergentive or imaginative creativity: This level is considered one of the highest levels of creativity and is rarely attained by the general public, in which the individual's ability to reach a new theory or principle is achieved (Al Hailat, 2015: 30).

Commentary on the theoretical background related to the fourth axis (creativity and its levels)

The vision of (Al-Jassim, 2010), the researchers differ with him, as creativity is a process that can be researched and studied, even if its essence is spiritual and divine. The two researchers agree with Guiford's vision that creativity has four main skills or components, and all other components and skills that were mentioned by the sources and researchers are implicit components represented in its basic components (fluency, flexibility, originality, and the ability to remotely relate). However, the levels of creativity, (Taylor) has created in the analysis nearly a hundred definitions of creativity and reached these levels, noting that these levels are only the basic components of creativity developed by (Guilford), but without being restricted to some sub-details.

- **Research procedures:**

Research Methodology

The experimental research method was adopted to verify the research objectives, after reviewing much literature, research, and previous studies in the field of specialization.

Experimental design

The design of the control group with the post-test was adopted. The research design is a blueprint for action or a program that shows how the research experiment is implemented. Furthermore the researchers' adoption of this design aim as a result of its relevance to the nature of research represented by the experimental group being exposed to the training program based on the (SAMR) model and according to the limited capabilities, while the presence of the control group is to reveal the impact of the training program in terms of differences in the scores of the two groups concerning testing the

creativity levels of mathematics teachers and the differences in the scores of their students in the achievement test, as shown in Table (1):

Table (1) *Experimental design for mathematics teachers*

The two groups	Equivalence of the two groups	Independent variable	Dependent variable	The measure of the dependent variable
Experimental	- Exact specialization - Years of service - The number of training courses - intelligence - Creative thinking	A training program based on the (S.A.M.R) model	Creativity levels	Creativity level test
Control		They will not be subject to any training program		

Research community

The research community represents all the vocabulary of the phenomenon that the researchers study, and defining the community when conducting research is one of the important steps and requires extreme accuracy and depends on the design and conduct of studies and the related efficiency and dissemination of results (Melhem, 2002: 247). The current research community includes all mathematics teachers in the general directorates of Baghdad Education, Karkh 1-2-3, whose number is (796), and the middle and high schools for boys in the aforementioned directorates, which number (258) as shown in Table (2).

Table (2) *Research community*

Seq.	Directorate	Math teachers	Middle and high schools for boys
1	The first Karkh	231	72
2	The second Karkh	328	109
3	The third Karkh	237	77
Total		796	258

The research sample

The sample of teachers was chosen by a simple random draw method from the research community of mathematics teachers who teach, regardless of the exact specialty (education or science), they were divided into two groups randomly, the experimental (they will be subject to the training program) and

their number after exclusion (15) teachers and the control (not subject to the training program), their number after exclusion has reached 16 teachers.

Adjustment procedure

To ensure the validity of the research results, and despite the random selection of the research sample, some procedures were adopted that the researchers expect may affect the experiment results. These procedures are as follows:

1. Internal safety of experimental research:

The researchers can attribute the difference between the two research groups to the effect of the independent variable and not to other extraneous factors, as follows:

1- Equivalence between the two research groups.
2- History.
3- Maturity.
4- Measurement tools.
5- Waste (experimental extinction.
6- Associated Accidents.
7- Statistical regression.

2. External Safety of Experimental Research:

It means that the research is honest so that the research results can be generalized to the research community in the same experimental procedures and conditions, and it includes the following procedures:

1- Sample members: All members of the research sample were chosen randomly.
2- Following the experimental procedures: This factor was controlled through the following procedure:

   Confidentiality of the experiment: To ensure the confidentiality of the experiment, it was agreed with the Mathematics Division in the General Directorate for Teacher Preparation, Development and Educational Training to inform teachers in all official correspondences related to the subject of research that the course is ministerial and adopted by the Department of Mathematics and Science in the aforementioned directorate.
3- The interaction of experimental situations: the two research groups were not exposed to any other experimental process during the research period.

- **Research Requirements**

Training program:

The training program expresses the tool that links the training needs and the objectives to be achieved, methods, materials, and training topics so that they form interconnected and overlapping threads that support each other in specific contexts according to a specific period to reach the desired goals for training, so an existing training program has been prepared On the SAMR model, according to the following steps:

Training program steps:

- Most of the aforementioned training programs, despite their names and content, must contain some of the main steps that participate in all these training programs (planning, implementation, evaluation).
- The main components of training programs (objectives, content, training activities, tools and means, evaluation).
- All studies agreed on the prior preparation of the training program.

