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Modern strategies and trends in teaching mathematics

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Abstract

The current era is witnessing many rapid changes and successive developments in various fields; this development has been reflected in the teaching and learning process, curricula and teaching methods in general, including the field of teaching and learning sports in particular. Where traditional methods of teaching are no longer suitable to face changes and meet needs and requirements.

The twenty-first century has presented challenges to acquire diverse future skills, which has prompted educational systems to advance the knowledge economy, to ensure the quality of learning outcomes. Therefore, it was necessary to search for modern strategies that include appropriate methods to prepare a generation capable of facing contemporary cognitive challenges. Mathematics is among the most important subjects with a cumulative structure that needs to be taught in line with the nature of the times and prepares the learner to deal with its successive technological developments to serve society and push the wheel of development.

Through the intervention, we will try to address the most important trends and modern strategies in teaching mathematics.
Keywords: strategies, modern trends, teaching methods, mathematics.

Introduction

Poor academic achievement in mathematics comes at the forefront of problems that attract the attention of specialists and teachers, those who are constantly working to provide methods that contribute to achieving appropriate levels of achievement for students. This is done by employing the latest findings of educational theories that have significantly affected the organization of teaching mathematics technically that affects the stages of development of the intellectual development of the learner in addition to the logical organization of the content of mathematics itself, these theories also recommended the adoption of modern mathematics teaching methods, methods and strategies and minimizing the method of memorization and indoctrination.Where the strategies used by the teacher are an important factor in expanding the role of the learner in the educational process through his participation and interaction with it instead of limiting his role to receiving information only, students have their own mental models, so they must have the opportunity to think about what they have learned and develop their skills.

In the same context, teaching strategies that will improve the levels of academic achievement are at the forefront of researchers' concerns. Some studies have shown a strong relationship between teaching methods and achievement in mathematics and that there is a significant effect on achievement in mathematics between direct teaching and indirect teaching style (Brik B. B., 2019, p. 03). "Sharari. 2014" on the importance of using active learning strategies in raising the level of academic achievement in mathematics. Al-Hanaki.2012 indicated that there is a statistically significant difference in the level of students in mathematical achievement when using the project-based learning strategy. Al-Biladi (2010) stressed the importance of using the mind map to teach mathematics in raising the level of achievement of middle school students (Al Kahlan & Mehrezi, 2020, pp. 415-416).

Strategy concept

Strategy language: a term used in military life of Greek origin, and its connotation has evolved and its use has extended to other areas, it has become a set of ideas and principles that deal with one of the fields of human activity in a comprehensive manner, to achieve certain goals (Al-Homsi & Dennaoui , 2015, p. 20).

While Ali defined it as: a set of procedures and activities practiced by the learner during the teaching and learning situation, with the intention of achieving predetermined educational goals (El Kasbani, 2010, p. 115).

The education strategy is defined in Albert Learning 2002 as a set of techniques, procedures and measures used by the teacher in the teaching process to help the learner be independent in his learning.

Protheroe N. & Clarke S (2018) defines it as a complex set of processes in which teacher-student activities interact directed at enhancing and improving learner performance (Abdel Hafez, 2020, p. 794).

Both (Abdul Rahman and Taha), and (Ahmed and Ali) agreed that the strategy is: a set of ideas and principles that address a field of human knowledge in a comprehensive and integrated manner, it proceeds towards achieving goals and then develops appropriate evaluation methods to know the extent of its success and achievement of the goals it set before (Al-Hashemi & Al-Dulaimi, 2008, p. 19).

*** The concept of mathematics:** mathematics is an abstract science created by the human mind, it is one of the materials that are concerned with ideas, methods of solution and patterns of thinking, as well as sequence and sequence in shapes, numbers and symbols.

It is also a method and style of thinking that organizes the logical proof and decides the probability of the validity of a hypothesis or issue, as it is organized knowledge in a structure that has its origins, organization and sequence (Ben Bayyah, 2020, p. 74).

