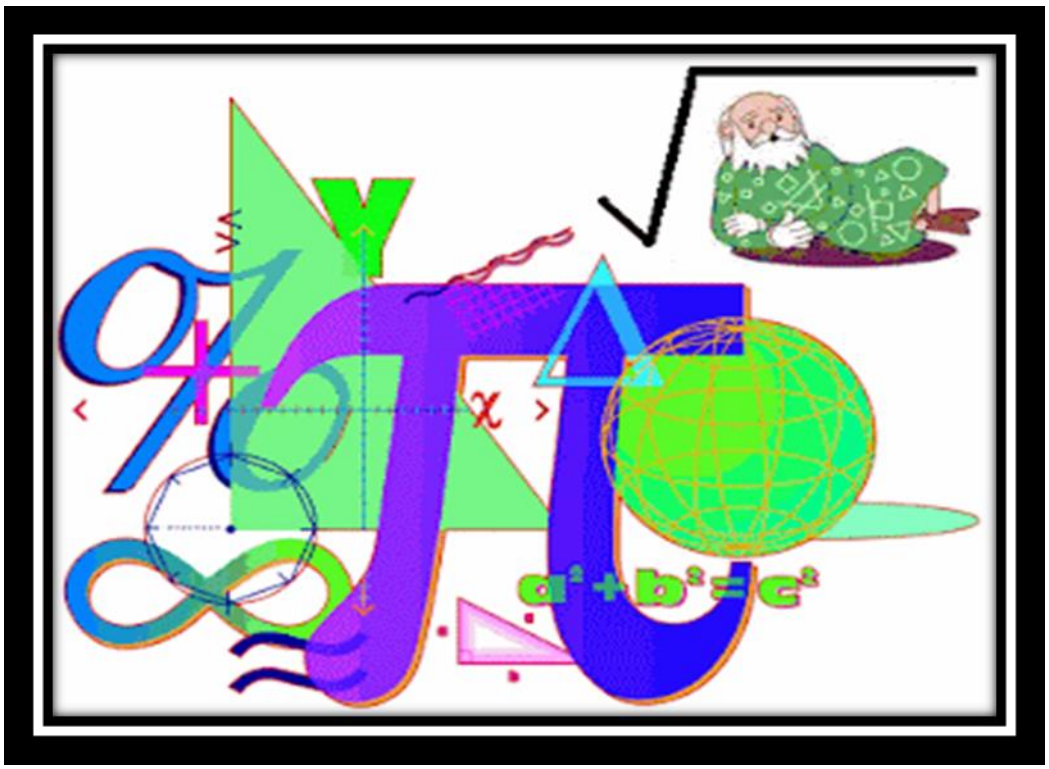
Teaching Methods

4th Year (Mathematics)



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Basic data

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Vision of the Faculty of Education

The Faculty of Education in Qena is distinguished in the fields of teaching, learning and educational research, including... Serves the community locally and regionally.

Faculty of Education message

The Faculty of Education in Qena seeks to prepare distinguished graduates who are academically and professionally qualified

Ethically, they are able to conduct educational studies and research that meet the requirements

The labor market using modern technologies, keeping pace with local and regional competitiveness

In order to achieve sustainable development within the framework of the values of Egyptian society.

Strategic objectives of the Faculty of Education

1- Preparing an academically and professionally distinguished graduate committed to the ethics and morals of the profession.

2- Building a scientific research system that keeps pace with the international level.

3- Effective contribution to community service and development of the local environment to achieve... sustainable development.

Introduction

In light of the tremendous global acceleration in various fields of knowledge and technical development that is making great strides towards leadership in all fields, it was necessary for education as a basic pillar in uncovering, adapting and developing creativity to be the building blocks of the future. It must develop and renew itself and break the habit, imitation and stagnation of the educational scene, until it breaks all... A restriction that prevents learners from freely practicing learning and enjoying the learning experience. From here, the idea of fun learning emerged to make learning a joyful, motivating and transformative experience, and as an educational solution that enables us to discover the joy of learning and become lifelong learners.

Teaching methods represent an important element of the curriculum, as they are closely linked to the objectives and content, and they have a significant influence on the selection of activities and educational methods to be used in the educational process.

We can say that teaching methods contribute greatly to achieving goals, because they are what determine the role of both the teacher and the learner in the educational process, and they are what determine the methods that

must be followed, the means that must be used, and the activities that must be performed.

If we analyzed the teaching methods in the past and determined their path, we would find that they were completely influenced by the traditional concept of the curriculum, as these methods worked to provide students with facts, concepts, and laws according to the traditional concept of the curriculum, if these methods worked to provide students with the facts, concepts, laws, and theories that the curriculum includes, that is, It was focused on delivering knowledge to students through the teacher, but modern methods have modified their goals and expanded their scope and now focus on the student's effort and activity in the learning process, as they start from modern education, which calls for teaching the child how to learn, and the Chinese proverb says: "Don't catch me a fish." But he taught me how to fish."

It is noted that interest in education and its teaching methods is increasing day after day, and the educational schools that deal with teaching methods are diverse and each one of them is classified in terms of effectiveness, impact, advantages and disadvantages that surround each method, as it is not possible to generalize a teaching method as being the best due to different educational situations. The most important teaching methods must be

mentioned, and the choice of method is left to the teacher to determine the method that suits the educational situation and the educational material. In this article, we will take a look at the teaching methods.

The teaching method is the method that the teacher follows in order to achieve the desired goals of the educational situation, and it includes a number of activities and procedures that the teacher follows in the classroom to convey to the students a set of facts and concepts related to the lesson.

The methods used for teaching vary depending on the material to be explained, the number of students in the class, and the time available to achieve the educational and behavioral goals required from the lesson. The most important methods in teaching are: the lecture method, the discussion method, the dialogue method, the story method, and the problem-solving method. We will discuss the lecture and discussion method as two commonly used examples. Nowadays, we will talk more about them.

Teaching methods mean the methods that the teacher follows, with the aim of clarifying the topic of the lesson to the students, i.e. the topic that is to be explained to them, and this is done through an implementation plan

that has been developed in advance. It is also possible for the teacher to use a large number of methods, and he can also use some There are means to explain that lesson in a visual and audio way and to do many activities. Therefore, the teacher must be very familiar with all the methods related to the teaching process, so that he can present the topic in an easy way and be familiar with all the information related to it.

In fact, there is no single method that is better or more effective than others that is suitable for use in education. This is because there are many factors that play an important role in determining the appropriate method in any educational situation, for example through the nature of the educational experience or the scientific material to be taught, or the student learner and his needs. The urgency, his previous experiences, the degree of his intelligence, the extent of his readiness and desire to learn, in addition to that, the nature of the specific educational methods or materials in achieving the desired goals, and finally the role of the teacher himself, the extent of his competence and his firm desire for serious educational work.

Hence, we affirm that the nature of the educational situation with its various elements is what determines

which teaching methods are most appropriate. It may be recitation alone, or recitation with discussion in one educational situation, or experimental or programmed instruction may be the most appropriate methods in another educational situation, and so on.

There is no way in which you can prefer one method of teaching over another. Even the types of teaching have been divided in order to be appropriate for all the different circumstances of the teaching process, and the teacher must also choose the method that suits that subject.

(1)
The nature of mathematics

1-1 The nature of mathematics

People knew mathematics and found the urgent need for this science since the presence of man on the surface of the earth. Perhaps the first man's practice of mathematics was limited to numbers only and the use of numbers, for example. The matter was limited to this, and no traces of mathematics that we can describe as complex appeared except among the Babylonians and Egyptians, three thousand.

In the year BC, they used algebra, arithmetic, and geometry, which were widely used for economic transactions such as buying and selling, taxes, and for calculating areas, construction, and calculating time.

Mathematics is a sequential science that always moves forward, and it is a cumulative science. Because its present and future depend mainly on its beginning (its past), and it is considered an abstract science; Because it is based on geometric and numerical relationships, which are distinguished by their accuracy and arrangement in presenting ideas and their progression, which helps in arriving at accurate clarifications and interpretations of all results.

Mathematics has been associated with many meanings, as in the eyes of some it was only arithmetic skills, and in the eyes of others it was a tool used in the fields of daily life and in scientific and academic studies. As for scientists and specialists in this field, they defined it as the deep study of abstract systems, and in this way it has

become A way of thinking that develops ways of thinking, develops them, and uses them with the utmost precision and innovation.

Mathematics is considered one of the most important types of sciences, and the one most closely related to various aspects of life, and to various different types of sciences. Mathematics is a science with abstract concepts and terminology, as this science is concerned with the study of geometry, arithmetic, and space, in addition to many other topics. Below is a mention of some of the most prominent concepts, terminology, and mathematical sciences, and the most prominent fields to which they contribute and add.

Mathematics is one of the most important subjects that gives the student many key cognitive skills. Teaching mathematics is focused on many different goals, whether cognitive, emotional, or skillful. To achieve these goals, many standards and foundations must be followed when developing and creating mathematics curricula in institutes. Schools and universities.

In 1965 AD, *Banks* defined mathematics as follows: (Mathematics is the "SALT" of the earth), and its translation means (mathematics is the salt of the earth). If this indicates anything, it indicates the extent of the importance of mathematics in scientific and practical life, just as food needs salt.

If each letter of the word (Salt) was divided separately, the four letters would produce the following words: the letter S symbolizes the word Science, the letter A symbolizes the word Art, the letter L symbolizes the word Language, and the last letter T symbolizes the word Tool, and thus mathematics becomes a science. A language, an art, and a tool. Below is an explanation of each of them:

• Mathematics is a science: Mathematics is characterized by knowledge based on sequence. It begins with concepts and ends with theories and laws on which the rest of the sciences are built.

• Mathematics is an art: Mathematics is characterized by the progression of ideas, their sequence, their harmony and consistency in constructing information, their dependence on each other, and their production of mathematical models capable of clarifying daily life situations.

• Mathematics is a language: Mathematics is a universal language; It uses unified symbols to communicate ideas between individuals, and it also helps in intellectual communication between members of society.

• Mathematics is a tool: Mathematics is widely used in areas of daily life, and it also plays a major role in studying other scientific branches. It is a tool used in

organizing and coordinating ideas and clarifying the environment in which a person lives.

Not all scholars agreed on a unified definition of mathematics; The concept of mathematics has changed and developed over the ages and times. It began simple, examining the basic operations of addition and subtraction, and it developed little by little until it became a science that investigates the most complex matters. Therefore, the definition of mathematics is a philosophical definition, not a final and conclusive definition, as Aristotle defined mathematics as: Quantitative science, but this definition is not accurate for our current era. Mathematics is: the science that investigates several different matters such as quantity, measurement, arithmetic, geometry, structure, arrangement, description of different shapes, and counting, and this is done using numbers and symbols.

1-2 Branches of mathematics

Mathematics has developed in the modern era, and has many diverse branches, each branch specializing in studying a specific mathematical field. The branches of mathematics have contributed to technological development to a great extent, so mathematics is considered a comprehensive science that is included in most other modern sciences, and it is one of the most prominent branches of science. Mathematics is the following:

Mathematics can generally be classified into the following branches:

Pure mathematics: Pure mathematics is defined as the study of the basic concepts and structures that build the science of mathematics. Its main goal is to reach a deeper understanding and broader knowledge of the mathematical sciences themselves. Pure mathematics has a group of branches, which are as follows:

Arithmetic: Arithmetic represents the oldest branch of mathematics and its foundation, as it deals with numbers and basic operations. Such as addition, subtraction, multiplication, and division. Arithmetic is the oldest branch of mathematics, and it specializes in studying basic operations on numbers, which are: Multiplication,

division, addition, and subtraction. This science includes basic mathematical operations that are used in daily life. Such as addition, subtraction, multiplication, and division, as well as fractions and percentages. They are a form of division, and exponents are a form of multiplication.

♣ Combinations and permutations.

♣ Mathematical structure.

♣ Number theory.

Algebra: Algebra represents a type of arithmetic operation, as it is used to calculate unknown quantities with numbers. The unknown quantities are expressed in alphabetical letters, and the use of letters helps to generalize these formulas and rules in order to find the unknown value in algebraic expressions and equations.

Algebra is based on the principle of equations that contain known variables and unknown variables. The known variable is a number, while the unknown variable is symbolized by one of the letters of the alphabet. Using formulas and analysis, the unknown values are found in algebraic equations.

This science specializes in analysis, differential and integral calculus, number theory, combinatory and permutations. Algebra has roots in numerical fields, real

values, and complex numbers. Algebra is used in various mathematical fields, and it is one of the most important basics of geometry.

Analysis science: Analysis is concerned with studying the rate of change in different quantities, and it is noted that differentiation and integration form the basis of analysis. Mathematical analysis is the science that studies the rate of change based on many properties, the most prominent of which are: Properties of integration and differentiation. This branch includes studying the rate of change of different quantities, and this branch of mathematics is built on the principles of differentiation and integration.

Differentiation and Integration: Differentiation and integration is considered one of the most famous branches of mathematics, and the most common and used in a large number of sciences. Differentiation is concerned with finding rates of change, while integration is considered the inverse process of differentiation, as integration is divided into two parts: limited and unlimited integration.

One of the most prominent applications of calculus is calculating areas and volumes. It is also widely used in

physics, various types of engineering, economics, and many other fields.

