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An educational model based on the integration of the dimensions of learning by Marzano and infographics in teaching mathematics and its impact on the development of lateral thinking and mathematical practices in First grade intermediate students

[1]Hajar Ali Dhifallah Al-Qahtani, [2]Hanan Ahmad Alsaydi

[1]Educational supervisor at the Education Department in Sarat Ubaida

jory1442@gmail.com

[2]Professor of Curriculum and Teaching Methods

Abah, Education College, King Khalid University

P. OBOX:960 Postal Code :612421 Abah

halsoaydi@kku.edu.sa

Abstract:

The aim of the research was to identify: The effect of an educational model based on the integration of Marzano's learning dimensions and infographics in teaching mathematics, to develop lateral thinking and mathematical practices among female students in the first intermediate grade. The experimental method was adopted with a quasi-experimental design with two groups (experimental/control) - with pre- and post-application. The research sample was selected in a simple random way from female students in the first intermediate grade (at the First Intermediate School in Sarat Abidah Governorate). Its classes were randomly divided into two groups: an experimental group with a number of (70) students. A control group with a number of (69) students. The two groups were applied: the lateral thinking test and the mathematical practices scale - in the "Polygons" chapter of the mathematics book for the first intermediate grade, third semester - (prepared by the researcher). The results reached: Preparing an educational model based on the integration of Marzano's learning dimensions and infographics suitable for developing lateral thinking and mathematical practices among female students in the first intermediate grade. The following stages were included: Using infographics to develop positive attitudes towards learning - Acquiring and integrating knowledge using infographics - Generalizing and deepening knowledge through mathematical practices - Meaningful employment of knowledge in mathematical practices - Using productive mental habits in mathematical practices. The results also showed: There is a statistically significant difference at the level (0.05) between the average scores of the experimental and control groups in the post-application of the lateral thinking test and the mathematical practices scale, in favor of the experimental group. There is a significant effect of the educational model based on the integration of Marzano's learning dimensions and infographics in teaching mathematics in developing lateral thinking and mathematical practices among first-year middle school students. The research presented a number of recommendations, including: Benefiting from the proposed educational model in this research in teaching mathematics, and the stages and activities that were applied when preparing the teacher's guide and activity booklet, to develop lateral thinking skills and mathematical practices among middle school students.

Keywords: Marzano's learning dimensions - infographics - lateral thinking - mathematical practices - first-year middle school students.

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Introduction:

The educational systems of the developed world focus on attention to thinking as a major goal of education and a basis for building civilizations and producing creative minds, so the development of human potential and intellectual and mental skills has become a necessity to comply with successive technological and cognitive developments, accordingly, the educational community has been interested in developing its educational curricula to keep pace with these developments, and to develop the ability of its students and provide them with higher skills in thinking. Humanity and the progress of human civilization, it focuses on the relationship of man, his fields, activity, and behavior with his environment, and recent trends confirm that mathematics is a fertile field for training in sound thinking methods at a time when education for the development of thinking skills has become a strategic goal for education (Khalaf Allah and Nasr, 2020). The students' ability to solve problems related to different areas of life is related to the New York State [NYS] mathematics standards, which are derived from the United States Mathematics Education Standards Framework It is formulated coherently and appropriately for each grade to describe students' expected behaviors and practice while learning mathematics and solving mathematical problems, and focuses on deepening students' understanding of mathematical content, enhancing their mathematical thinking, and developing their communication and mathematical connection skills (Ahmed, 2020). Mathematical practices consist of eight sub-dimensions, namely understanding mathematical problems, perseverance in solving them, mathematical justification, building arguments and mathematical proof, designing mathematical models, using appropriate tools strategically, paying attention to accuracy, searching for structure and benefiting from it, and expressing regularly in repeated reasoning (Standards for Mathematical Practices, 2020).

Therefore, it is important to follow teaching models that contribute to the development of students' abilities and mathematical practices by recognizing the nature of life problems related to mathematics and integrating them with previous knowledge to produce creative ideas to solve them, including Marzano's dimensional model.

Marzano's Dimensions of Learning model is one of the educational models that have proven effective in the field of teaching and learning mathematics, as it represents an educational framework that aims to provide students with learning how to think and obtain knowledge on their own, in addition to encouraging them to self-search and lifelong learning, as it calls for teaching for thinking, not remembering, and then forgetting (Dhalami, 2020).

The Marzano dimensions model is based on constructivist philosophy and reflects three basic theories in educational interaction, represented in learning compatible with brain functions, cooperative learning and problem-centered learning, and consists of five dimensions, as the model assumes that all forms of learning occur within a framework of positive trends and perceptions of learning that develop or stop learning, as well as that learning is affected by the extent to which the student uses productive habits of mind and these two dimensions They work in harmony with the acquisition and integration of knowledge so that it expands, purifies and makes meaningful use of it (Marzano, 2000).

Based on the above, it is clear the importance of developing lateral thinking and mathematical practices in mathematics according to the standards of the next generation (NYS) in order to make them more able to address mathematical problems of life with careful study and thinking that addresses several aspects of them to generate creative ideas to solve them, by linking the various previous educational experiences and new experiences to integrate them, so the research sought to develop an educational model based on the integration between the dimensions of learning by Marzano and infographics in teaching mathematics and studying its impact on the development of thinking Lateral and sports practices among first-grade intermediate students.