Here are the most important strategies:

1- Cluster Learning Strategy

Mahrezi (2017) defines it as: the strategy of dealing with numerically dense classes, adjustments are made in cooperative learning strategies that require students to be grouped into groups, classify groups instead hypothetically by adopting a column, class or group of students who belong to each other morally, students do not need to move from their positions, work as directed by the teacher, and under the supervision of a leader who is prepared to exercise a leadership role in helping and supporting his colleagues and forming other leaders from the same group. The level of concepts and skills ranges from easy to difficult and from simple to complex, depending on the principle (success leads to more success) where the learning process begins in its first step from the teacher, then moves to the class leaders, and from them to all students in the classroom.

*** Foundations of the developed cluster learning strategy**

- The learning process is the responsibility of the students, with the help and supervision of the teacher.
- Success leads to more success.
- Combining self-learning and cooperative learning, to develop the individual's abilities to the maximum, and to benefit from peers as much as possible.
- Class density is a real challenge, but it is possible to overcome it.
- The learning process is gradual, starting with the teacher, led by distinguished students, and benefiting everyone.
- Various methods of group and individual evaluation and timely feedback.
- Spreading the spirit of cooperation, brotherhood and fun during lessons.
- Encouraging cooperation and belonging among students. (Al Kahlan & Mehrezi, 2020, pp. 420-423)

2- Brainstorming strategy

The "brainstorming" strategy is one of the approaches that depend on the proposed dialogue and discussion between a group of individuals, to generate a large number of ideas regardless of their validity or incorrectness; it is through discussion that their validity is determined.

Brainstorming is defined as carefully planned learning situations, and specific steps, to rain as much ideas as possible without criticism or change, and try to surround the dimensions of the material to be taught to students, then comes the stage of structural structure to present and synthesize ideas, criticize them, stabilize their validity and the most appropriate in understanding and interpreting the educational material.

*** Stages of brainstorming strategy**

- Propose, explain and define the problem.
- Crystallization and reformulation of the problem.
- Free excitement of ideas.
- Evaluation of ideas reached.
- Preparing to put ideas into practice.

*** Factors contributing to the success of the brainstorming strategy**

- The session should be dominated by an atmosphere of lightness and fun.
- Unfamiliar ideas should be accepted during the session and encouraged.
- Stick to the main rules of brainstorming (avoid criticism welcoming quantity and quality).
- Different stages and methods of paraphrasing must be followed.
- The person responsible for the session separates between deriving ideas and evaluating them.
- The session should be objective and away from personal opinions and defenses.
- Writing down and numbering the ideas emanating from the session so that all participants see them.
- The need to pave the way for brainstorming sessions and holding sessions to remove barriers between participants.

*** Objectives of teaching with brainstorming strategy**

- Activating the role of students in educational and training situations.
- Motivating students to generate creative ideas on a particular topic, by searching for correct answers, or possible solutions through the issues presented to them.
- Training students to respect and appreciate the opinions of others.
- Accustom students to benefit from the ideas of others, by developing and building on them. (Hafez, 2008, pp. 608-610)

3- Metacognitive Strategy

Metacognitive strategies are defined as a series of actions that an individual uses to control cognitive activities and ensure that goals are achieved; these procedures help to organize and monitor the learning process and include planning and monitoring cognitive activities and ensuring that these activities are achieved.

The main idea of a metacognitive strategy is based on reflection on the processes involved in problem solving. This is confirmed by the definition of (Abdessalam Mustafa Abdeslam, 2001) of the metacognitive strategy, it is a set of procedures that relate to the student's reflection on his mental processes, employing them in the appropriate circumstances, reviewing his degree of success.

Metacognitive strategy is also defined as training the student to think, and knowing what we know? Why don't we know?.And they are procedural processes to manage and organize thinking, the student when he uses these strategies but he manages his thinking, and benefit him in possessing knowledge, understanding and appropriate use of this knowledge with awareness and control in learning and accomplishing the task and the student's knowledge of himself and his awareness of it as a learner and self-awareness of his learning processes.(Shehata, 2005, p. 105)

*** The role of metacognitive strategy in teaching mathematics**

In light of the modern trends in teaching mathematics, students are responsible for making many decisions that were previously considered the responsibility of the teacher and the textbook. These decisions include, for example, choosing the appropriate method of solution, setting hypotheses, and determining the reasonableness of the solution through assessment or any other appropriate method. It is also the student's responsibility to explain and defend how to solve it to others and try to convince others of it with mathematical evidence. As for the teacher, he chooses the issues and activities that suit his students, challenge their thinking and provoke in them the desire to search for a solution, it also provides the right conditions to ensure that students are busy learning.