Engineering mathematics: It is defined as the field of mathematics related to the study of space, and the relationships between points, lines, and curves. This branch of mathematics deals with spatial entities.

Geometry: Geometry is the most practical branch of mathematics. It is concerned with shapes, sizes, and their properties, and points, lines, angles, surfaces, and solids represent their basic elements.

Geometry is the most practical branch of mathematics. It studies the shapes and sizes of shapes and their properties. The basic elements of geometry are: Lines, points, angles, and surfaces.

Space Geometry: Space geometry is concerned with the study of areas and volumes, and the reconciliation between them based on proven laws. Perhaps the most prominent shapes studied by spatial geometry are: a prism, a cube, a pyramid, a sphere, a cylinder, and others. It also studies straight lines, their intersection with planes, etc. that. This important mathematical branch has become widely used by scientists and specialists in certain types of science, especially with the recent

scientific and technical developments that the world has witnessed.

Applied Mathematics: Applied mathematics is defined as the application of pure mathematics in its various branches to problems that arise in different fields. Such as science, engineering, etc., and also includes developing new methods and solving scientific problems and their challenges. Applied mathematics depends on several branches of mathematics, which are as follows:

♣ Differentiation and integration.

♣ Statistics, probability.

♣ Set theory.

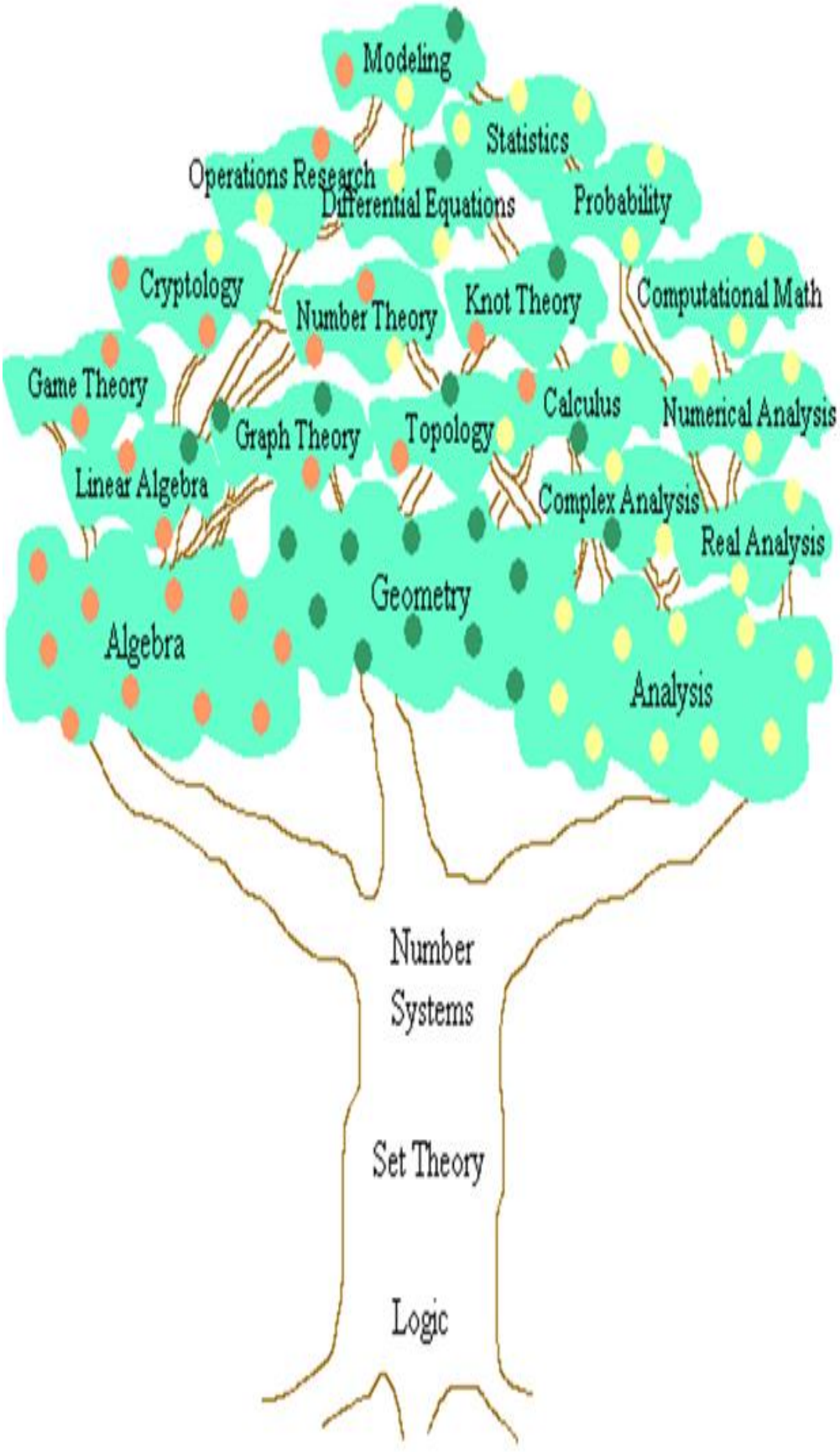
Trigonometry: The concept of trigonometry is derived from two Greek terms: The first term means triangle, and the other term refers to measurement, as it is concerned with studying the relationships between the angles and sides of triangles. Trigonometry is the science that studies the relationship between the sides and angles of triangles.

This branch is related to the description of triangular angles and the mathematical aspects related to them, and this branch is used in different branches of mathematics. Such as geometric, Euclidean, and analytical, and its

scope can be expanded to include real and complex numbers, and therefore this branch is also useful in solving differential equations and complex analysis.

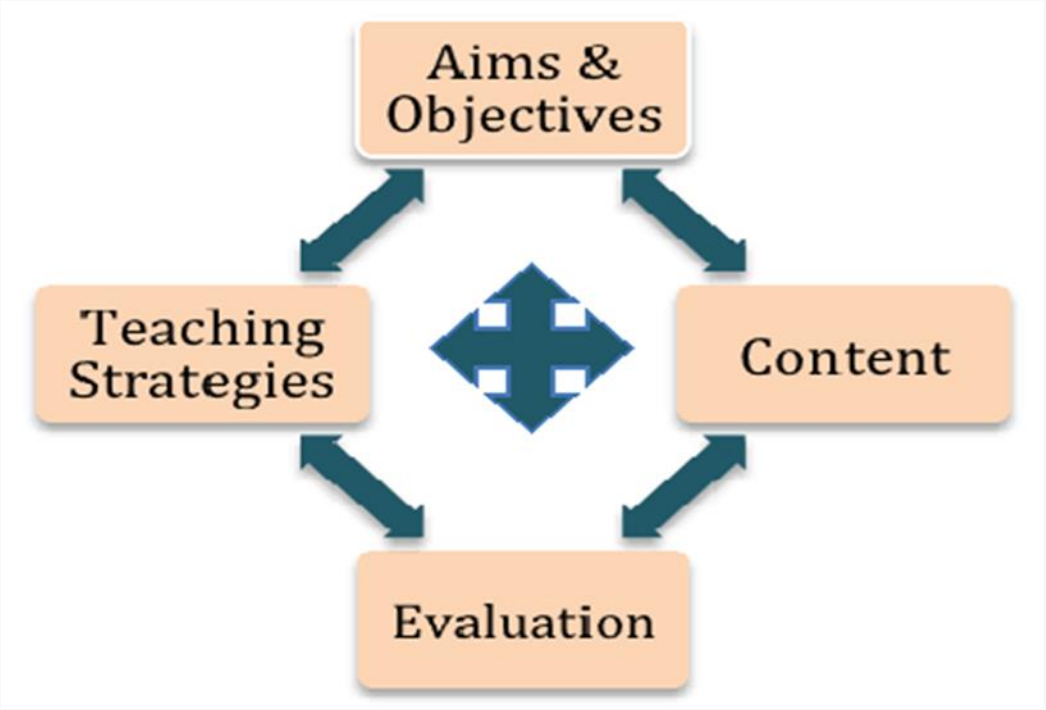
Statistics: Statistics is considered one of the most important and prominent branches of mathematics, and the one most closely related to many different areas of practical life. Statistics is primarily concerned with analyzing the available data set, studying it, and then representing it using appropriate means. Hence, this science is largely involved in the business sector, the social sciences, and a large number of branches of the humanities, among others.

Mathematics has many branches. These branches may differ in the quality of their issues and the practical applications of their results. In any case, mathematicians working in various disciplines are often involved in the use of the same basic concepts and processes. This item discusses some basic types of mathematics.


Modeling
Statistics
Operations Research
Differential Equations
Probability
Cryptology
Number Theory
Knot Theory
Computational Math
Game Theory
Graph Theory
Topology
Calculus
Numerical Analysis
Linear Algebra
Complex Analysis
Real Analysis
Geometry
Algebra
Analysis
Number Systems
Set Theory
Logic

1-3 Planning in mathematics teaching

Planning in teaching:



Elements/Components of Curriculum

Lesson planning is one of the basic skills for the teacher, because mastering this skill requires mastering many teaching skills, such as formulating specific and clear educational objectives, analyzing content, organizing the sequence of experiences, choosing or preparing different evaluation methods, as well as using them to reveal the extent to which educational objectives have been achieved.

Lesson planning is the process of designing a clear vision of what the educational situation could be like to achieve

the goals, and it includes choosing methods and activities appropriate to the educational situation and the nature of the learner.

Lesson planning includes the following tasks:

1. Determine the teaching objectives and the appropriate content to achieve them.
2. Choosing the appropriate teaching method, activities, and educational methods.
3. Determine methods for measuring and evaluating educational outcomes.

The importance of planning for teaching:

1. Preparing the teacher to teach in a real, appropriate environment, thus enhancing his self-confidence and the confidence of his students in him.
2. Enriching the teacher's knowledge of his specialty subject and teaching methods.
3. Employing the teacher's expertise in teaching, avoiding mistakes and embarrassment.
4. Identify the strengths and weaknesses in the teacher's performance and work to remedy them.
5. Identifying learners' abilities and needs.
6. The teacher avoids improvisation and randomness.
7. Choosing the most appropriate activities and methods for the topic.

8. Choose appropriate evaluation methods to ensure that goals are achieved.

Types of study plans: The teacher usually carries out three types of educational planning: some are long-term and cover an entire course (annual plan), some are medium-term and deal with a subject taught in a semester, and some are short-term and cover the educational activity in one lesson.

• 1 Annual plan (long-range planning): It is the planning in which the teacher gives a comprehensive vision of the progress of the educational process in light of the general objectives of the course. The annual plan does not detail precise details, but rather includes broad outlines of the course's teaching progress during an academic year and includes: defining the general objectives of the course. - Determine the content of the study material that achieves each of these general goals - Establish a timetable and define strategies.

• 2. The quarterly plan (medium-term planning): It is similar to the annual plan, but it distributes the academic material taught in one semester over weeks, taking into account the timing needed by each unit and includes:

• The basic objectives of the unit. The main idea of this unit.

• The type of teaching aids I will use.

• 3. Daily plan (daily planning): This plan is implemented during one lesson, and this record is useful to the teacher as he can refer to it if he forgets something during the course of the lesson. The formulation of lesson objectives must be behavioral (measurable and observable).

The most important elements of the lesson plan (daily):

1. Introductory information such as class, day, date, and subject.
2. The content and the concepts, skills, principles, or mathematical problems it contains.
3. Teaching objectives are behaviorally formulated, measurable, and distributed across the levels of the cognitive field in a balanced manner and according to what is imposed by the subject of the lesson.
4. Methods, means and activities used to present the lesson.
5. Evaluation methods necessary to ensure the achievement of the desired goals in the lesson plan.
6. Homework.
7. Distribution of class time among lesson activities and other observations.

The most important features of the daily lesson plan:

1. Clarity: The plan is usually written clearly in the correct and precise language that helps the teacher and enables him to implement it procedurally.
2. Implementable: That is, it is applicable and there is no great difficulty in implementing it.
3. Continuity: That is, the same plan can be used at other times and for other students.
4. Flexibility: That is, the daily plan should be able to add or delete some activities, goals, strategies, or implementation time and date according to changes in the educational situation.
5. Comprehensive: The plan's activities must be appropriate to cover the entire lesson time and the content of the prepared material.

1-4 Objectives of teaching mathematics

Educational goals have different levels. There are general goals, which are: goals that are concerned with the outcomes of education in the long term, and there are specific teaching goals that are concerned with the outcomes of education in the short term. If the special teaching goals are formulated in a specific way, they become behavioral goals.

Behavioral goals

Definition of behavioral objectives: This means a type of linguistic formulation that describes a specific behavior that can be observed and measured and that the learner is expected to be able to perform in the educational activity. It is used as a guide for the teacher in the teaching process.

Formulating behavioral objectives is considered one of the most prominent problems facing many teachers, even though they are in dire need of it when preparing lessons. So what is the meaning of a behavioral objective? How can it be formulated? .

Behavioral goal: It is the smallest behavioral educational outcome (verbal or non-verbal) that is expected to occur in the learning process and can be measured.