Search problem:

The research sought to answer the following questions

1- What is the educational model based on the integration of Marzano's learning dimensions and the appropriate infographic to develop lateral thinking and mathematical practices among first grade students?
2- What is the impact of an educational model based on the integration of the dimensions of learning by Marzano and infographics in teaching mathematics in the development of lateral thinking among first grade students?
3- What is the impact of an educational model based on the integration of the dimensions of learning by Marzano and infographics in teaching mathematics

Mathematics in the development of mathematical practices among first-grade intermediate students?

Research Objectives:

The research aimed to achieve the following:1. Designing an educational model based on the integration of Marzano's learning dimensions and infographics for teaching mathematics to first-grade intermediate students.
2. Revealing the impact of an educational model based on the integration of the learning dimensions of Marzano and infographics in teaching mathematics in the development of lateral thinking among first-grade intermediate students.

3. Revealing the impact of an educational model based on the integration of the dimensions of learning by Marzano and infographic in teaching mathematics in the development of mathematical practices among first-grade intermediate students.

Importance of Research:

The importance of research is evident in the following:

1. The research is a response to modern trends in teaching mathematics, as it includes the development of one of the dimensions of the next generation (NYS) by proposing an educational model based on the dimensions of learning for Marzano, who proved its impact on teaching mathematics and improving its educational outcomes in many previous studies, and infographics that achieve the integration of traditional education and e-learning by including graphs and multimedia to achieve learning goals.

1. The current research can be useful in improving the level of performance of first-grade intermediate students in the skills included in the mathematics course in particular, and in their daily lives in general, as a result of the development of lateral thinking and mathematical practices.
1. The research presents a proposed model for combining Marzano's learning dimensions with infographics that can guide mathematics teachers to teach mathematics at the intermediate level.
2. The research provides a lateral thinking test that math teachers can use to measure their students' level.
3. The research provides a measure of mathematical practices that can be useful for math teachers in measuring their students' level.

Research Limitations:

2. The search was limited to the following limits:

- Objective limits:

1. An educational model based on the integration of Marzano's learning dimensions and infographics in teaching the "polygons" chapter of the mathematics textbook for the first intermediate grade and the third semester because this chapter contains various information, data and knowledge related to geometric shapes that should be represented in graphic forms, in order to facilitate and simplify complex information.
2. The lateral thinking test includes the following skills: generating concepts, presenting alternatives, perceiving relationships, and producing ideas.

3. The scale of mathematical practices includes the following practices: understanding problems and persevering in solving them, abstract and quantitative reasoning, building logical arguments and critiquing the reasoning of others, mathematical modeling, using strategically appropriate tools, accuracy and

communication at work, exploring the mathematical structure, searching for repetitive reasoning and order.
- Spatial boundaries: Government intermediate public education schools affiliated to the Department of Educational Supervision in the Sarat Obaida sector of the Department of Education in Sarat Obaida Governorate.
- Time limits: The research was applied in the third semester of the year 1446 AH.
- Human limits: a random sample of female students The first intermediate grade in one of the public intermediate public education schools affiliated to the Department of Educational Supervision in the Sarat Obaida sector of the Department of Education in Sarat Obaida Governorate.

Search terms:

- Educational model:

Ali (2013) defined an educational model as: "an applied format of learning models in the classroom, in other words, a more detailed outline based on a particular learning model and proposing a set of specific and structured actions that will guide the implementation of teaching and learning activities" (p. 76).
- Marzano's Learning Dimensions Model:

Marzano defined Marzano's learning dimensions model as: a teaching model that includes several sequential procedural steps, focusing on the interaction between five modes of thinking: acquiring positive attitudes and perceptions about learning, acquiring new knowledge, integrating and coherence with existing knowledge, deepening and scrutinizing knowledge to reach new endings and results, making meaningful use of knowledge, and developing the use of productive mental habits that occur during learning and contribute to its success (Marzano, 1992, p. 2).
- Infographic:

Bicen & Beheshti (2017) have pointed out that "the term infographic refers to the combination of the words graphic and information, which means the representation of information, data and various knowledge in graphic forms, with the aim of facilitating and simplifying complex information" (p. 101).
–Lateral thinking:

Al-Kubaisi (2013) defined lateral thinking as: "A pattern of thinking that depends on creating the largest number of solutions and alternatives to a problem or situation of life situations, and is characterized by searching and moving freely in multiple directions, and focuses on generating new ways of seeing things (p. 62).
Sports Practices:
The Next Generation Mathematics Standards (NYS, 2017) defined it as: "practices aimed at enabling students to employ mathematical knowledge in explaining life phenomena and enabling them to relate mathematical knowledge to each other and not just acquire it in general and develop their ability to apply mathematical models to enhance their understanding of mathematical knowledge in a practical and applied way to qualify them in a new way to learn mathematics for life and employ it in aspects of their daily lives" (p. 9).