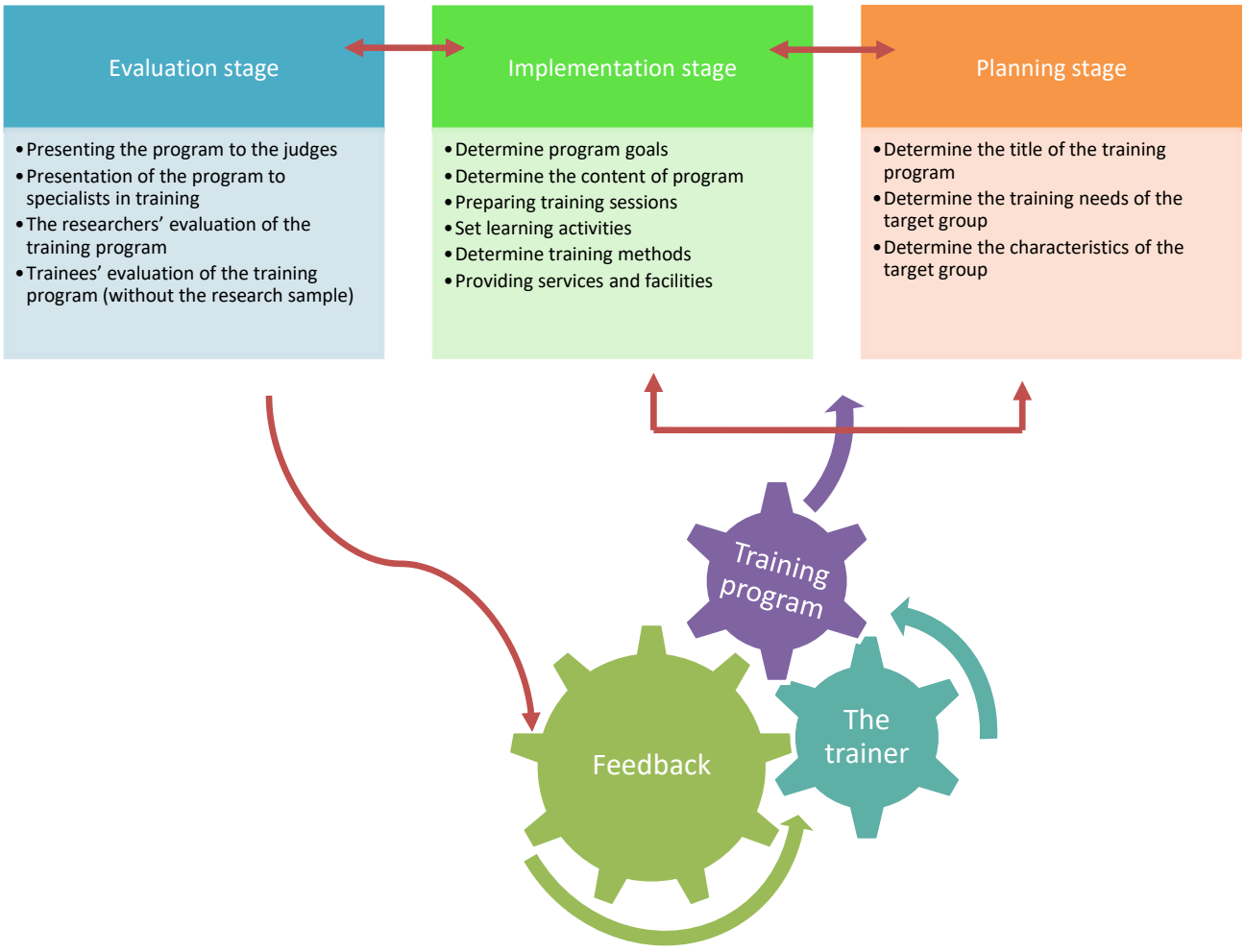

Figure (1) The steps for constructing the training program

- **The research tool**

Creativity level test

The creativity levels test for mathematics teachers was built according to the following steps:

1- Determine the purpose of the test.
2- Reviewing the literature and previous studies.
3- Determine the levels of creativity.
4- Indicators of creativity levels.
5- Crafting the test items.
6- Preparation of test instructions.
   - Answer instructions.
   - Correction instructions.
7- Sample Information and Sample Statistical Analysis:
   - Information Sample: To ensure the clarity of the test instructions and paragraphs, and to determine the time needed for teachers to answer the test, the test was applied to a sample of information (9) teachers distributed over three schools, with three teachers in each school, and each school belongs to one of the three directorates as of Monday, 16/08/2021 until Thursday 19/8/1202.
   - Statistical Analysis Sample: Some of the instructions were clarified based on the teachers' inquiries. The test was applied to the sample of the statistical analysis, which numbered (50) middle school teachers, distributed over several schools belonging to the three directorates as of Sunday, 22/8/2021 until Thursday 9/9/2021.
8- Validity Test:
   - Face validity
   - Construct validity
9- Test reliability
10- Correction reliability
11- The creativity test in its final form

- **Statistical Means:**

The (cooper) equation was used to find the percentage of agreement between the arbitrators, and the Statistical Package for the Social Sciences (SPSS) version (23) was used for the following statistical methods:

1- Pearson correlation coefficient to find the correlation coefficient between the degrees of each creativity level.
2- The (Cronbach's Alpha) equation to find the reliability of creativity levels test.
3- Levene's test to find out how homogeneous the two research groups are in some variables.
4- Chi-square test to find out the equivalence of the two research groups in a variable.

5- A t-test for two independent samples to verify the equivalence of the two research groups in some variables.

- **Presentation and Interpretation of Results:**

- The results presentation

Results related to the null hypothesis: "There is no statistically significant difference at the level (0.05) between the average scores of the mathematics teachers of the experimental group who were subjected to the training program based on the (SAMR) model, and the average scores of the mathematics teachers of the control group who did not subject the training program in the creativity levels test, after completing the application of the creativity levels test and correcting the responses of the mathematics teachers and organizing them in special tables, it was found that the arithmetic means of the scores of experimental group teachers was (31,800) with a standard deviation of (4.057), while the arithmetic means of the scores of control group teachers was (26,670) with a standard deviation of (4.139), as shown in Table (3):

Table (3) *Statistical description of the two research groups in the variable of creativity levels*

Group	Number of teachers	Arithmetic mean	Standard deviation	Standard error of the arithmetic mean	95% confidence interval in Arithmetic mean	
					Upper limit	Lower limit
Experimental	15	31.800	4.057	1.047	8.063	2.037
Control	16	26.750	4.139	1.035	8.062	2.038

To find out the significance of the difference between the differences in the scores of the two group teachers, the Levene's test was applied and the value of (F) is (0.01) at the significance level (0.972), which is greater than the approved significance level of (0.05), which indicates that the two research are homogeneous in this variable. To find out the significance of the difference between the average scores of the two group teachers, a t-test was applied for two independent samples and the value of (t) is (3.427) at the significance level (0.002) which is smaller than the approved significance level of (0.05) at the degree of freedom (29). This indicates the teacher's superiority of the experimental group who were subjected to the training program based on the (SAMR) model over the teachers of the control group who did not subject to the training program, as shown in Table (4):

Table (4) *The value of (F) and (t) for the experimental and control groups in the creativity levels variable*

Group	Number of students	Levene's test to equalize the variance		t-test to equalize the averages		Degree of freedom df	Statistical significance at the 0.05 level
		F	Significance	T	Significance	29	Statistically significant
Experimental	15	0.01	0.972	3.437	0.002		
Control	16						

Thus, the first null hypothesis was rejected and the alternative hypothesis was accepted, which states: "There is a statistically significant difference at the level (0.05) between the average scores of the mathematics teachers of the experimental group who were subjected to the training program based on the (S.A.M.R) model and the average scores of the mathematics teachers for the control group who did not subject to the training program in the creativity levels test. To find out the effect size of the independent variable (the training program based on the SAMR model) on the dependent variable (creativity levels), Cohen's value (d) was calculated and the value of (d) was (1.273), which indicates that the effect of the independent variable was (very large) in favor of the experimental group, as shown in Table (5):

Table (5) *The value of (d) and the effect size on the creativity levels of the two research groups*

Independent variable	Dependent variable	t value	dt	d value	Effect size
A training program based on the S.A.M.R. model	Creativity levels	3.427	29	1.273	Very big