The behavioral goal consists of:

(1) (2) (3) (4) (5) (6)

That + behavioral verb + learner + scientific term + minimum performance + conditions for achieving the goal

The behavioral goal consists of the following parts:

A - The behavioral act (which precisely defines the learning behavior) B - The actor of the behavior (the learner) C - The content (the topic to be treated) D - The circumstances (the state in which the learner is while performing the behavior) E - The standard (the degree of mastery with which the teacher evaluates the performance learner)

Conditions that must be met in formulating the goal

(1) The goal must be completely clear to the teacher and the learner.

(2) The goal must be realistic and the extent of its achievement can be measured.

(3) The goal should be appropriate for the students' growth and maturity
(4) The goal must be specific, meaning that it does not interfere with another goal.
(5) The educational objectives must be consistent with the general objectives of the educational stage.
(6) The goal should contain only one idea.
(7) The goal represents a direct intended outcome of the educational experience.
(8) The goal begins with a present tense verb that expresses the behavior that will occur in the student.
(9) The goal should state the learning outcome and not the learning process itself.

Behavioral goal areas:

Bloom's classification of behavioral objectives is considered one of the most well-known classifications, and he classified them into the following three areas:
(1) The perceptual, mental, or cognitive field: It includes goals that address and remember knowledge, perceive it, and develop mental abilities and skills.
(2) The affective, affective, or emotional domain, which includes goals that describe changes in interests, attitude, trends, values, development of appreciation, and adaptation.

(3) The psychomotor field or the skills field: It represents goals that focus on one of the muscular or motor skills or that require skillful manipulation of some materials or objects or some actions that require neuromuscular coordination.

Curriculum Goals, Objectives and Outcomes

A goal is:

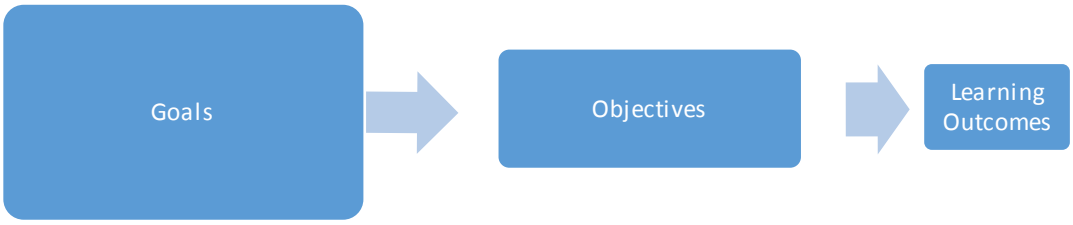
1. states a target for a course or program
2. states the general outcome of a course or program
3. describes a more general learning outcome
4. may have several learning objectives

The characteristics of effective educational goals can be summarizing as:

- Relevant: confirm to the needs of the learner and institutional objectives.
- Logical.
- Unequivocal: clear action verbs to be used.
- Observable: able to see the action performing,
- Ex (Writing- spoken- performed, etc.).
- Measurable: able to evaluate, check and recheck.

- Ex (Rating- Grading- making etc.).

Goals are where you want to go.
Objectives are how you get there.
Outcomes are proof that you have arrived.



The objectives are the arrows that help the learner reach the target and demonstrate mastery. For preparing teaching\learning program:

- Facilities course planning.
- Communicates describe emphasis of treatment.
- Provides for selective approach.
- Helps in Curriculum design.
- Facilities Evaluation.
- Facilities Learning.

Learning Objectives emphasize:

1. students' performance
2. the end product
3. what students learned

Learning Objectives do not emphasize:

1. teacher performance.

2. the subject matter.
3. how knowledge was acquired.

In order to ensure clear and measurable Learning Objectives, one must focus on:

1. *Performance:* Describe what is to be learned in with outcome of performance in mind.
2. *Norm:* Describe clearly what outcome is expected and what level of accuracy is expected in order for the learning to be judged adequate.
3. *Settings:* Describe the specific circumstances under which the learner is supposed to perform and what tools are to be used

Element of specific objectives:

1. Activity- appropriate action verb to be use.
2. Content: what is to be implement or performed.
3. Condition: with or without help of (Equipment – book- specimen report-……..,etc.).
4. Criteria: level of Minimum performance.

Illustrative verbs for stating specific learning objectives:

Design	Compare	Decide
Generalize	Predict	Defend
Criticize	Simplify	Evaluate
Modify	Synthesize	Explain
Analyze	Systematize	Revise
Appraise	Conclude	Formulate
Combine	Contrast	Plan

Types of Educational Objectives:

A. According to types of objectives:
    1. Institutional.
    2. Departmental (Intermediate).
    3. Specific instructional/behavioral.
B. According to domain:
    1. Cognitive domain.
    2. Affective domain.
    3. Psychomotor domain.

1)Cognitive Objective: Dealing with intellectual abilities; Approximately 80% of educational objectives fall into this domain; Most familiar to both instructors, authors and learners

2)Affective Objective: Relating to the expression of feelings, including emotions, fears, interests, attitudes, beliefs, values and appreciations: Often the most difficult objectives to develop

*3)Psychomotor Objective***:** The easiest objectives to write as the behavior is easily observed and monitored. Psychomotor skills often involve the use of tools or instruments; "Hands On" courses will contain psychomotor objectives

C. According to person:
    1. Teacher centered.
    2. Student centered.

Learning Outcomes

Learning outcomes are statements of what a student will be able to do as a result of a learning activity. They are specific, measurable, clear, and assessable statements that define what a student is able to do at the end of a course or completion of a program. These outcomes may involve:

1. Knowledge (cognitive).
2. Skills (behavioral).
3. Attitudes (affective behavior)

All three above statements must show evidence that learning has occurred.

Example:

1. Each goal may have several Objectives associated with it.
2. Each objective will have one learning outcome associated with it.

Goal 1: The Educational Technology course (program) will enable the students to make reliable and accurate assessments of the type of assistive technology needed for a variety of disabilities.

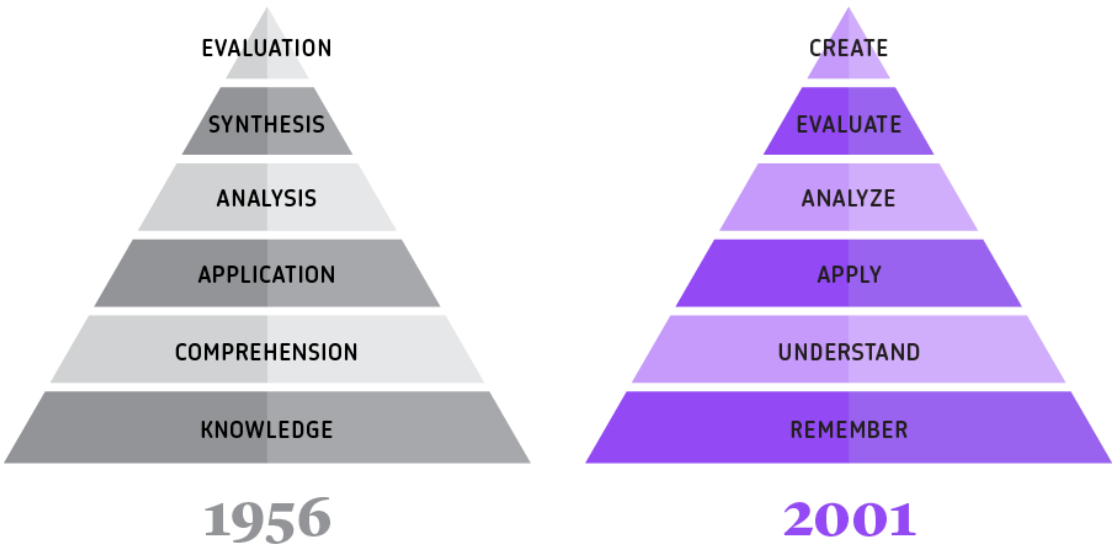
Objective 1: The student will be able to use an appropriate technology to address the needs of autistic children in the classroom.

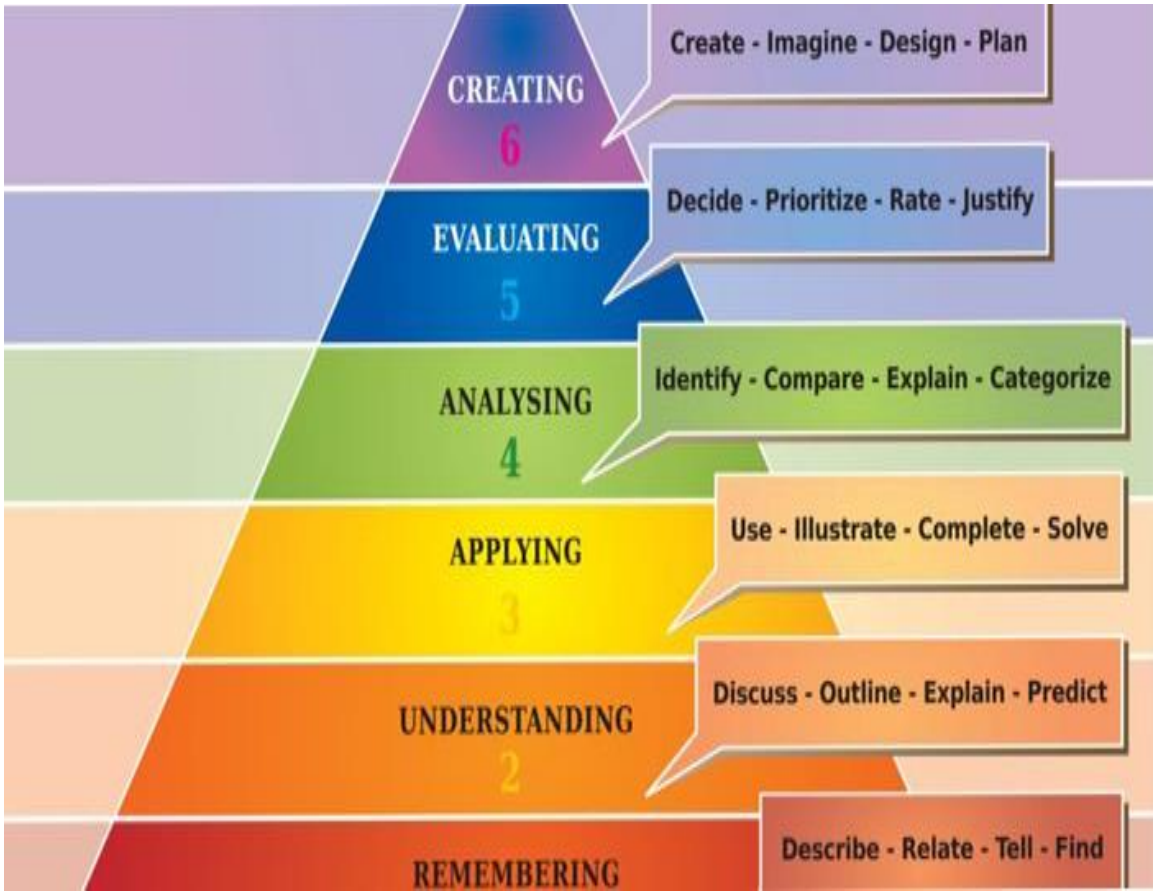
Objective 2: The student will be able to adapt any assistive technology to address the problems of behavioral problems.
Learning Outcome 1: At the end of the course (program) the student will be able to create lesson plans using Inspiration to teach autistic students how to draw a picture independently.

Learning Outcome 2: At the end of the program the student will be able to create an activity teaching autistic children how to behave in the classroom.

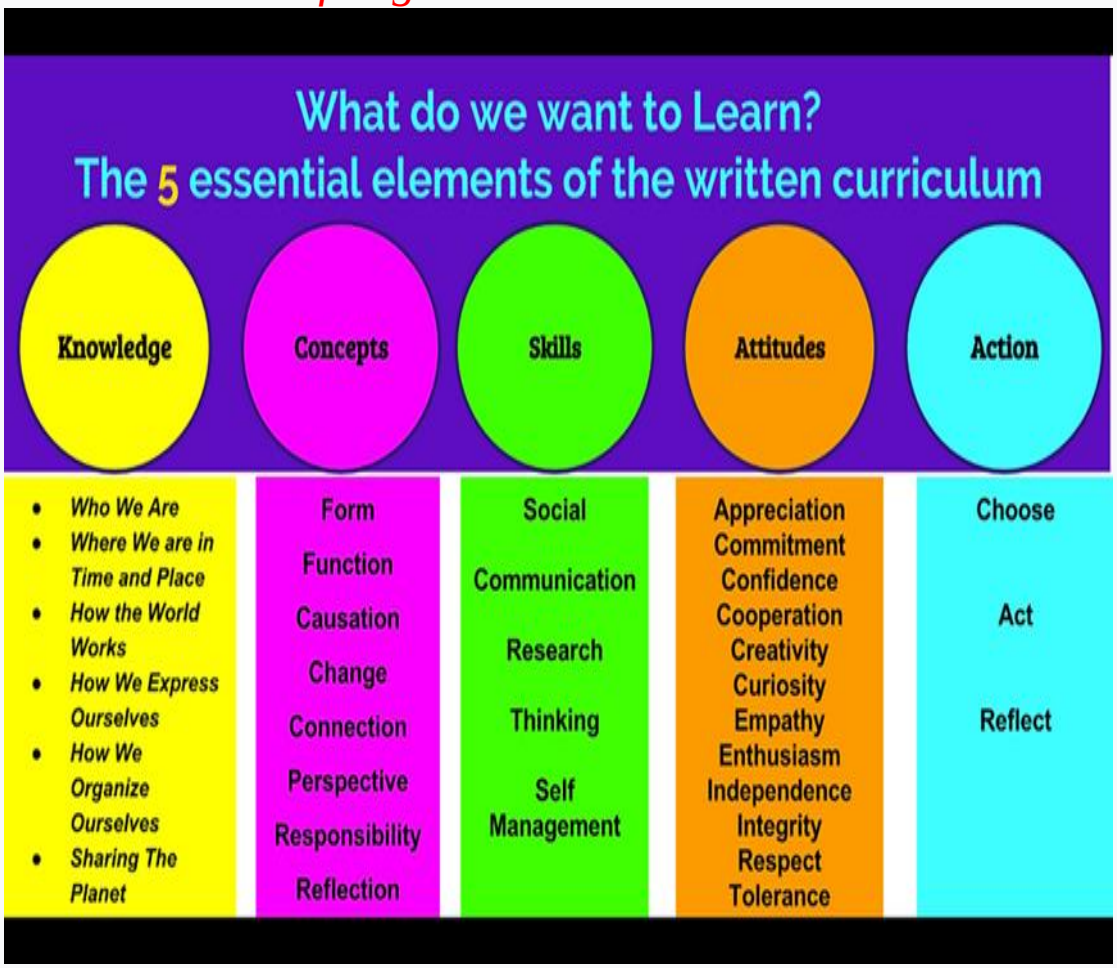
Blooms Taxonomy:

Taxonomies are classification systems based on an organizational scheme. In this instance, a set of carefully defined terms, organized from simple to complex and from concrete to abstract, provide a framework of categories into which one may classify educational goals.