The concept of Marzano's learning dimensions model:

Marzano et al. (1997) defined Marzano's learning dimensions model as "an integrative framework for planning and decision-making regarding teaching using a number of teaching strategies that develop the student's types of thinking, by developing his cognitive and emotional potential, which increases his efficiency in
The philosophical foundations of Marzano's learning dimensions model:

Marzano's learning dimensions model is based on the constructivist philosophy that believes that previous knowledge is a condition and a requirement for new learning to occur, and that any new learning formed by active mental effort on the part of the student is built on the basis of his previous knowledge and experience and is not transferred from the teacher to the student, so the learning in which the student builds his own knowledge and modifies it based on the data of new knowledge is fruitful learning and is

characterized by continuity and continuous development (Dhalami, 2020), and the Marzano learning dimensions model is based on Many different educational theories and philosophies, including what was indicated in the study of Abu **Rjeily and Khalil (2023), namely:**

1. Social learning theory and participatory teaching: which assumes that students learn most effectively when they actively participate and collaborate with others to achieve common goals.
2. Direct Teaching Theory: This theory emphasizes that learning requires clear guidance and teaching by the teacher, and that the use of appropriate teaching methods can improve the effectiveness of learning.
3. Self-learning theory: This theory suggests that students can learn skills and concepts independently if they get the necessary guidance and assistance, and that providing self-learning opportunities can improve the effectiveness of learning.

4. Sociocultural theory: It is based on the fact that students learn by interacting with others and the social and cultural environment to which they belong.

5. Behavioral theory: It is based on the fact that the behavior that is reinforced and repeated will learn better and will lead to improved performance.

Humanistic theory: It is based on caring for the student as a human entity with freedom and the ability to learn on his own and second development.

The role of the teacher in Marzano's learning dimensions model:

The teacher plays an important role through his use of Marzano's Learning Dimensions model, through which he can reach students to a clear and comprehensive understanding regardless of the individual differences between them and raise their level of motivation towards learning (Aissat, 2022), through the teacher's focus on three areas when using Marzano's Learning Dimensions Model referred to by the study of Abu Rjeily and Khalil (2023), namely:

1. Classroom strategies and behaviors: The strategies and behaviors teachers use to improve student learning focus on things such as setting clear learning goals, providing feedback, and using effective questioning techniques.

2. Basic educational methods, so that these educational practices are most effective to enhance student learning and include identifying similarities and differences, summarizing and taking notes, enhancing effort, providing some kind of appreciation, non-linguistic representation, providing feedback homework and practices, hypothesis development and testing, guidance and questions, and cooperative learning.

3. The three areas of learning, namely: cognitive, emotional and psychomotor, the model emphasizes the importance of addressing the three areas in teaching to promote deep and lasting learning.

Infographics and teaching and learning mathematics:

4. The use of drawings and art forms has become a necessary condition to ensure the success of the exchange of information, and the use of these drawings and art forms through technology in teaching can affect it by improving its methods and effectiveness and thus improving its level (Al-Arabi, 2018), and among these modern technical methods that can be used in teaching is the method of converting information and written data into images, which makes it easier for students to understand this data and provide them with information in a simple, fun and beautiful way, away from written novels and complexity, and thus it changes the way that They think about complex data and information and understand them in a structured way and this is confirmed by the study of both (El-Sayed, 2020; Yildirm, 2016).

Philosophical foundations of infographics:

5. Among the theories on which educational infographic technology is based are the study **of (Ahmed et al., 2018; Khamis, 2013; Baghae, 2017), which are:**

1. Information processing theory: This theory is based on the fragmentation of content and information to be processed infographically for very small steps that may be in the form of images, drawings, arrows or

fixed texts, and this theory enjoys the support of fixed infographic, and this theory is based on the concept of treasure, which is the process of dividing information into units or small parts called thesaurus, and the thesaurus is any meaningful unit that may be numbers, words, pictures, drawings, etc.
2. Cognitive burden theory: The theory of cognitive burden is based on the basic assumption that without recognizing the nature of the student's cognitive system, the design of activities is likely to become random and that many traditional activities do not take into account the limits of his cognitive system, especially working memory, which is the active component that processes the required information and that the information to be processed imposes a high level of difficulty.

3. The theory of binary cryptography, where information is assumed to be stored in long-term memory in visual and verbal forms, and according to this theory, human knowledge consists of two cognitive subsystems, which process information independently, but simultaneously, where

There are links and relationships between them that allow binary encoding of information. The teacher's role in infographic design: There are many criteria that the teacher must be keen on while designing an infographic that is easy to acquire through practice, including what the Shaltout study (2016) indicated, namely: choosing one topic for each design so that it is focused and clear, choosing an attractive and distinctive title, choosing data and information that can be visually represented, the validity of the information provided in the design, and that the design is characterized by sequential information, and that the shapes and emojis contained in it are carefully chosen, and that the colors Attractive and commensurate with the idea and purpose of it, and supports the presentation of information, and be simple in design, and be free of spelling errors.

The student's role in using infographics:

The study of both (Bahjat, 2020; Radwan, 2022; Abdel Dayem and Mohamed, 2022; Taner, 2016; ALMashaleh, 2023) that the student has a key role in the use of infographics in education, which is represented in the following:

1. Gives more visual attention to important information, and uses it to form his cognitive structure, by linking the visually represented information to his visual memory, making it easier for him to easily retrieve his previous knowledge to build new experiences.

2. Organizes information in a logical way by tracking information in the correct logical order to facilitate understanding and finding relationships and links between them.

3. Combines symbols, images, graphics and text to help them understand content in a more effective way than relying on text alone.

4. Interacts with the multimedia included in the infographic, and links what it contains to daily life to make its learning process meaningful and purposeful.

5. Analyzes the information contained in the visual representation, compares them and draws from them unfamiliar ideas.

The importance of infographics in teaching mathematics: .