Metacognition is an important component of intelligence and has an impact on academic performance (achievement) in general and in sports performance in particular. Students who possess

metacognitive knowledge and awareness of when, where, and how to use different strategies to solve mathematical problems are more successful in mathematics than students who do not.

We find that there is a relationship between the numerical sense and metacognition, and this is confirmed by many studies, where the numerical sense is concerned with the development of thinking and planning for mental performance and the ability to mental perception and monitor and evaluate those movements. That is, the numerical sense includes a set of skills that require the student to be aware of his thinking, monitor his performance strategies, evaluate them, and make judgments about their reasonableness. Metacognitive thinking includes various mental activities such as planning, monitoring progress, making mental efforts to evaluate the way and speed of performance and decision-making, choosing work safety, and the safety and quality of strategies used in its performance. In conclusion, it is a good management of the thinking process, and there is no doubt that this is what the age of distinguished man requires.

The teacher should ask the students to specify the steps taken to answer and the reasons for choosing alternatives, this helps to strengthen metacognitive processes (awareness of thinking) so other students expect to benefit from their peers' ways of thinking, and can use other styles and plans different from their peers and produce new ideas that may be original. (Ali Khattab, 2007)

4- Active Learning Strategy

Salem (2001) defines active learning strategy as the procedures followed by the learner within a learning group, after planning them; it makes cognitive conflicts encountered through participation, dialogue and classroom interaction in organized groups, and through guided educational activities based on classroom discussions.

(Suleiman and Abdelkader, 2006: 423) defines the active learning strategy as the pedagogical practices followed by the teacher in the classroom, it depends most on the student's activity, effectiveness and positivity, taking responsibility for his learning, his ability to decide about his learning, and encouraging him to work collaboratively to support his own and social intelligence.

Mckinney (2010) defines it as a student's dynamic, which is more than just listening to a lecture, where he does things that involve discovery, processing, and applying information, and derives from two basic postulates:

- Learning is inherently active endeavors.
- Different people learn in different ways.

*** Principles underlying active learning**

- Active learning is one that encourages interaction between teacher and learner.
- Encourages collaboration between learners.
- Encourages active teaching practices that provide sufficient time for learning.
- Active learning is the one that sets high expectations in achieving goals.
- Active learning is interdisciplinary based on multiple intelligences so it uses multiple methods of learning.
- Provides rapid deterrent nutrition.
- The rate of active learning increases with the increase in the learner's integration into educational activity, through listening, speaking, writing, experimenting, investigating, examining, analyzing, linking new information with previous experiences, and applying what he has learned in his daily life. (Al-Ghamdi, p. 27)

5- Computer method

The use of computers in teaching and learning mathematics is consistent with modernity, as the use of computers can cause a lot of improvement in students' attitudes towards learning mathematics, because the majority of students do not like mathematics, it is possible that the computer provides them with an active role that improves their level of motivation. In addition, the use of computers increases the realism of mathematics, and helps to achieve the goals of individual learning, as it provides appropriate opportunities for each student to learn according to his level, abilities, skills, motivations, speed of education and ability to solve problems. The computer helps to create opportunities for research and

exploration for students, so that the student chooses the questions he wants to answer and the educational resources he wants to resort to, and the computer works to save time and effort for the student.

6- How to solve problems

Mathematical problem solving is defined as a math situation referred to by the solver, a behavior that organizes previously learned concepts and rules in a way that helps to apply them in the problematic situation facing the learner. It is also defined as the activity and actions carried out by the learner when faced with a problem situation to overcome the difficulties that prevent him from reaching a solution.

The problem-solving method helps the learner discover new concepts and generalizations, and it also raises the desire for him to reach a solution to the problem, and it also works to increase confidence between the teacher and the student.

*** Method of discovery:** This method is one of the most important methods of teaching contemporary mathematics, and defines (Farag 2005) learning by discovery as learning that achieves the result of selective high-level mental processes is done by analyzing the given information and then recombined, and converted into a new image and access to information and conclusions unknown before.