CREATING
6
Create - Imagine - Design - Plan
EVALUATING
5
Decide - Prioritize - Rate - Justify
ANALYSING
4
Identify - Compare - Explain - Categorize
APPLYING
3
Use - Illustrate - Complete - Solve
UNDERSTANDING
2
Discuss - Outline - Explain - Predict
REMEMBERING
Describe - Relate - Tell - Find

Bloom's levels of cognitive domain



Level 1: Remember

Recall is the basic and first level in Bloom's pyramid, and depends on students' ability to memorize and recall key facts and concepts. For example, a learner can memorize and recall information through repetition or memorization of basic facts. One way to test learners' memorization ability is to take a test that involves choosing from multiple options.

The second level: understanding

The second level of understanding. At the second level of Bloom's taxonomy, learners demonstrate that they have a

deeper understanding and understanding of the interconnectedness of the facts. During this level, learners explain ideas and concepts in detail, such as what the facts indicate and how they may be connected. To test understanding, learners can be asked to repeat Formulate information and compare ideas.

The third level: application

The third level of the pyramid comes in application, and requires learners to use their new knowledge and apply it to different situations, whether by solving or interpreting problems.

Level Four: Analysis

Now comes the analysis. During this level, it requires the development of critical thinking. Learners must compare ideas to find out the logic of some opinions by knowing the facts and analyzing them. To do this, learners can be asked to explain a variety of connections between topics or ideas, or how to understand the main facts of the topic.

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Level Five: Evaluation

During the evaluation phase, learners establish their own foundations and explain their decisions using explanation. Learners can clarify this phase by critiquing ideas and explaining how they are understood using facts, analysis, understanding, application and analysis.

Sixth level: Creativity (composition)
This level is the top of the pyramid. Learners must begin to form. At this level, learners formulate various elements together to create a new pattern or structure. For example, proposing a new thought process or formulating a new idea. Learners may demonstrate the ability to create by creating A recent hypothesis or idea and synthesize past levels to strengthen their logic.

Here is an overview of the categories that make up the framework:

- Knowledge
    - Knowledge of specifics
        - Knowledge of terminology
        - Knowledge of specific facts
    - Knowledge of ways and means of dealing with specifics
        - Knowledge of conventions
        - Knowledge of trends and sequences
        - Knowledge of classifications and categories
        - Knowledge of criteria
        - Knowledge of methodology
    - Knowledge of universals and abstractions in a field
        - Knowledge of principles and generalizations
        - Knowledge of theories and structures

- Comprehension
  - Translation
  - Interpretation
  - Extrapolation
- Application
- Analysis
  - Analysis of elements
  - Analysis of relationships
  - Analysis of organizational principles
- Synthesis
  - Production of a unique communication
  - Production of a plan, or proposed set of operations
  - Derivation of a set of abstract relations
- Evaluation
  - Evaluation in terms of internal evidence
  - Judgments in terms of external criteria

Bloom's Taxonomy Action Verbs						
	Knowledge	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**
DEF	Remember previously learned info rmation.	Demonstrate an understanding of the facts.	Apply knowledge to actual situations.	Break down obj ects or ideas into simpler parts an d find evidencet o support genera lizations.	Compile component i deas into a new whole or propos e alternative solution s.	Make and defend judgments based on internal evi dence or external criteria.
VERB	• Arrange • Count • Define • Describe • Duplicate • Draw • Enumerate • Find • Identify • Label • List • Match • Memorize • Name • Order • Outline • Quote • Read • Recite • Recognize • Record • Relate • Recall • Repeat • Reproduce • Select • Sequence • State • Tell • View • Write	• Classify • Convert • Defend • Describe • Discuss • Distinguish • Estimate • Explain • Express • Extend • Generalized • Give example(s) • Identify • Illustrate • Indicate • Infer • Interpret • Locate • Paraphrase • Predict • Recognize • Report • Restate • Rewrite • Review • Select • Summarize • Trace • Translate • Understand	• Act • Administer • Apply • Articulate • Assess • Change • Chart • Choose • Collect • Compute • Construct • Contribute • Control • Determine • Develop • Discover • Dramatize • Draw • Employ • Establish • Extend • Illustrate • Imitate • Implement • Interpret • Manipulate • Modify • Operate • Paint • Participate • Practice	• Analyze • Appraise • Calculate • Classify • Compare • Contrast • Correlate • Criticize • Debate • Deduce • Diagram • Differentiate • Discriminate • Distinguish • Examine • Experiment • Focus • Identify • Illustrate • Infer • Limit • Model • Outline • Point out	• Adapt • Anticipate • Arrange • Assemble • Categorize • Collaborate • Collect • Combine • Compare • Compile • Comply • Compose • Construct • Create • Design • Develop • Devise • Explain • Express • Facilitate • Formulate • Generate • Incorporate • Initiate • Integrate • Intervene • Invent • Make up • Model • Modify	• Appraise • Argue • Assess • Attach • Choose • Compare • Conclude • Contrast • Criticize • Critique • Defend • Decide • Describe • Estimate • Evaluate • Explain • Judge • Justify • Interpret • Relate • Predict • Prioritize • Prove • Rank • Rate • Reframe • Select • Summarize • Support • Value

The Affective Domain

In addition to devising the cognitive taxonomy, the Bloom group later grappled with a taxonomy of the affective domain–objectives concerned with interests, attitudes, adjustment, appreciation, and values.

This taxonomy consisted of five categories arranged in order of increased internalization. Like the cognitive taxonomy, it assumed that learning at the lower category was prerequisite to the attainment of the next higher one. Here is an overview of the categories:

- Receiving (Attending)
  - Awareness
  - Willingness to receive

- Controlled or selected attention

- Responding
  - Acquiescence in responding
  - Willingness to respond
  - Satisfaction in response

- Valuing
  - Acceptance of a value
  - Preference for a value
  - Commitment
- Organization
  - Conceptualization of a value
  - Organization of a value system

- Characterization by a value or value complex
  - Generalized set
  - Characterization

The emotional field

He pays attention - shows - receives - agrees - initiates - feels - loves - supports - justifies - parallels - commits - reconsiders - follows - believes - imitates - imitates - resists - obeys... etc.

Psychomotor field

Move - step - prepare - examine - operate - imitate - imitate - reconstruct or build - master a performance - implement a skill - write in beautiful handwriting - draw - build a shape - design a work - act a role.....etc.

1-5 Principles and standards of school mathematics

This (document) principles and standards issued by the National Council of Teachers of Mathematics in the United States of America (NCTM) calls for the existence of a general rule for mathematics that all students must learn, despite the presence of individual differences between them, as students display different talents, abilities, achievements, requirements, and interests in mathematics, and despite this All students must have quality programs for teaching and learning important mathematics, while providing opportunities for students to benefit from their broad skills and interests to obtain mathematical and practical careers. Students with special educational needs must also be provided with the opportunities and support they need to gain a basic understanding of important mathematics.

NCTM Principles and Standards for School Mathematics

Principles are specific statements that reflect the basic rules of world-class mathematics education. They include the following main principles:

Equity Principle: Excellence in mathematics requires equality, high expectations, and strong support for all students.

Curriculum Principle: The curriculum should be consistent, focus on important mathematics, and be coherently linked across grades.

Teaching principle: Effective mathematics teaching requires understanding what students know and what they need to learn, then challenging and supporting them to learn it well.

Learning principle: Students should learn mathematics with understanding and effective construction of new information from previous experience and information.

Assessment Principle: Assessment should support the learning of important mathematics and provide useful information for both teacher and student.

The principle of technology: Technology is considered an essential element in teaching and learning mathematics, as it affects learning mathematics.

As for the standards, they describe the understanding, information, and mathematical skills that students must obtain from pre-kindergarten through the twelfth grade. The standards are divided into:

1. Content standards: These standards describe what students should learn, and include:

Numbers and operations, algebra, geometry, measurement, data analysis and probability.

2. Process standards: These standards include methods of acquiring and using knowledge related to the content, and include: problem solving, mathematical thinking and proof, communication, linking, and representation.

1-6 Mathematical Processes

The mathematical processes that support effective learning in mathematics are as follows:

- problem solving
- reasoning and proving
- reflecting
- connecting
- communicating
- representing
- selecting tools and strategies

The mathematical processes can be seen as the processes through which all students acquire and apply mathematical knowledge, concepts, and skills. These processes are interconnected. Problem solving and communicating have strong links to all the other processes. A problem-solving approach encourages students to reason their way to a solution or a new understanding. As students engage in reasoning, teachers further encourage them to pose questions, make conjectures, and justify solutions, orally and in writing.

The communication and reflection that occur before, during, and after the process of problem solving help students not only to articulate and refine their thinking but also to see the problem they are solving from different perspectives. This opens the door to recognizing the range of strategies that can be used to arrive at a solution. By seeing how others solve a problem, students can begin to reflect on their own thinking (a process known as "metacognition") and the thinking of others, as well as their own language use (a process known as "metalinguistic awareness"), and to consciously adjust their own strategies in order to make their solutions as efficient and accurate as possible.

The mathematical processes cannot be separated from the knowledge, concepts, and skills that students acquire throughout the year. All students problem solve, communicate, reason, reflect, and so on, as they develop the knowledge, the understanding of mathematical concepts, and the skills required in all the strands in every grade.

Problem-Solving Strategies. Problem-solving strategies are methods that can be used to solve problems of various types. Common problem-solving strategies include the following: simulating; making a model,

picture, or diagram; looking for a pattern; guessing and checking; making an organized list; making a table or chart; solving a simpler version of the problem (e.g., with smaller numbers); working backwards; and using logical reasoning.

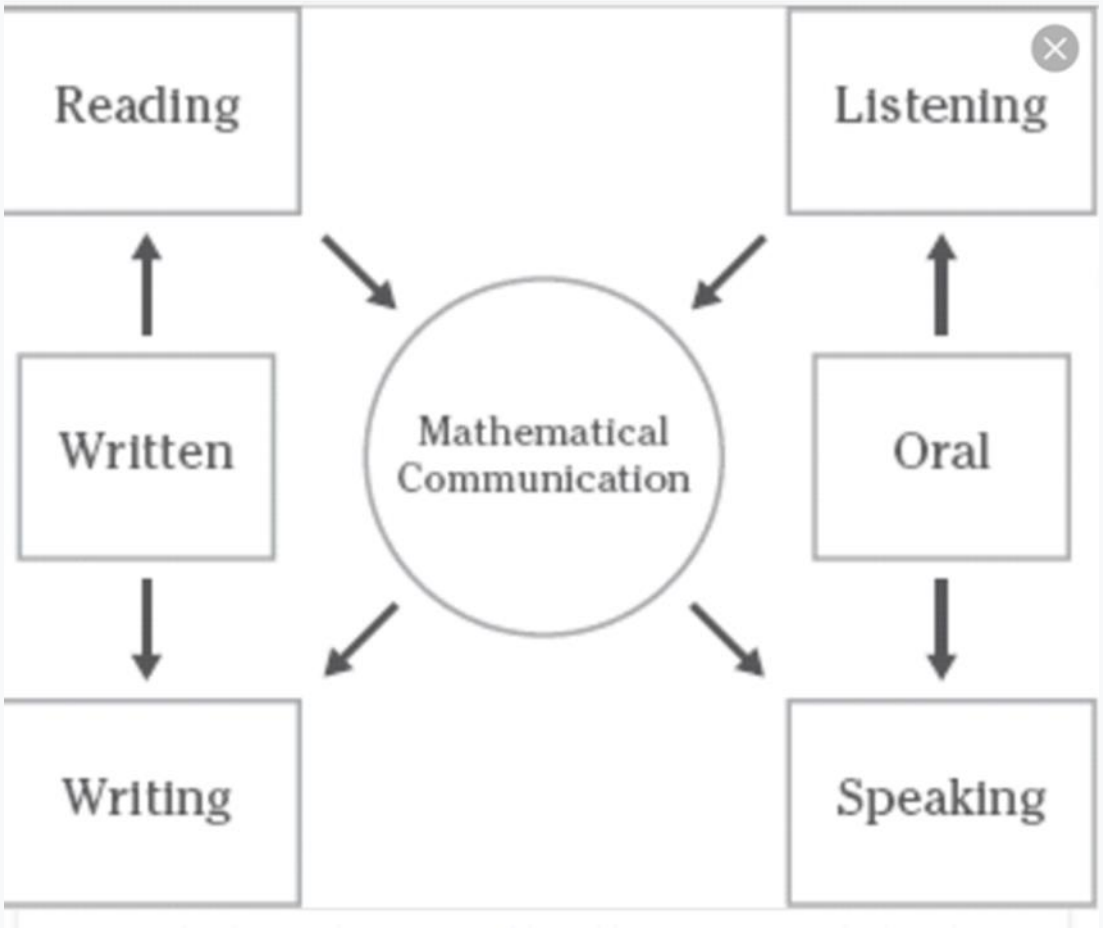
Teachers can support all students as they develop their use of these strategies by engaging with solving various kinds of problems – instructional problems, routine problems, and non-routine problems. As students develop this repertoire over time, they become more confident in posing their own questions, more mature in their problem-solving skills, and more flexible in using appropriate strategies when faced with new problem-solving situations.