A number of studies have confirmed the impact of using this technology in teaching mathematics, including (Barakat, 2022; Students, 2022; Abdullah, 2022; Al-Mutairi and Al-Harbi, 2022; Shaltout, & Fatani, 2017), where the use of infographics in learning mathematics, especially in developing students' skills and simplifying information, and the importance of using infographics in teaching mathematics is evident in helping students present mathematical concepts and shapes in an easy and logical way, and converting verbal information into attractive images and drawings, and the study of (Ibrahim, 2016; Barakat, 2022) indicated that the importance of applying infographics in teaching mathematics comes from the following:

1. Has the ability to transform abstract concepts into sensory concepts and deepen students' understanding by simplifying complex information.

2. It makes mathematics education fun and interesting, attracts students' attention and makes them feel motivated and persevering, due to its ease of understanding, clarity and simplicity.
3. Develops image recognition, interpretation, comparison, evaluation and other spatial visualization skills.
4. Makes the class more energetic and energetic and helps effective classroom discipline.
5. It helps to improve knowledge and information through drawings and support the ability of the student's visual system to see patterns, perceive relationships and interpret.

Lateral thinking, teaching and learning mathematics:

Lateral thinking is one of the modern thinking patterns through which the student seeks to change old ideas, concepts and perceptions to generate new ideas, concepts and perceptions that are applicable, and it has been called lateral thinking to distinguish it from vertical or vertical thinking (Mazyad and Ali, 2015).

The concept of lateral thinking:

De Bono (1997) defined lateral thinking as "an imaginative creative way of solving problems that alter one's perceptions and perceptions of a problem." what" (p. 120).

The role of the teacher in developing lateral thinking:

The role of the teacher to encourage his students to practice lateral thinking is as follows (Toogie, 2011):
1. Use brainstorming to address various new topics, in multiple disciplines, and encourage new ideas, and when reaching a new idea or a sudden and good answer, the teacher should ask his students about the steps to reach this answer.

2. Allocate some time during the week or even the school day practice lateral thinking, so as to stimulate students' minds to see new sectors and ideas through the practice of creative exercises, because there is a part of lateral thinking produced by bringing dissimilar things together, as well as concepts to reach new ideas.
3. Provide sufficient time to practice lateral thinking, while starting with problems and issues related to students' lives in society and their daily life, and encourage them to direct thinking towards new visions and ideas to face unusual problems.

The student's role in the practice of lateral thinking:

Lateral thinking helps students open mind, gather as many ideas as possible, not rush judgments, encourage intellectual curiosity and curiosity, offer unfamiliar alternatives, flexibility in solving problems and unleashing thinking (Asfour, 2011).

Dimensions of learning for Marzano, infographics and the development of lateral **thinking skills in athematics in the middle stage:**

It is difficult for many to deny the nature of mathematics in terms of it is the subject of thinking, and this is the essence of the material and its content, which confirms that it is not possible to deal with its different vocabulary in it, absorb its concepts and practice solving its problems without the use and practice of the student to think that makes him able to solve its problems, as learning mathematics motivates him how to think by linking its concepts and skills with its learning methods (Stockero, 2017). In the context of talking about thinking of different types and its importance for students, and based on the role of mathematics as a fertile field for the development of thinking, lateral thinking comes as one of the important types of thinking.

The student's role in the practice of lateral thinking:
Lateral thinking helps students open mind, gather as many ideas as possible, not rush judgments, encourage intellectual curiosity and curiosity, offer unfamiliar alternatives, flexibility in solving problems and unleashing thinking (Asfour, 2011).

Dimensions of learning for Marzano, infographics and the development of lateral thinking skills in mathematics in the middle stage:The role of the teacher in the development of sports practices:The revised

NYS Next Generation Math Standards also outline what students should understand and be able to do as a result of their math, so the teacher should consider the **following (NYS, 2019):**

1. Evaluate the student in his understanding and comprehension of what has been studied in mathematics, and provide opportunities for him to use this mathematical knowledge and experiences and apply them.. Improve teaching allowing students to successfully transition to learning, living and working after school.
2. Focus on evaluating the procedural skills of students' mathematical concepts and generalizations. Setting standards for what students should understand and be able to do in the educational process during each grade.

The student's role in applying mathematical practices:

The development of sports practices requires students to actively work on sports tasks and activities, individually or collaboratively, they analyze situations and problems, participate in the processes of thinking, guessing, arguments, discussion with colleagues and the teacher, and take advantage of technology and other resources and sports operations, and therefore this makes students always engaged in sports work until the completion of tasks and solving problems. The intermediate stage in mathematics, since this integration helps motivate students to use mathematical tools and models in providing an accurate presentation of mathematical concepts and the use of different patterns and mathematical structures to analyze and link different concepts to each other and employ this link in providing arguments and proofs for different claims, which helps in deepening the understanding of these concepts and employing them meaningfully in solving various mathematical problems related to the reality of life and by students' practice of these mental processes within various activities in mathematics based on the dimensions of the model Marzano Infographic technology will have a positive attitude towards learning mathematics and appreciating its value in their future real and practical lives.

Hypothetically researched:

The research sought to verify the validity of the following two hypotheses:1. There were no statistically significant differences between the average scores of the experimental and control groups in the dimensional application of the lateral thinking test.2. There were no statistically significant differences between the average scores of the experimental and control groups in the dimensional application of the scale of sports practices.