Discovery learning allows students to discover knowledge on their own by engaging in self-guided activities in educational situations. The method of discovery is one of the latest methods of learning, whether in terms of knowledge and understanding of mathematical facts or in terms of social benefit, the formation of habits and sound scientific thinking.(Brik B. B., 2019, pp. 19-21)

7- Strategies based on cooperative learning and participatory learning for teaching mathematics:

Differentiated Learning Strategy

It is intended to devise multiple ways that provide students of different abilities, experiences, inclinations, interests and educational needs with equal opportunities to understand, assimilate and use concepts in everyday situations.

* Teaching steps according to differentiated learning: The teacher determines the skills and abilities of each student trying to answer two questions:

What does each student know? In addition, what does each student need?

- The teacher chooses the appropriate teaching strategies for each student or groups of students and the adjustments he makes to make the strategies suit this type.
- Identifies the tasks that students perform to achieve learning objectives.

Placemat Strategy

The (Placemat) strategy is one of the modern strategies that can be applied in teaching mathematics, and it is a strategy applied in groups and goes through five steps, as follows:

1. Pose the problem: The teacher poses the problem, or the mathematical problem to the students.
2. Forming groups: In this step, the teacher asks the learners to divide into groups.
3. Thinking: .. Every student thinks alone about solving tasks... Exchange ideas during the group.
4. Participation: Here the teacher asks the groups to present solutions and share the ideas they have come up with with their classmates.
5. Evaluation: At this stage, the teacher evaluates the learners using short tests or discussion in determining the level of understanding of learners by evaluating their answers, and learners participate in evaluating themselves.

Weekly Review Strategy (Wochenplan)

The weekly review strategy (Wochenplan) is one of the modern strategies that are currently being used in German schools, with the aim of making the learner the focus of the educational process and taking responsibility for his own learning, learning how to learn, and doing himself.

At the beginning of the class, students receive higher-order thinking activities that are accomplished either individually, bilaterally or in groups. The student also gets a solution sheet, through which he can do himself or another student's paper. The teacher's role here is to design activities and prepare the necessary tools, support self-learning processes, and provide assistance when absolutely necessary, as well as guidance, guidance and monitoring.

This strategy goes through three steps:

- Distribution of activities: through which the subject of the class and questions of varying difficulty related to higher thinking skills and the time allocated to each question are determined, to be added to the forms that determine the learning style and how to evaluate.
- Determine the learning style: individual, even or group.
- Determine the method of evaluation: self-evaluation or from the other party (peer or teacher). (Shaqlal, 2018, pp. 455-461)

Thayer Strategy

Thayer is also one of the modern strategies that can be applied in teaching mathematics.This strategy is an old version of the concept of flipped learning, where students were asked to see the content at home through the book and write down their questions to ask in class to be answered by either peers or teachers.

It was developed by Bob Anderson and called it "Thayer classroom", where it was applied in mathematics to develop analytical and evaluation skills in order to develop students' critical thinking.

This strategy is attributed to Colonel Sylvanus Thayer, who was a teacher at the Military Academy from 1817 to 1822 in Point West in New York City. It is under self-learning and makes learning learner-centered. So that the student is the focus of the educational process and responsible for his learning and self-education.

Students were asked to prepare the lesson at home and write down questions to ask in class for answer by peers and the teacher. The teacher then begins to ask questions in a gradual manner and discuss them with the students to ensure the extent to which the students understand the material.

The goal of Thayer's strategy is not just to understand and apply what they have learned at home or to present the solution they have come up with in the classroom to students, rather, the students of the group must explain the mathematical problem, determine the data available in it, determine the mathematical relationships used, explain them, how they reached the solution, and present the method of solution. Thus, we can move towards deeper and broader-minded learning through a student-centered class and work to form relationships between students. (Jeffrey & Merrill, 2010, p. 15)

Conclusion

In general, the optimal use of appropriate teaching strategies has an effective role in achieving the desired goals, including raising the level of academic achievement, and developing students' athletic tendencies, especially those that focus on the student's positivity and vitality during the lesson, and his active participation in achieving his goals. Which all fall under the name of active learning, which is based on the principle of active individual work with the presence of a teacher who encourages them to take responsibility for teaching themselves themselves under his close supervision, it pushes them to achieve the ambitious goals of the school curriculum, which focuses on building the integrated and creative personality of today's student and tomorrow's man.

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