Reasoning and proving are a mainstay of mathematics and involves students using their understanding of mathematical knowledge, concepts, and skills to justify their thinking. Proportional reasoning, algebraic reasoning, spatial reasoning, statistical reasoning, and probabilistic reasoning are all forms of mathematical reasoning. Students also use their understanding of numbers and operations, geometric properties, and measurement relationships to reason through solutions to problems.

Reflecting: Students reflect when they are working through a problem to monitor their thought process, to identify what is working and what is not working, and to consider whether their approach is appropriate or whether there may be a better approach. Students also reflect after they have solved a problem by considering the reasonableness of their answer and whether adjustments need to be made.

Connecting: Experiences that allow all students to make connections – to see, for example, how knowledge, concepts, and skills from one strand of mathematics are related to those from another – will help them to grasp general mathematical principles. Through making connections, students learn that mathematics is more than a series of isolated skills and concepts and that they can use their learning in one area of mathematics to understand another. Seeing the relationships among procedures and concepts also helps develop mathematical understanding.

Communicating:



Communication is an essential process in learning mathematics. Students communicate for various purposes and for different audiences, such as the teacher, a peer, a group of students, the whole class, a community member, or their family. They may use oral, visual, written, or gestural communication. Communication also involves active and respectful listening. Teachers provide differentiated opportunities for all students to acquire the language of mathematics, developing their

communication skills, which include expressing, understanding, and using appropriate mathematical terminology, symbols, conventions, and models.

For example, teachers can ask students to:

- share and clarify their ideas, understandings, and solutions;
- create and defend mathematical arguments;
- provide meaningful descriptive feedback to peers; and
- pose and ask relevant questions.

Effective classroom communication requires a supportive, safe, and respectful environment in which all members of the class feel comfortable and valued when they speak and when they question, react to, and elaborate on the statements of their peers and the teacher.

Representing: Students represent mathematical ideas and relationships and model situations using tools, pictures, diagrams, graphs, tables, numbers, words, and symbols. Teachers recognize and value the varied representations students begin learning with, as each student may have different prior access to and experiences with mathematics. All students are supported as they use the different representations appropriately and as needed to model situations, solve problems, and communicate their thinking.

Selecting Tools and Strategies: Students develop the ability to select appropriate technologies, tools, and strategies to perform particular mathematical tasks, to investigate mathematical ideas, and to solve problems.

Technology. A wide range of technological and digital tools can be used in many contexts for students to interact with, learn, and do mathematics.

Students can use: calculators and computers to perform complex operations; create graphs; and collect, organize, and display data;

digital tools, apps, and social media to investigate mathematical concepts and develop an understanding of mathematical relationships; statistical software to manipulate, analyses, represent, sort, and communicate data;

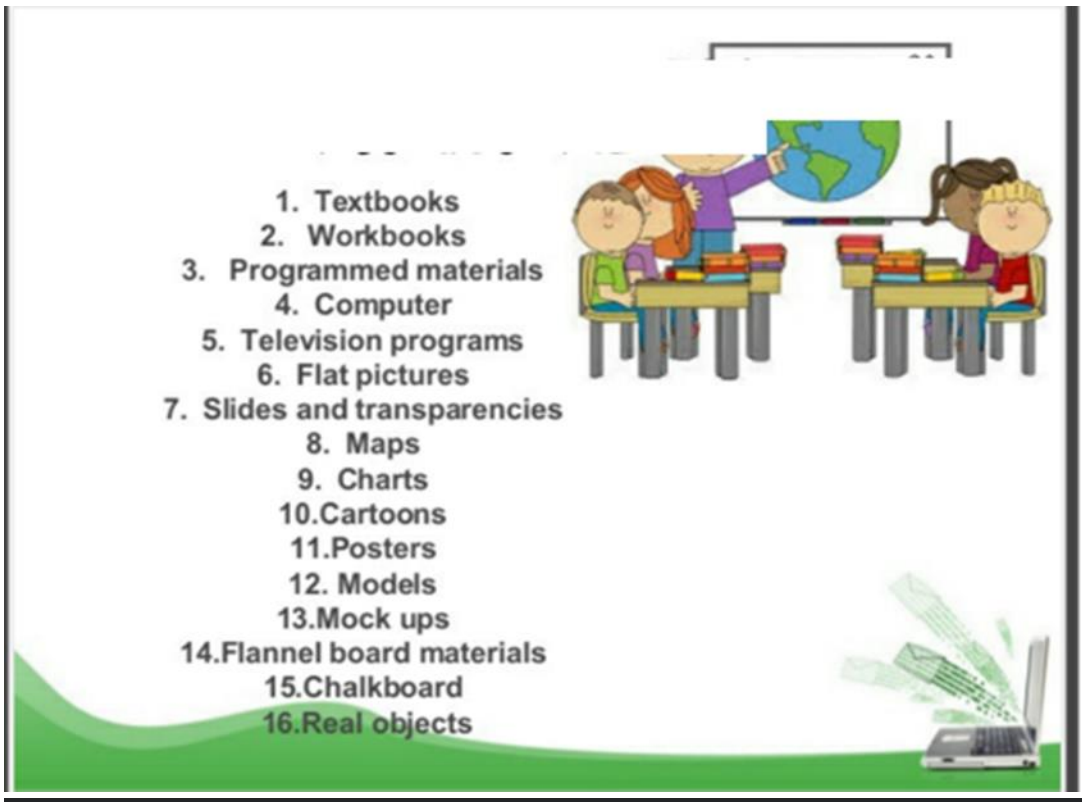
software to code; dynamic geometry software and online geometry tools to develop spatial sense; computer programs to represent and simulate mathematical situations (i.e., mathematical modelling); communications technologies to support and communicate their thinking and learning; computers, tablets, and mobile devices to access mathematical information available on the websites of organizations around the world and to develop information literacy.

Tools. All students should be encouraged to select and use tools to illustrate mathematical ideas. Students come to understand that making their own representations is a powerful means of building understanding and of explaining their thinking to others.

Using tools helps students:

- see patterns and relationships;

- make connections between mathematical concepts and between concrete and abstract representations;
- test, revise, and confirm their reasoning;
- remember how they solved a problem;
- communicate their reasoning to others, including by gesturing.



Difficulties learning mathematics:

• Verbal learning difficulties: The student faces difficulty in dealing with mathematical problems orally.

• Symbolic learning difficulties: In this case, the student is unable to recognize the shape of a number or write it, or recognize it if it is in the form of a symbol.

• Terminological learning difficulties: In this case, the student finds a large number of difficulties in reading mathematical symbols.

• Written learning difficulties: The student finds great difficulties in writing mathematical symbols.

• Difficulties in learning mathematical concepts: In this case, he faces many difficulties in understanding mathematical ideas.

• Practical and procedural learning difficulties: In this case, the student is unable to perform arithmetic operations such as addition, subtraction, division, and multiplication.

• Complete failure in arithmetic: In this case, the student lacks all basic skills in mathematics.

• Partial decline in all skills: In this case, the student achieves results that are less than the results expected of him, and the student's neglect of the subject may be one of the reasons for this decline.

• Failure of a section of arithmetic skills: In this case, the student is unable to understand part of the mathematics subject, such as algebra, for example, while he understands the remaining sections of the mathematics subject with complete ease.

• Difficulties related to mastering some special concepts related to basic arithmetic operations: In this case, the student is unable to perform complex arithmetic operations, and is content with performing simple arithmetic operations.

There are a group of methods through which difficulties in learning mathematics can be treated, and the most prominent of these methods are:

• Positive education method: In this method, the teacher and parents encourage the student and enhance his self-confidence and his ability to understand mathematics. They also help him get rid of the negative thoughts that are in his mind, by providing easy educational activities for him so that he can solve them, and thus his confidence in his ability to understand is strengthened. mathematics.

• Direct teaching method: In this method, curricula and teaching methods are designed that are compatible with these curricula and help the student master mathematics with complete ease.

• The aloud teaching method: In this method, the teacher asks the student to read the mathematical problem in a strong and clear voice, and then asks the student to specify what is required

out loud, and also asks him to specify the data out loud as well, in addition to specifying the solution method. The necessary steps are also out loud.

• Individual learning style: This method is based mainly on a set of foundations, where the teacher teaches the student alone only mathematics, and therefore the teaching time will differ from one student to another. In this method, the teacher can discover the student's weak points in mathematics, and thus Using methods that contribute to its treatment.

• Mathematical games method: This method is suitable for treating difficulties in learning mathematics for children in the early stages of education, as the teacher uses educational means made of games, which leads to drawing the student's attention and attention to the educational means, and thus the teacher can address his existing weaknesses by integrating it. Between fun and learning.

1-7 Teacher teaching competencies

First: teacher preparation in light of globalization

The competency-based teacher preparation movement is one of the most prominent features of contemporary educational innovations, and the most common and popular in professional educational circles for teacher preparation. Interest in it has expanded until it has become a distinctive feature of most teacher preparation and training programs in most developed countries, and it has reached advanced stages in many of them. Competency-based programs are described as: a set of procedures that help the student/teacher during preparation to acquire the information, skills, and attitudes that research, scientific evidence, and experts have shown can contribute to preparing him to perform his role effectively.

The teacher's roles are always changing; Therefore, teacher preparation programs must always be reviewed to keep pace with changes and enable teachers to perform their expected roles, and the need to build teacher preparation systems in accordance with the requirements of the age of knowledge and technology, with the need to introduce new courses in informatics and methods of using modern technologies in learning within teacher preparation curricula.

Globalization:

What is meant by the challenges resulting from the elimination of borders between countries accompanied by the density of information and the flow of its production, and the means of its production and means of disseminating and benefiting from it depend on information and communications technology.

The educational process in the era of globalization and information

The era of globalization and information represents the societal shift brought about by information technology, which is the result of the fertile convergence of many scientific tributaries such as: the Knowledge Worker industry, the Information Content industry, the Information Processing industry, Information Technology, and Communication Systems.

The most important features of education in the age of globalization and information can be summarized as follows:

1. It is characterized by universality: it is education through connection to global information networks that have become bi-directional and allow interaction between the learner and information

sources. With technological advancement, it has become possible to use the Internet in the evaluation process efficiently. Hence, students should be trained on how to obtain knowledge, as information technology technologies will shape the procedural environment for learning, teaching, and curricula in the near future.

2. It is concerned with global culture: it is based on the openness of all countries to each other. Hence, the learner must know many countries of the other world while paying attention to his local culture.

3. Keeping pace with the flow of knowledge: As information is unstable and rapidly changing, it is necessary to review the contents of academic courses and work on renewing them on an ongoing basis.

4. It aims to benefit society and individuals: it is characterized by projects, problem solving, design, discovery and invention; It is an education that seeks to provide the individual with thinking skills and the ability to deal with contemporary changes. With attention to the emotional and moral aspects and giving the person the ability to realize himself and live a more advanced life.

5. It provides students with opportunities to research and investigate targeted information by communicating with local and international networks. Acquiring information is no longer a goal in itself, but what is more important is the ability to access original sources of information and use them to solve problems.

6. It adopts the principle of mastery, that is, self-mastery of information while benefiting from it in other situations. This principle is represented in dealing with the world of information space or virtual worlds.

7. Provides students with self-learning opportunities for topics that suit their needs and interests, whether at school or at home.

8. Provides students with opportunities for cooperative learning using computers or through an Internet connection. Hence, education seeks to develop positive thinking among the learner, and deepen the concept and trends of cooperation.

Education in the age of globalization and information

The teacher in the age of globalization and information is the link between the information age

and its technologies. He is a social pioneer who contributes to the development of society, developing his students' abilities for self-learning, breaking their habit of dependency, and encouraging them to have intellectual independence for greater imagination and creativity.