Research Methodology:

To know the impact of the educational model based on the integration of the dimensions of learning by Marzano and the infographic in teaching mathematics in the development of lateral thinking and mathematical practices among first-grade intermediate students, as an experimental group was taught according to the proposed educational model based on the integration of the dimensions of learning for Marzano and infographic, while the control group was taught in the usual way and according to the mathematics book issued by the Ministry of Education. For the year 1445 AD,

Research sample:

The research sample was selected in a simple random way from the students of the first intermediate grade at the first intermediate school in Sarat Obaida Governorate, and its classes were randomly divided into two groups, an experimental group and a control group, as the educational model was applied to the experimental group, while the control group was not applied to the model.

Search Tools:

The research relied on the following two tools:

1. Lateral thinking test in the chapter "Polygons" of the mathematics book for the first intermediate grade - the third semester - prepared by the researcher.

2. The scale of mathematical practices in the chapter "polygons" of the mathematics book for the first intermediate grade - the third semester - prepared by the researcher.

They were prepared according to the following:

First: The lateral thinking test in the "Polygons" chapter of the mathematics book for the first intermediate grade of the third semester, was prepared according to the following steps:
1. Determine the goal of the test: The aim of the test is to measure the level of lateral thinking skills in the "Polygons" chapter of the mathematics book for the first intermediate grade.

(1) Calculation of the coefficients of difficulty and discrimination for the vocabulary of the test: The coefficient of difficulty and discrimination was calculated for each question of lateral thinking skills only in the three sections of the skill (generating new concepts, alternatives and perceptions), as the answers to the questions of these skills are specific to (true - false), and it is easy to determine the extent of their difficulty or discrimination, while the questions in the fourth section of the skill of generating new ideas depend on the student's ability to present unfamiliar ideas and is characterized by novelty and originality, using the following equation to calculate the coefficient Discrimination, Table (3-6) shows the results in this regard:

Table (3-6) Difficulty and discrimination coefficients for skills questions in testing lateral thinking skills (generating new concepts, alternatives and perceptions)

Concept Generation Skill Questions			Skill questions generating new alternatives			Skill Questions Generating New Perceptions		
Question number	Coefficient of difficulty	Discrimination coefficient	Question number	Coefficient of difficulty	Discrimination coefficient	Question number	Coefficient of difficulty	Discrimination coefficient
1	0.42	0.85	6	0.22	0.45	11	0.61	0.75
2	0.29	0.65	7	0.39	0.80	12	0.36	0.35
3	0.42	0.85	8	0.22	0.45	13	0.40	0.40
4	0.42	0.85	9	0.28	0.70	14	0.40	0.30
5	0.24	0.50	10	0.24	0.80	15	0.61	0.50

It is clear from Table (3-6) that the values of the difficulty coefficients for the questions of lateral thinking skills (generating new concepts, alternatives and perceptions) range between (0.22-0.61), which indicates that the questions of lateral thinking skills (generating new concepts, alternatives and perceptions) are not very easy or difficult, which indicates that the questions of lateral thinking skills (generating new concepts, alternatives and perceptions) are well distinguished, as the vocabulary with a discrimination coefficient of more than (0.20) is considered good discrimination (Allam, 2011).
(1) Verification of the stability of the lateral thinking skills test: The stability of the test was calculated using the Kuder Richardson equation 20 and Table (3-7) shows the values of the stability coefficient and the distribution of lateral thinking skills test questions.

Table (3-7)Stability coefficient values and distribution of lateral thinking skills test questions

Sub-Skill	Number of vocabulary	Coefficient of stability
Generating new concepts	5	0.85
Generating new alternatives	5	0.79
Generating new perceptions	5	0.84
Generating new ideas	5	0.86
The test as a whole	20	0.87

It is clear from Table (3-7) that the values of the stability coefficient for the test range between (0.79-0.86), and the value of the stability coefficient for the test as a whole is (0.87), which are all high

values. Therefore, it can be said that the test has a high degree of validity and stability, and has become in its final form, applicable to the research sample.
Second: The scale of mathematical practices for the first intermediate grade in mathematics: It was prepared by following the following steps:

1. Determine the goal of the scale: The goal of the scale is to identify the mathematical practices of first-grade students in mathematics.
2. Sources of the scale: The scale was built by reviewing previous research and studies that dealt with sports practices, including (Ahmed, 2020; Al-Khazraji, 2021; Al-Ruwaili, 2022), and by referring to the general framework of the next generation standards, accordingly, (8) dimensions of the scale of sports practices were identified, namely: understanding problems and persevering in solving them - mathematical modeling - using the appropriate tools strategically - accuracy and communication at work - abstract and quantitative reasoning - exploring the mathematical structure - searching for patterns in repeated reasoning - building logical arguments and critique of inference others.
3. Verify the validity of the scale: The scale was presented in the initial image to the same arbitrators of the research materials and the lateral thinking test, to verify the appropriateness of its phrases to measure sports practices, and to ensure the integrity of their formulation and belonging to the dimension they measure, and according to their suggestions, the scale was modified,
Table (3-8)