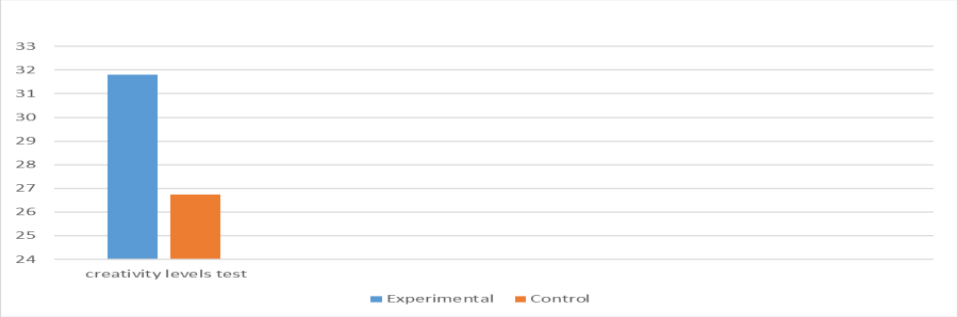

Figure (2) *Arithmetic mean for mathematics teachers in creativity levels test*

Results and discussion

Interpret the results of the null hypothesis

The results of the creativity levels test showed the superiority of mathematics teachers in the experimental group who were subjected to the training program based on the (SAMR) model over the teachers of the control group who did not subject to the training program. This may be because technology has changed the way of thinking in various ways, it is not possible for technology to be a tool to curb creativity, on the contrary, it is a stimulating tool for creativity. Creativity works to observe and interpret the world to reach new ideas and concepts while technology works to see that world from a different perspective and access the necessary information at any time and place. Because the training program contains activities, exercises, and some interactive sites related to mathematics, which represents a fertile field for the development of thinking and a challenge to the mind in the situations and events that the individual is exposed to, and that daily training and planning of activities based on the (SAMR) model and the various activities that used these skills, teaching methods and training media and different training strategies, it had a clear impact in meeting some of the training needs of the trainees and achieved the goals because the training sessions had a positive impact and proved its impact in improving the creativity levels of mathematics teachers. The research results were consistent with the results of previous studies that dealt with training programs, including the study of (Al-Sarraf, 2008; Nur & Lale, 2017; Al-Sheyab and Shinikat, 2021) in the variable of creative thinking.

Conclusions

1- The training program based on the (S.A.M.R) model contributed to meeting the training needs of mathematics teachers for the second intermediate grade.
2- The training program based on the (S.A.M.R) model contributed to improving the ability of mathematics teachers to prepare daily lessons by applying what they learned during the training sessions.
3- The integration of technology in the teaching of mathematics is in line with recent developments in the educational field and the development of various curricula on the one hand, and the capabilities of teachers on the other.
4- The training of mathematics teachers for the second intermediate grade on the use of some contexts of the (S.A.M.R) model had a positive impact in raising their creativity levels.

Recommendations

1- Adopting the training program based on the (S.A.M.R) model and including it in an integrated program for the training courses prepared by the General Directorate for Teacher Preparation, Training and Educational Development.
1- Emphasis on the practical aspect related to the use of interactive applications, programs, and websites that support the integration of technology in the teaching of mathematics and not be satisfied with theoretical information without direct application.
2- Opening various channels of communication between the preparation and training departments, school administrations, specialized supervisors, and teachers, to identify their training needs and their professional and technological preparations, and direct all training courses in this regard.
3- Include all training courses or workshops with some information related to blended learning in general and the integration of technology into mathematics teaching in particular.
4- Conducting training courses or specialized workshops on the most important developments that may appear in the field of integrating technology in the teaching of mathematics, assuring that the development process is continuous and not limited in time or space.
5- Draw the attention of those in charge of the educational process, including decision-makers, supervisors, school administrations, and teachers, to the need to use technology integration in the teaching of mathematics and to encourage students to identify and use it through the practice of individual self-learning and some classroom and non-classroom activities.

Suggestions

1- Conducting other studies similar to the current research in other scientific or human disciplines such as chemistry, life sciences, geography, and others.
2- Conducting other studies similar to the current research targeting other samples, such as the middle school or the primary school.
3- Conducting other studies similar to the current research that deal with other models for integrating technology in mathematics teaching.
4- Conducting other studies similar to the current research that deal with other contexts of the (S.A.M.R) model for integrating technology in mathematics teaching.
5- Conducting other studies similar to the current research dealing with the effect of the training program based on the (S.A.M.R) model on various variables such as educational practices, teaching competencies, or reducing the level of technological anxiety among teachers or teachers of mathematics.

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