Therefore, the student/teacher should be trained through the content of his preparation program on the following:

Understanding: It means the individual's ability to know how and when he can use the principles and concepts that he possesses.

Logic: means deducing one idea from another idea.

Certainty: It means that any branch of knowledge in which the results are certain and final.

Accuracy: It means training in mental work that achieves accurate results.

Coding: It is the language of some sciences (such as mathematics) that is based on symbols

Creativity: It means reaching results in the easiest ways. Its manifestations include fluency, originality, and flexibility.

Realism: It means the possibility of using science to manage some daily life affairs.

Abstraction: means the process by which the mind organizes concepts. Its manifestations include perception, analysis, generalization, and synthesis.

Intuition: It means direct knowledge of things without mental debate.

Exchange of experiences: This means that the elements of human experience as a whole are interconnected and intertwined with each other.

In light of this, the important role of the courses included in the teacher preparation program in achieving the above becomes clear, as through them many strong foundations can be identified to activate the mathematics teacher's teaching performances in a way that contributes to managing his teaching behavior for the better. What should characterize the courses of the teacher preparation program in the age of globalization and information can be summarized as follows: -

Including computer and its software courses as a scientific or academic subject; Providing real opportunities for creativity, thinking, and talent discovery and development. Relying on the mental element; Compatibility of information evolution. The courses of the Mathematics Teacher Preparation Program in the Age of Globalization

and Information can be characterized by the spirit of the age of globalization and information. and that is through:

- The courses should be used to solve current problems and develop a vision for future problems, taking into account the importance of accessing the sources of knowledge itself.
- To give the individual flexibility in making decisions, speed of thinking, and geographical, social and intellectual mobility.
- To be concerned with the needs of society and the individual's personal demands
- To prepare the learner to complete his work on his own, and to know how to spend his free time in what benefits him, especially since indications of the near future indicate the scarcity of work in the era of globalization.

Features of the content of the teacher preparation program in the age of globalization and information

The content of the teacher preparation program can be described in seven features:

1. Educational features: The contributions of the program content include: providing the opportunity for the student/teacher to use and interact with

educational technology; Providing the student/teacher with the opportunity to apply information and experiences to life situations; Help the student/teacher to seek, find, organize and employ knowledge; The student/teacher gains the ability to select information and apply it to new situations; The student/teacher gains the ability to categorize the information they obtain; The student/teacher acquires the ability to analyze information and reach a conclusion; The student/teacher gains the ability to apply information to solve problems.

2. Educational features: It includes the contributions of the content to the development of values and positive attitudes among the student/teacher.

3. Administrative features: It includes the contributions of the program content to training the student to manage school activities.

4. Social features: The contributions of the program content include training the student/teacher to be a social pioneer who presents the culture of society to his students, and in consolidating cooperation with other social institutions.

5. Humanitarian features: It includes the contributions of the program's content to achieving

the call for the values of peace, tolerance and cooperation.

6. Informational features: Content inclusion Obtaining information through electronic sources.

7. Global features: The content helps students communicate with others at the local and global levels.

Content of the teacher preparation program and modern challenges

The content of the teacher preparation program in our contemporary world faces many challenges that require sincere efforts to confront them in a scientific manner that determines the type of those challenges and how to deal with them. Among these challenges are:

A- The technical challenge: The present era is called the era of information media, or what is called infomedia. The Internet has also revolutionized the world of communications and created a link between all innovations.

This technological development has been reflected in teacher preparation programs, and therefore training the teacher on this technology during his preparation stage makes him interested in

exercising his true roles as an organizer, planner, decision maker, coordinator of activities, and evaluator.

B - The information challenge: The current era is witnessing an unprecedented knowledge explosion that has led to the accumulation of knowledge in all fields of science, which has placed those in charge of preparing curricula with a challenge represented in designing academic curricula. There is no doubt that this challenge requires developing the content of teacher preparation programs so that the development includes curricula and methods. And calendar methods.

D- The challenge of globalization: The most important characteristic of globalization is that it is characterized by phenomena expressed by the technological revolution in the field of communication. One of the manifestations of globalization in the field of education is the growing global trend towards continuing education and open education.

Second: The global teacher

In any educational system, the teacher is the important element on whose efforts the education process is based. He is the true implementer of the

curriculum and the active element in the educational process, with the information, knowledge, and values that he transmits, and the abilities, attitudes, and skills that he develops.

The in-service teacher preparation and training programs and the role he plays as an essential element in the educational system should be reconsidered, so that programs are prepared through which the teacher acquires cognitive and professional skills and competencies that reflect positively on his teaching method, ensuring that we raise generations capable of facing the challenges of globalization. Examples of these competencies include: 1- Lesson preparation competencies (planning for teaching). 2- Lesson implementation competencies. 3- Human relations competencies. 4- Classroom management competencies.

In this regard, the teacher should be characterized by personal characteristics (physical, mental, emotional, behavioral, and social), and professional characteristics (professional and specialized growth, planning, organizing and implementing the lesson, evaluation methods, and use of technology and educational means).

Teacher preparation institutions should also work to:

Teacher preparation institutions should also work to:

* Availability of the knowledge base, which is extremely important. A teacher who does not have the appropriate knowledge base cannot teach and succeed in it, as the knowledge base in the field of specialization is pivotal in the teaching profession.
* Availability of technical skills. Teaching has become an art with its own skills and strategies, which must be available to the global teacher, who is a generation trained to live in the new century. Without these technical skills, the teacher cannot perform his role.
* The availability of classroom observations and field training for the student teacher before graduation, through which he can learn many things if they are conducted in a sound, systematic, scientific manner.
* Shifting from being recipients of information to sources of information to achieve self-fulfillment and relying on the educational information we have, and presenting our own distinct educational model for dealing with information, formulating it, analyzing its dimensions, and then disseminating it so that others can learn about it and benefit from it.

The emergence of the movement to individualize education also played an important role in the emergence of the approach to teacher preparation based on competencies, as the interest in individualizing education came as a result of several factors, most notably: - The spread of the idea of education for mastery. -Advances in educational technology. -Increasing interest in in-service training. - Criticism directed at traditional training programs because they neglect performance and motivation, which leads to a disconnect between what is learned and performance and practice in the real world and the field of work, which makes the learner feel a lack of his ability to perform.

By preparing the teacher in light of the competencies, it is possible to:

o Clearly defining the competencies required of the student/teacher in preparation programs to ensure that the teacher achieves them.

o Training the student/teacher on performance and practice, unlike what is known in traditional teacher preparation programs built on the basis of theoretical knowledge.

♣ Providing the preparation program with educational experiences in the form of specific competencies that help the teacher perform his new educational roles.

♣ Providing the preparation program with the standard by which teacher competencies will be determined.

♣ Defining the competencies that the teacher needs clearly and accurately, which makes the student/teacher more aware of their importance and meaning to him.

♣ Helping the student/teacher to view, observe and sense his or her progress in light of the criteria of a precisely defined acceptable level of performance.

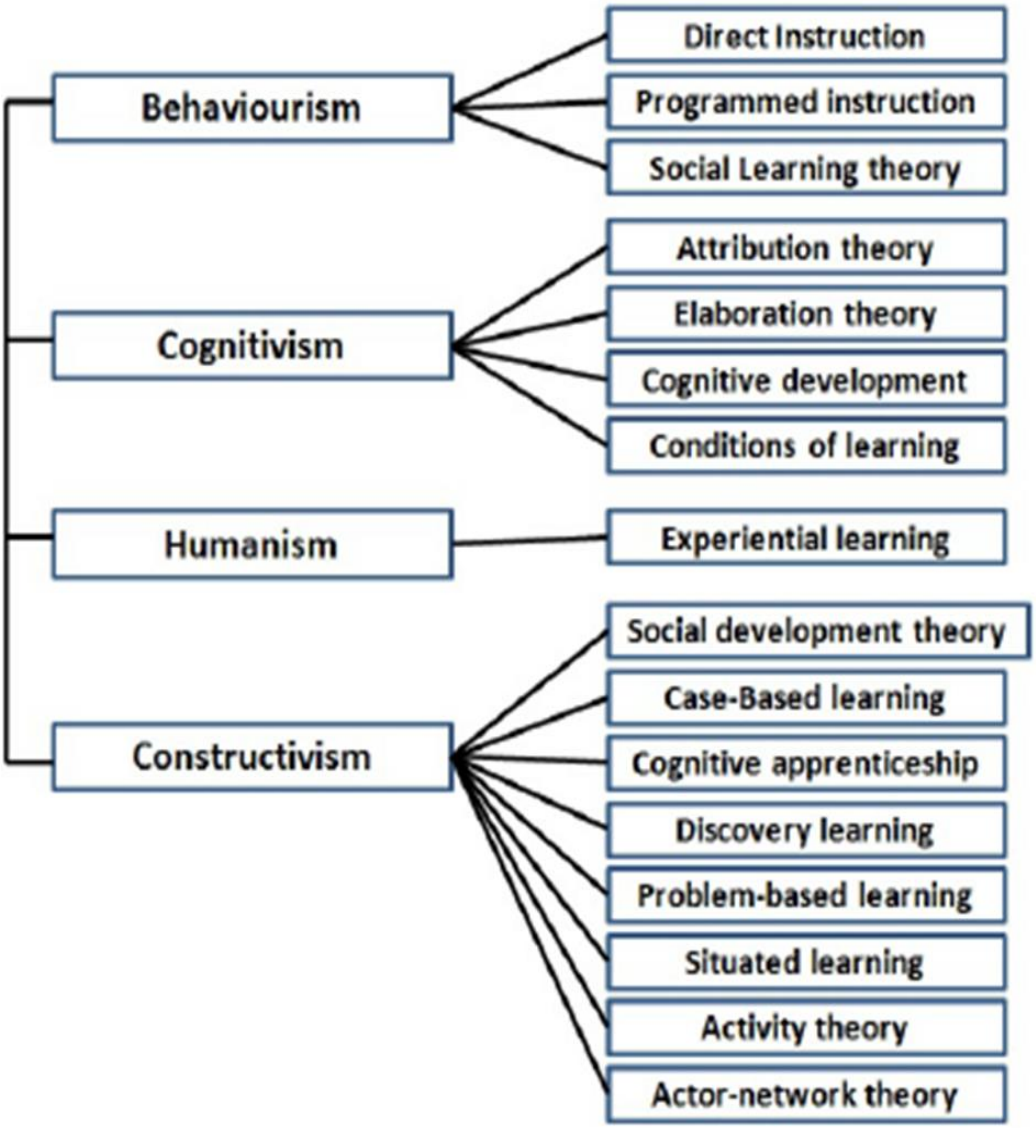
♣ Focusing on the student/teacher, which makes the "teacher teacher" - the supervisor - more interested in the individual competencies of each student/teacher, and more keen to provide opportunities to acquire them and demonstrate them in his future behavior.

♣ It makes training and evaluation programs and processes clearer, more specific, and more effective.

♣ Developing the idea of enhancing training, and providing the student/teacher with many diverse opportunities to achieve the prescribed competencies using the various means and methods available in training activities.

(2)
Theories of learning

2-1 Theories of teaching and learning mathematics



1. *Jerome Bruner's* theory

Bruner assumes that every individual can be taught any subject at adny age and that the environment surrounding him should be enriched so that the individual's energy can be developed and invested to the maximum extent possible, as the individual's thinking grows through his interaction with his environment. Every human being has

a special perception of seeing the world around him and interpreting this vision for himself. If the teacher understands the learner's way of imagining his world, he can teach him any subject.

Bruner gives the learner an active role in developing information and believes that the learner should be able to formulate his problems and search for alternative solutions instead of searching for only one answer. It is concerned with the personal way in which each individual develops his concept of himself and his world.

Therefore, he is interested in discovery learning and defines it as reorganizing and transforming data and evidence in order to reach beyond these available data and information and discover new data or information for the learner.

The goal of education, according to Bruner, is to transfer knowledge to the learner and also to develop a positive attitude toward learning in him, and to develop the learner's investigation and discovery skills in a way that allows him to interact positively with his social and physical environment and prepares him for mental growth.

♣ Organizing the content

Bruner believes that the content is organized so that the basic ideas are presented, including concepts, principles, and practical concrete representations, then representation with models and pictures, then with symbolic abstract representations. He believes that the content is organized according to the spiral organization of the curriculum.

♣ Presentation methods

Bruner believes that the way content is presented is considered to be three types:

1 - Tangible visual representation (with work and activity) Inactive Mode

It explains experiences through tangibles and actions, especially motor skills.

2 – Iconic Mode

It explains experiences through pictures, drawings, models or maps.

3 - Symbolic & Logical Representation

Where experiences are translated into language, which allows logical deduction to solve the problem.

The teacher can choose one or all of these stages when presenting the study material.

♣ Teaching process

Bruner is more concerned with investigative skills than with facts, as he believes that if the learner understands the structure of knowledge, this understanding allows him to advance on his own, and thus he relies on the method of discovery in teaching.

The discovery method has several sub-methods, including:

Inductive method - problem solving method - guided discovery - free discovery - open discovery - guided discovery.