Correlation coefficients for Mathematical Practices Scale dimension statements

Understand problems and persevere in solving them		Mathematical modeling		Use the right tools strategically		Accuracy and communication at work	
Ferry	Correlation coefficient and its significance	Ferry	Correlation coefficient and its significance	Ferry	Correlation coefficient and its significance	Ferry	Correlation coefficient and its significance
1	0.95**	6	0.62**	11	0.71**	16	0.41**
2	0.62**	7	0.74**	12	0.89**	17	0.87**
3	0.61**	8	0.75**	13	0.54**	18	0.60**
4	0.82**	9	0.88**	14	0.50**	19	0.75**
5	0.86**	10	0.88**	15	0.64**	20	0.86**
Skill as a whole	0.71**	Skill as a whole	0.83**	Skill as a whole	0.59**	Skill as a whole	0.77**
Abstract and quantitative reasoning		Explore the mathematical structure		Find patterns in recurring inference		Building logical arguments and critiquing the reasoning of others	
Ferry	Correlation coefficient and its significance	Ferry	Correlation coefficient and its significance	Ferry	Correlation coefficient and its significance	Ferry	Correlation coefficient and its significance
21	0.44**	26	0.86**	31	0.67**	36	0.60**
22	0.57**	27	0.86**	32	0.87**	37	0.65**
23	0.77**	28	0.61**	33	0.88**	38	0.74**
24	0.89**	29	0.76**	34	0.58**	39	0.79**

25	0.83**	30	0.75**	35	0.87**	40	0.77**
Skill as a whole	0.60**	Skill as a whole	0.62**	Skill as a whole	0.80**	Skill as a whole	0.77**

(**) means that the significance level is less than (0.01).
It is clear from Table (3-8) that there is a statistically significant correlation at the level of the function (0.05) or less between the scale statements and the dimensions to which they belong, and accordingly it was found that there is internal consistency between the scale statements and the dimensions to which they belong.
(1) Verification of the stability of the scale: The Alvacronbach coefficient was used to verify the stability of the scale, and Table (3-9) shows the values of the stability coefficient and the distribution of statements on the scale of mathematical practices.
Table (3-9)
Stability coefficient values and distribution of statements on the scale of mathematical practices

Dimension	Number of ferries	Coefficient of stability
Understand problems and persevere in solving them	5	0.83
Mathematical modeling	5	0.84
Use the right tools strategically	5	0.80
Accuracy and communication at work	5	0.75
Abstract and quantitative reasoning	5	0.76
Dimension	Number of ferries	Coefficient of stability
Explore the mathematical structure	5	0.82
Find patterns in recurring inference	5	0.82
Building logical arguments and critiquing the reasoning of others	5	0.79
The scale as a whole	5	0.85

It is clear from Table (3-9) that all values of the stability coefficient are high, which indicates that the measure of mathematical practices has a high degree of stability, which has become in its final form, applicable to the research sample.

Research results and discussion

The results of the research, by answering its questions, verifying the validity of its hypotheses, and then these results were discussed, interpreted and linked to the results of previous studies.

1- What is the impact of an educational model based on the integration of the dimensions of learning by Marzano and infographics in teaching mathematics on the development of lateral thinking among first grade students?

2- 2- What is the impact of an educational model based on the integration of the dimensions of learning by Marzano and infographics in teaching mathematics on the development of mathematical practices among first-grade students?

View search results:

The results of the research were displayed by answering his questions and validating his **hypothesis as follows:**

Results related to the answer to the first question of the research:

The first question of the research reads: "What is the educational model based on the integration of Marzano's learning dimensions and the appropriate infographic for the development of lateral thinking and mathematical practices among first-grade intermediate students?" Preparing this model by reviewing previous studies that dealt with both Marzano's learning dimensions model and infographic technology, taking into account the characteristics of the age stage for middle school students, and the variables that the research aimed to develop, represented by both lateral thinking and mathematical practices, and its validity was verified by presenting it to a number of specialized arbitrators,

Arithmetic averages, standard deviations, and the value of (T) and their statistical significance for the scores of the students of the experimental and control groups in the pre-application of the lateral thinking test

Skill	Experimental Group (70)		Control Group (69)		Degree of freedom	alue (v)	Statistical significance	TA square value (η^2)
	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation				
Generating new concepts	4.09	0.76	2.86	0.90	137	.76	0.001	.36
Generating new alternatives	4.00	0.82	2.70	1.12	137	.88	0.001	.31
Generating new perceptions	4.27	0.74	2.10	0.93	137	5.27	0.001	.63
Generating new ideas	3.63	0.77	1.93	1.06	137	0.83	0.001	.46
The test as a whole	15.99	1.51	9.58	2.01	137	1.27	0.001	.77

It is clear from Table (4-1) that there is a statistically significant difference at the level of (0.05) between the average scores of the students of the experimental and control groups in each skill of lateral thinking skills and a test as a whole, in favor of the experimental group; accordingly, the first hypothesis of

the research was rejected and the alternative hypothesis was accepted, which states that "there is a statistically significant difference at the level of (0.05) between the average scores of the experimental and control groups in the dimensional application of the lateral thinking test, in favor of the experimental group", and it was also found that the value of (η2) for each skill of lateral thinking skills and for the test as a whole greater than (0.14), which are respectively for the skill of generating new concepts (0.36), for the skill of generating new alternatives (0.31), for the skill of generating new perceptions (0.63), for the skill of generating new ideas (0.46), and for the test as a whole (0.77), and since if the value of (η2) is equal to (0.14) or greater, the size of the effect is large (Abu Daqqa and Safi, 2013), and this indicates a significant impact of the educational model based on the integration of the dimensions of learning by Marzano And infographics in teaching mathematics in the development of lateral thinking among first-grade intermediate students.