2- *Robert Gagne's* theory

Robert Gagné established the principles of a theory of learning that serves as a model for education. Gagné assumed that every academic subject, every subject in this subject, or every part of this subject has a hierarchical structure, the top of which includes the most structured topics or parts, followed by the least structured, even the simplest, at the base of the hierarchical structure.

The topics of each level are considered a prerequisite for learning the topics that are most complex in the hierarchical cognitive structure.

In light of this assumption, *Gagné* believes that the learner is ready to learn a new topic when he can meet the prerequisites necessary to learn this topic. Thus, planning for education should be concerned with identifying and arranging the prerequisites necessary to learn each topic within the subject, as well as those necessary to learn the subject as a whole, and this depends on task analysis.

♣Organizing content

Gagné calls for organizing the content in a hierarchical order consisting of levels that begin with the most complex at the top of the pyramid and end at the base of the pyramid with the simplest. Each level includes tasks that have the same degree of complexity, and the tasks of each level are considered prerequisites for learning the tasks of the more complex level (as shown in the figure).

♣ Teaching process

When planning to teach a subject according to *Gagné's* theory, the subject to be taught is analyzed into tasks graduated from complex to simple according to a

hierarchical organization with the most complex task at its apex and the simplest at its base. At each level of the hierarchical organization, the expected performance of the learner is determined in the form of a target behavior. When implementing the lesson, we start with the base of the pyramid, that is, the simplest tasks and teach them to the learner, and when the learner comprehends the simplest level, he moves to the most complex level, which is what *Gagné* calls the vertical transfer of learning.

Thus, *Gagné* sees the use of the analytical method in organizing the content and planning the lesson, as it starts from the complex and ends with the simple, while he suggests the synthetic method in implementing the lesson, as he recommends teaching the simplest tasks and then gradually arriving at the most complex, which is the main task.

3- Jean Piaget's theory

The Swiss psychologist *Jean Piaget's* theory of cognitive development is based on the descriptive and analytical approach to mental development. An approach that mediates the psychometric approach and the cognitive approach in dealing with cognitive mental activity, and

he built it by observing his three children in their development.

In his theory, *Piaget* assumes that any individual can learn any subject provided that it suits the individual's stage of mental development. Any individual is born with a small amount of organic reflections and latent capabilities in the form of strategies, which are therefore an important element in the learner's cognitive construction.

Strategy - from *Piaget's* point of view - is the way through which the child can deal with environmental variables during the stages of his development in order for new interactions to occur between him and the environment. These strategies change according to the child's maturity and the experiences he gains.

Piaget discovered that children in their mental development go through specific stages, and the child's behavior and thinking in each of them are characterized by certain characteristics. Piaget points out that the stages of mental development are characterized by stability in their succession system in every child and in every culture. This does not mean that the time limits are

fixed, but rather they differ. Time limits from one child to another within the same culture.

Stages of mental development

Piaget divided the child's mental development into four main stages according to age groups:

1 - Sensory Motor Stage:

It extends from birth until the end of the second year, during which the newborn possesses a set of essentially innate and reflexive behavioral methods, such as sucking, grasping, and others. While interacting with the environment, the child develops certain behavioral patterns. He acquires simple sensory skills and coordination, as well as the ability to achieve coordination between the information issued by his various sensory organs.

The most important thing that distinguishes the child’s behavior in this period is that he faces things with random physical movements without thinking, and the existence of the thing for the child depends on his awareness of it.

2 - Pre-operational stage (symbolic thinking):

This stage begins in the second half of the second year of the child’s life until approximately the age of seven. At

this stage, the child begins to learn language, the symbolic representation of things, and the formation of simple ideas and mental images. The child's thinking gradually transforms from his kinetic image to the image of symbolic thinking.

3 - Concert Operational Stage:

This stage begins from the age of seven until approximately the age of eleven, meaning it takes the primary stage and the first years of middle school.

At this stage, the child begins to think similar to the thinking of an adult. Through social interaction, he begins to free himself from self-centeredness and takes into account the point of view of others.

The child's thinking shows the ability to do reversibility, that is, to go in reverse, where he can arrange things in reverse. The idea of constancy also appears for weight, number, and measurement. However, the child's thinking at this stage is concrete, tangible, and not abstract.

4 - Formal Operational Stage

This stage extends between eleven and fifteen years of age. The child enters the stage of adolescence and maturity, and at this stage the child's ability to think abstractly grows and he is able to address issues by

isolating variables and confirming some of them to verify the work of others.

Thus, through these stages, the newborn who came to this world and has no idea about it moves from a mere biological being to an adult who faces the world, interacts with it, and thinks logically about the problems of this world.

♣ Organizing the content

Piaget's theory is concerned with the vertical organization of the curriculum, as Piaget's stages of development extend from birth to the age of fifteen. Piaget proposes organizing the content of the curriculum for students at each stage of development according to the characteristics of mental and cognitive development for this stage.

For example, students in the primary stage (fourth and fifth grades) fall into the stage of concrete operations, and therefore the curriculum is built and organized in light of the child's thinking at this stage, especially in content, exercises, and exercises.

Teaching process:

Piaget's theory suggests taking into account the student's mental development and psychological characteristics,

especially the concepts of representation, adaptation, and internalization when presenting any new material.

Piaget divides the learning process into:

Representing the alignment of the introduction (of new knowledge into the learner's cognitive structure)

Piaget's theory also gives an important role for guidance, guidance, and emphasis on cognitive construction.

4- David Ausubel's theory

Ausubel's theory of meaning-based learning goes back to cognitive psychologist *David Ausubel*, who tried through this theory to explain how individuals learn spoken and read verbal material.

Ausubel believes that each academic subject has an organizational structure that distinguishes it from other subjects. In each structure, the most comprehensive and general ideas and concepts occupy the top position, then the less comprehensive and general ideas and concepts graduate below it, then the accurate detailed information.

The cognitive structure of any academic subject is formed in the learner's mind in the same order from the most comprehensive to the least comprehensive. Hence, *Ausubel* believes that there is a similarity between the structure of information processing in each subject and

the cognitive structure that is formed in the learner's mind from this subject.

Ausubel assumes that learning occurs if the academic material is organized along lines similar to those by which knowledge is organized in the learner's mind.

It is believed that the learner receives verbal information and links it to previously acquired knowledge and experiences. In this way, the new knowledge, in addition to the previous information, takes on a special meaning for him.

Ausubel presented a classification of learning into four types based on two dimensions:

The first dimension: the method of presenting information through reception or discovery.

The second dimension: The learner's way of linking new knowledge to his cognitive structure through understanding or memorization.

This is according to the following plan:

Providing knowledge

Reception, discovery

The learner's style of linking knowledge to understanding

Perceiving meaning * Receptive learning based on meaning: Meaningful Perception Learning

When knowledge is presented in a complete form to the learner, he connects his cognitive structure in an organized manner * Meaningful Discovery Learning

It occurs when the learner accesses knowledge himself and works to connect his cognitive structure in an organized way

Memorization * Learning by reception based on memorization: Rote

Perceptional Learning

It occurs when knowledge is presented in a comprehensive form to the learner and he memorizes it without linking it to his cognitive structure

* Discovery learning based on memorization: Rote Discovery Learning

It occurs when the learner arrives on his own but does not link it to his structure but rather memorizes it.

♣ Organizing the content

To achieve meaning-based learning, *Ausubel* suggests two principles for organizing content:

1 - Progressive differentiation.

2 - Integrative reconciliation.

The first principle means organizing the content of the study material from the most comprehensive concepts to the most detailed and specialized concepts.

The second principle means that new knowledge of a certain content is integrated and compatible with previous knowledge existing in the cognitive structure of the learner's mind.

♣ Teaching process

According to his theory, *Ausubel* proposes a specific strategy that uses Advancement Experience Organizers, which, according to *Ausubel*, is a comprehensive introductory introduction presented to the learner before learning new knowledge, and it is at a level of abstraction, generality, and comprehensiveness, and in terms that are familiar to the learner. So that it facilitates the inclusion of the new material in the learner's cognitive structure by linking the new ideas to be learned with the existing ideas in the learner's cognitive structure.

Advanced organizations are divided into two types:

1 - Explanatory Advanced Organizers:

This style is used where the material to be learned is completely new and unfamiliar to the learner, as it provides the learner with a conceptual structure about the learning topic so that it can be linked to the details of that topic.

2 - Comparative Advanced Organizers:

This style is used where the subject matter of learning is familiar to the learner. Among the characteristics of this style of advanced organizations is that:

- It helps the learner to find integration between new concepts and existing concepts in his cognitive structure.
- It helps the learner to distinguish between new ideas and existing ideas in his cognitive structure.

Thus, "*Ausubel*" sees the use of the synthetic method in the process of organizing content and the teaching process, as it starts from the general to the specific (from the simple to the complex), and thus it is noted that *Ausubel* sees the opposite of what "Jagnier" sees in organizing learning.


مقارنة بين
نظريات التعلم
تناسب وضعيات التعلم الآتية:
السلوكية
المعرفية
البنائية
المهام التي تستدعي مهارات التفكير الأولية كالتذكر والفهم والتطبيق.
حل المشكلات التي تتطلب مهارات التفكير المتقدمة كالفهم والتطبيق والتحليل والتقييم والإبداع.
حل المشكلات غير المحددة باستخدام مهارات التفكير المتقدمة كالفهم والتطبيق والتحليل والتقييم والإبداع.
دور المعلم
السلوكية
المعرفية
البنائية
يوجه المتعلمين إلى الجواب الصحيح من خلال وسائل واستراتيجيات مختلفة.
يتيح للمتعلمين وسائل الربط بين المعارف الجديدة وتلك المكتسبة لديهم.
يساعد المتعلمين في اكتشاف وضعيات التعلم والفهم الذاتي عبر طرح الأسئلة المناسبة.
دور المتعلم
السلوكية
المعرفية
البنائية
المتعلم سلبي يتلقى المعرفة ولايتفاعل إلا عند الاستجابة لمثير خارجي.
المتعلم نشط يقوم باستقبال وفهم ومعالجة وتخزين المعلومات واستدعائها عند الحاجة.
المتعلم عنصر فعال يبني تعلماته ويفسر مايستقبله من معلومات بناء على تجربته الشخصية.
كيف يحدث التعلم؟
السلوكية
المعرفية
البنائية
بالاستجابة لمثيرات تتغير أثناء الانتقال إلى وضعيات عامة أو جديدة.
باستدعاء المعلومات السابقة واستخدامها في وضعية مختلفة أو جديدة.
باستخدام المعارف السابقة في وضعية من سياق الحياة العامة.

2-2 Technological innovations

There are a number of factors that contributed to the use of technological innovations, which can be summarized as follows:

- The spread of the software industry in general, and educational and learning in particular, to develop teaching and training methods. The paper book is no longer the only source of knowledge, but rather technological innovations have become among the most important sources that help transfer knowledge to the largest number of learners in different places and at the same time.

- The rapid developments in the field of the computer industry, and the accompanying development in the production of programs and educational software to match this industrial and technical progress.

The spread of research, studies, seminars and scientific conferences related to computers and its software, which encouraged competition in the production process according to educational standards and foundations that seek universality and aim to computerize the educational process and individualize education.

- Introducing the computer into all stages of education at its various levels, which helped in the production and development of educational software by specialized bodies, institutions, and individuals.

- The development of means and methods of communication, especially electronic ones via the Internet, which facilitated the process of exchanging and transferring information in various ways characterized by ease and simplicity compared to typical traditional methods of communication, which helped to move towards interest in technological innovations and their production, and research and exploration for everything that is new in this field. .

The computer and educational software are among the most famous means, techniques, and technological

innovations used in the field of teaching mathematics for the various educational stages, especially in the primary stage, because it works to increase suspense, draw the attention and excite students because it contains pictures, drawings, colors, movement, sound, music and other effects. Which are used in means, techniques and technological innovations

The emergence of the computer was accompanied by new mathematics, and this has now found a special place in mathematics curricula at all different levels of education. Examples of mathematics include:

Principles of number theory, the concept of category, basic concepts of geometry, and some elementary algebra topics. Therefore, those responsible for developing mathematics curricula turned to paying attention to the basics, and treating mathematics around a group of mathematical structures or structures, as well as abandoning unnecessary details and complications. This means that the computer contributed to the introduction of new mathematics, and it was also the reason for deleting some old topics. Or process it in a new way.

Given the many benefits of using computers in teaching and learning, and until these benefits are identified, they can be classified into three types of benefits according to

their impact on the learner, the teacher, and the educational institution.

First: Benefits specific to the learner: Among the benefits specific to the learner are the following: It enables the student to be independent while learning individually. Taking into account individual differences among students. Choose the appropriate time and place for each student in the learning process.

Second: Special benefits for the teacher: Saving time for the teacher, which gives him the opportunity to present more in-depth topics. Providing time for the teacher gives him the opportunity to exchange opinions and viewpoints and interact between him and the students. The computer provides opportunities for the teacher to do research in order to develop curricula.

Third: Benefits for the educational institution: Solving the problem of the shortage of academically qualified teachers. Solving the problem of the shortage of educationally qualified teachers. Contributing to curriculum development.

One of the advantages of the computer in mathematics is that it helps:

- Training students to solve issues and problems and reach the solution in the shortest way.

- Training students to express ideas in an integrated system.
- Forming positive attitudes towards mathematics, which develops students' appreciation for it.
- Focus on concepts.