Results related to the answer to the third question To search, validate the second hypothesis.

The third question of the research reads: "What is the impact of an educational model based on the integration of the dimensions of learning by Marzano and infographics in teaching mathematics on the development of mathematical practices among first-grade intermediate students?" The first hypothesis of the research also stated that "there are no statistically significant differences between the average scores of the experimental and control groups in the dimensional application of the scale of mathematical practices" to answer this question and verify the validity of the hypothesis, the arithmetic averages and standard deviations were calculated, and the calculation and test (T-Test) and their statistical significance for the results of the experimental and control research groups in the dimensional application of the scale of mathematical practices, and to verify the effect of the independent variable (an educational model based on the integration of the learning dimensions of Marzano and infographics in mathematics) on the variable The equation for the magnitude of the effect was used to square of ETA (η2); and Table (4-3) shows the results in this regard.

Arithmetic averages, standard deviations, value (T) and their statistical significance for the scores of students of the experimental and control groups in the pre-application of the scale of mathematical practices

Distance	Experimental Group (70)		Control Group (69)		Degree of freedom	Value (T)	Statistical significance
	Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation			
Understand problems and persevere in solving them	15.17	0.54	11.93	1.24	137	19.95	0.75
Mathematical modeling	17.01	2.35	12.78	0.59	137	14.61	0.61
Use the right tools strategically	18.14	0.46	14.94	0.48	137	40.08	0.92
Accuracy and	15.09	0.50	12.15	1.25	137	18.12	0.71

communication at work							

Abstract and quantitative reasoning	15.41	0.71	11.93	1.24	137	20.29	0.75
Explore the mathematical structure	18.29	2.39	15.74	1.64	137	7.33	0.28
Find patterns in recurring inference	15.11	0.32	11.28	1.11	137	27.62	0.85
Building logical arguments and critiquing the reasoning of others	15.49	0.65	12.15	1.25	137	19.76	0.74
The scale as a whole	129.71	4.58	102.88	5.37	137	31.70	0.88

It is clear from Table (4-3) that there is a statistically significant difference at the level of (0.05) between the average scores of the students of the experimental and control groups in each dimension of sports practices and a test as a whole, in favor of the experimental group, according to that, the first hypothesis of the research was rejected and the alternative hypothesis was accepted, which states that "there is a statistically significant difference at the level of (0.05) between the average scores of the experimental and control groups in the dimensional application of the scale of sports practices, in favor of the experimental group", and it was also found that the value of (η2) each dimension of the dimensions of mathematical practices and for the scale as a whole greater than (0.14), respectively for understanding and persevering in solving problems (0.75), for mathematical modeling (0.61), for the use of strategically appropriate tools (0.92), for accuracy and communication at work (0.71), for abstract and quantitative reasoning (0.75), for exploring mathematical structure (0.28), for searching for patterns in repeated reasoning (0.85), for building logical arguments and critiquing the reasoning of others (0.74), and for the scale as a whole (0.88); this indicates a significant impact of the existing educational model. On the integration of the learning dimensions of Marzano and infographic in teaching mathematics in the development of mathematical practices For first-grade middle students.

Discussion and interpretation of results:

The results found a statistically significant difference at the level of (0.05) between the average scores of the experimental and control groups in the dimensional application of the lateral thinking test and the scale of mathematical practices, in favor of the experimental group, and the existence of a significant impact of the educational model based on the integration between the dimensions of learning for Marzano and infographic in teaching mathematics in the development of lateral thinking and mathematical practices among first-grade intermediate students, and the researcher attributes the results to the following: First: Developing lateral thinking skills:

The results of the current research agreed with several studies that confirmed the importance of combining the dimensions of learning by Marzano and infographic technology in achieving the goals of the educational process, including a study (Al-Saadi, Al-Ayasrah and Al-Mahrizi, 2024; Mansour, 2016), and the current research agreed with the results of Ahmed's study (2023) on the impact of using Marzano's learning dimensions model to develop lateral thinking skills, and with a number of studies that employed infographics in developing higher thinking skills in mathematics, including (Barakat, 2022; students, 2022; Abdullah, 2022; Al-Mutairi and Al-Harbi, 2022; Shaltout, & Fatani, 20

This integration in mathematics in the development of lateral thinking skills explains what Al-Qahtani's study (2019) indicated that the learning dimensions model of Marzano model focused on what happens inside the student's mind and his ability to understand and process information, his motivation and thinking patterns, and the study of Shaqar and Al-Khasawneh (2020), which showed that according to this model, the student must link previous knowledge with new knowledge and integrate them through activities that improve knowledge and make it meaningful, and what Saadeh's study (2013) indicated that employing infographics in Teaching is an attempt to enrich the educational process and make it more effective to achieve teaching goals and develop thinking skills, and a study (Brigas et al., 2013) that showed that integrating infographics effectively into the curriculum from the first grades in order to facilitate the process of understanding and expressing ideas, and Sabry's study (2019), which emphasized the importance of using infographics in teaching facts, concepts, and generalizations and consolidating them among students and their contribution to the development of their thinking.

The researcher believes that this integration contributed to facilitating the acquisition of knowledge by students and looking at it from more than one side by linking it through visual representation with more than one new concept and relationship that illustrates its characteristics and dimensions of its use in mathematics and in addressing various mathematical and real-life problems, as well as explaining the results reached from the mechanism that was followed in the application of the proposed educational model, the following has been taken care of:

1. The integration between Marzano's learning dimensions model and infographic technology is not limited to displaying information, but the student must be asked to represent this knowledge herself, either to express it in a new way or by linking it to previous knowledge she has or new knowledge and finding some possible alternatives to achieve meaningful employment such as finding cause and effect, comparisons and creativity in solving problems, which in turn can lead to the development of lateral thinking skills in indirect ways during his learning. For mathematics.

2. Presenting the mathematical knowledge associated with the lessons by designing an infographic in order to introduce the student to this knowledge and understand it in preparation for enabling the student to reformulate the concepts related to it in a new way, such as that the student reaches new concepts related to complementary angles, and that she reaches new concepts related to the correctness of the angles of the circular sector correctly.

3. Training students to realize the new relationships between different mathematical concepts through infographic design by asking several questions aimed at motivating them to retrieve their previous cognitive experiences and link them to new knowledge, such as that the student infers new relationships from the analysis of circular sectors in different ways, and that she reaches new relationships related to polygons that cannot be used to til properly.

4. Presenting a number of problems from real life to reach meaningful learning by providing new alternatives using mathematical knowledge, such as that the student provides new alternatives to solve the problem of determining directions and kisses based on angles correctly, and that new alternatives are presented to solve the problem of demolishing buildings using triangles correctly.

5. Training students to generate new ideas using mental habits about employing new knowledge in mathematics, and discussing these ideas to extract the best ones and summarize what has been learned using a creative infographic design, such as mentioning the student as many new ideas as possible to determine complementary and integrated angles in easy ways without using the protractor, and providing the largest possible number of possibilities for problems that may occur in the absence of the method of

representation in circular sectors to represent statistical data.
Second: Development of Sports Practices:

The results of the current research agreed with what Marzano (2007) confirmed that the presentation of similarities and differences in symbolic or drawn images strongly enhances students' understanding, and their ability to deduce, and use knowledge, and what was confirmed by (Costa & Kallick, 2008) that visual tools contribute to improving content recollection, helping to find a deeper understanding of concepts, increase the ability to communicate abstract concepts, and form a metacognitive perception, and the current research also agreed with a number of studies that integrated the learning dimensions model of Marzano and visual representation using infographic technology, including the study of each of (Al-Saadi et al., 2024; Mansour, 2015).

This integration in mathematics in the development of mathematical practices explains what was indicated in Al-Qahtani's study (2019), which showed that Marzano's learning dimensions model is based on the fact that learning is a continuous activity carried out by the student when he faces a problem or task that affects his life, generating self-energy that makes him persevere in order to reach a solution to this problem, and accomplish that task, and the study (Yildirim & Gebre, Barakat (2022), which showed that infographics contribute to enhancing students' ability to better express what is going on in their minds, and therefore it is a useful tool for teaching and studying both Al-Ghamis and Al-Zahrani (2024), which indicated that infographics have a greater ability to communicate abstract concepts and deepen students' understanding because it contributes to simplifying complex information and contributes to Developing the skills of recognition, interpretation, comparison, construction, evaluation and other image perceptions, and contributes to the formation of a sound mental perception and the modification of their wrong perceptions.
The researcher believes that this integration helped motivate students to use mathematical tools and models in providing an accurate presentation of mathematical concepts and the use of different patterns and mathematical structures to analyze and link different concepts to each other and employ this link in providing arguments and proofs for different claims, which helped in deepening the understanding of these concepts and employing them meaningfully in solving various mathematical problems related to the reality of life.

Summary of research results. The research reached the following results:

1. Develop an educational model based on the integration of the dimensions of learning for Marzano and the appropriate infographic to develop lateral thinking and mathematical practices among first-grade intermediate students, including the following stages: Using infographics to develop positive attitudes towards learning - Acquisition and integration of knowledge using infographics - Dissemination and deepening of knowledge through sports practices - Meaningful employment Knowledge of sports practices - The use of mental habits produced in sports practices.

2. The existence of a statistically significant difference at the level of (0.05) between the average scores of the experimental and control groups in the dimensional application of the lateral thinking test, in favor of the experimental group.

3. The existence of a significant impact of the educational model based on the integration of the dimensions of learning by Marzano and infographics in teaching mathematics in the development of lateral thinking among first-grade intermediate students.

4. The existence of a statistically significant difference at the level of (0.05) between the average scores of the experimental and control groups in the dimensional application of the scale of sports practices, in favor of the experimental group.

5. There is a significant impact of the educational model based on the integration of the dimensions of learning by Marzano and infographics in teaching mathematics in the development of mathematical practices among first-grade intermediate students.

Research recommendations:

In light of the findings, the research recommends the following:

1. Benefiting from the educational model proposed in this research in teaching mathematics and the stages and activities that have been applied when preparing the teacher's guide and activity booklet to develop lateral thinking skills and mathematical practices among middle school students.
2. Include a number of activities that rely on infographic technology in mathematics curricula because of their impact on improving many educational outcomes and developing higher-level thinking skills.
3. Training mathematics teachers to design different styles of infographics to make it easier for them to use these designs in teaching mathematics.

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