From the above, it can be concluded that the technological innovation is characterized in the educational environment in general; The classroom environment in particular has many advantages, the most important of which are:

- Simulating real-life environments, and providing a two-way communication environment that controls the barriers of the classroom and connects it to the world and the learner's environment.
- Enabling the learner to be self-reliant, developing his self-learning skills, making learning interactive learning, and ensuring that its impact remains.
- The technological innovation, including various stimuli, can contribute to attracting the learner's attention, making the material to be learned the focus of feeling, and overcoming the distractions that exist in the educational situation by appealing to more than one sense of the learner to activate his learning tasks.
- Providing an organized and safe environment as a requirement for effective education, and achieving the

principle of purposeful learning that makes the learner aware of what he is required to accomplish.

- Developing cooperative and collaborative skills, as the innovation provides interaction between the learner and others from the same class or in different classes through a link from the Internet.
- Applying the idea of appropriate learning by providing the user with the opportunity to access more information in more and easier ways - knowledge on demand.
- Promoting and developing education in the context of the modern world, and professional development for the learner and providing him with the basic and necessary teaching competencies in order to integrate into the world surrounding him.
- Achieving the principle of learning for mastery through the availability of clear expectations and specific criteria for what success in performing tasks looks like and detecting and treating the causes of delay or stumbling in learning.
- Reducing behavioral problems in the classroom by increasing the learner's motivation and positivity to learn, and the diversity of experiences that prepare him through information and actual practical practices.
- It enables the learner to improve his learning, by helping him encode stimuli, based on many learning

theories, including: Dual Coding Theory, which calls for the learning process to have a more lasting effect if the learned information is received through two different channels - hearing and sight. And simultaneously.

- Developing meta-cognitive skills. The innovative educational environment is a flexible environment that presents educational content at several graded levels - from simple to complex, from easy to difficult, from the whole to the part, from the concrete to the abstract. This requires the learner to be able to make decisions and self-evaluate. For himself, managing and controlling himself, which helps the learner build his learning, knowledge, and mental model.
- Increasing individual interaction, reducing the fear factor of experimentation, developing a love of curiosity, innovation, and teamwork, and increasing the individual's awareness of critical sorting and selection, and choosing in accordance with his value framework.
- Redeveloping the concept of study through effective practical training and good practice to link training, productivity and the labor market instead of training before production, and then achieving the principle of active learning that takes place through work and not just observation, and positive participation instead of passive viewing in learning.

Examples of employing technological innovations in mathematics include word processing software in preparing educational content for mathematics at all levels. Through this software, it is also possible to insert images, drawings, tables, and animated films, and it provides different types and sizes of lines and geometric shapes. It also provides formats Many pages, paragraphs and headings.

Drawing software is used to design, color, and animate the illustrations needed for educational activities and materials, while Photo software is used to edit, redesign, color, and produce images, and Presentation software is used to prepare explanations for the various educational content units in a way. Interesting and fun, it helps students focus and follow up most of the time the student spends learning. Programs are also used to prepare automated exams for various curricula and design educational websites on the Internet.

The computer can be used as a means of controlling various educational media to link various audio-visual devices, such as data display devices, video devices, and cassette recorders, as the teacher stores in his program the scenario required to present the lesson material, so that the computer plays the role of the maestro in

organizing the rhythm and distributing the roles to the media. Different types of educational material

There are modern roles for mathematics teachers in light of educational website technology that differ from traditional roles, the most important of which are: employing e-mail to update education in the field of mathematics, explaining through educational websites, and developing students' self-learning of mathematics by dealing with educational websites easily and conveniently, and creating the educational programs necessary for learning. Mathematics, and cooperating with mathematics teachers in designing new websites that attract students' attention, are interesting and easy to use, and are used as electronic educational websites, and plan lessons that are published online to prevent and treat students' errors and then implement them, and Organizing group discussions from time to time to identify the difficulties that students face when studying the course through online educational sites, adapting educational mathematics programs to publish them on the online educational site, and encouraging students' motivation to search and investigate knowledge and information related to mathematics through the Internet to enrich their learning. And cooperate with mathematics

teachers in designing mathematics lessons in a manner appropriate to the nature of educational sites.

2-3 Hypermedia for engaging educational design

In light of the various technologies and the tremendous technological development, educational experts are looking for alternative means to textbooks and traditional classroom lessons in order for students to obtain information and receive knowledge in an attractive way that helps them catch up with the global trend. Here, hypermedia emerges as an attractive interactive means, by which we mean the interconnection of information elements with each other in a non-linear manner that helps enrich the student's information and increases his motivation, and through it, data is transformed into information, and information into knowledge.

1- What is hypermedia or hypermedia?

Hypermedia can be defined as “an educational software environment that helps link information elements in a non-linear form, which helps the learner to browse it, flip through its elements, and control its display to interact with it in a way that achieves his educational goals and meets the learner’s needs.”

It can be said that it is the complete “information” available for a group of multiple educational media that are mutually invested in an organized manner in the educational situation, which includes graphs, pictures, audio and music recordings, still and moving video scenes, maps, tables, symbols, and animation, all within an informational textual framework that helps in gaining experience. , All of this is within an informational text framework that helps to gain experience, and here all or most of these media are integrated with each other via the computer with a system that ensures that the learner

controls the speed, path, and information and its sequence according to his own capabilities.

It is also defined as "a program for organizing and storing information in a non-sequential manner. It is also considered a method of providing individual learning in various frameworks that helps increase the learner's motivation through immediate feedback and increases his ability to control the learning process."

2- Properties of hypermedia

– It is an educational environment used to design educational computer programs.

- Includes all information elements.
- It works to link all information elements.
- The student uses it to control and interact with it.
- It gives the student the freedom to move between information elements, using interconnections according to his educational goals and his own needs, and thus provides him with individuality.

– Hypertexts are part of hypermedia. Hyperlink connections are available in both.

3- Components of hypermedia

These are the information elements that make up hyper-interconnected media and include:

A - Written text: It is the simplest form of media elements, where the text is processed with various effects in terms of font type, size, color, movement, etc.

B - Drawings of all kinds: including graphs, illustrative, schematic, and others, whether static or animated.

C- Image: It includes still, moving, and three-dimensional images. The use of digital images helps clarify components with accuracy and high quality, and provides a high level of clarification of the text. Some devices are used to scan or convert a paper image into a digitally processed image.

D- Sound effects: include natural and artificial sounds and music.

4- Hypermedia preparation tools

Many devices and tools are required to produce super-interlaced media, including the following:

- Computer: It must be updated with the latest versions, have high speed, and contain multimedia equipment such as sound cards, photos, videos, Internet connections, etc.

– Computer accessories: such as keyboard, DVD and CD player, scanner, printer, etc.

-Video devices of various types.

– Digital audio equipment for audio input and display.

5- Advantages of these media

Hypermedia is characterized by:

- Consume large pieces of information.
- Takes into account the needs of learners.
– It is adjustable and interchangeable and does not have a permanent shape.
- It allows the student to acquire an appropriate amount of information at the time he specifies.
- Develops creative thinking.
- Contributes to the flexibility of the curriculum.
– Attracts students' attention and increases understanding and achievement.
- Increase the use of dialogue and interaction with programs.
- Makes education more effective.
- It solves some educational problems such as dropouts and boredom.
- It helps in training self-learning and self-reliance.

6- The educational importance of hypermedia

The educational importance of hypermedia is evident in that it:

- It contributes to achieving many learning goals.
- It helps to acquire knowledge and concepts that require the ability to think abstractly to comprehend.

- It develops some of the learner's skills and improves his attitudes towards using computer systems in educational situations.
- Directs the learner and motivates him towards individual learning.
- The auditory learning process proceeds and helps the learner understand the structural structure of types of knowledge.
- It helps the learner to delve into the design and development of educational courses.

7- Factors of teaching with hypermedia

Which:

1- The learner: It depends on the learner's absorptive abilities, learning skills, and study objectives.

2- Learning tasks: Learning tasks must be clear and contain problem solving and innovative thinking.

3- Learning content: It must have a logical and clear structure.

4- Learning activities.

8- Hypermedia design programs and applications

Hypermedia can be designed using tools such as:

– Adobe Flash.

– Adobe Director.

– Macromedia Otherware.

-Machoir Media.

– Some devices that support SAG specifications, such as the iPhone.

– Any HTML editor can be used to create files that can be accessed via any Internet browser. The Hyper Publish application is considered one of the latest applications for designing educational content using hypermedia.

Question: Explain with examples how you, as a teacher, can benefit from hypermedia in teaching mathematics?

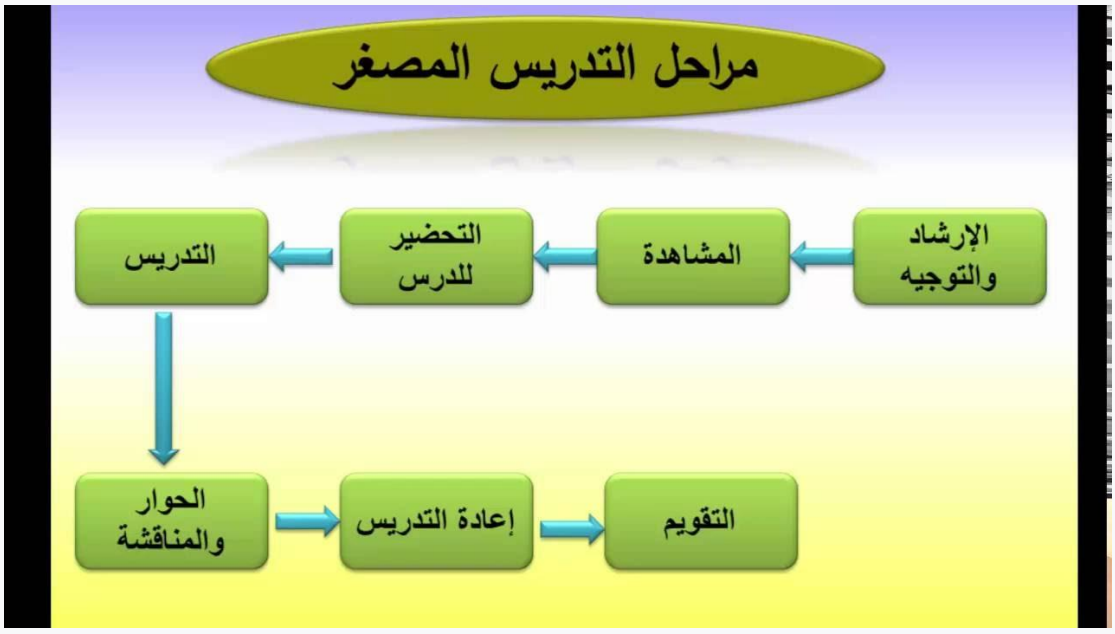
2-4 Microteaching and Teaching skills

Microteaching is known as one of the training methods that targets teachers. Through its application, it seeks to train and teach them the skills and academic qualifications they need to raise their efficiency in teaching, by providing the trainee teacher with the opportunity to teach a class consisting of a small group of learners. Who represent his fellow trainee teachers, for a short period of time, during which the teacher's

performance is filmed with a video camera, to be evaluated later, and given feedback on his performance.

It is a process that includes many elements that interact with each other to simplify complexities, transfer experiences, clarify tasks, and complete work, which is represented by a certain number of adult students, who may be called (student teachers), considering what will be. Their number ranges from 9-10 students. A specific time limit of no more than ten minutes in the classroom. The teacher must have feedback. These elements are what distinguish microteaching from general teaching.

Microteaching steps



• Choosing the lesson topic: The first step in applying the micro-teaching method is for the trainee teacher, in agreement with the training supervisor, to choose the lesson topic or skill that the trainee teacher will teach to the group of learners.

• Developing a teaching plan: In the second step, the trainee teacher develops the plan that he will follow in teaching, then presents it to his colleagues and the training supervisor, to benefit from their opinions and suggestions regarding its details, and regarding the standards and foundations that the trainee teacher must adhere to.

• Starting and documenting teaching: In the third step of applying the micro-teaching method, the trainee teacher begins teaching what he has prepared for, to a group of his fellow trainee teachers, and he must commit to a specific and short period of time to do so, and while the trainee teacher is teaching, one of the individuals takes charge of Those in the classroom are tasked with documenting the lesson, and the trainee teacher's interactions with colleagues who play the role of learners, using a video camera.

• Evaluating the trainee teacher’s performance: After the trainee teacher has finished teaching, the fourth step comes, in which the teaching video is shown, and the

supervisor, trainee teacher, and colleagues analyze and evaluate the trainee teacher's performance, and give him useful feedback.

• Re-teaching: In the fifth and final step, after the end of the analysis and evaluation, the trainee teacher repeats the lesson again based on the feedback directed to him from the other teachers and the supervisor. This ensures that he benefits from it to the maximum extent, and that he benefits from the training process as a whole in raising his competence and qualifications.

Objectives of microteaching

• Simplifying, facilitating and transferring experiences from teacher to learner.

• Preparing the teacher to adapt to all climates and deal with all problems.

• Creating teachers who are sufficiently skilled in all aspects of cognitive, affective, skillful, experiential, etc..

• Controlling behavior, given that learning is a semi-permanent change in behavior. Either by acquiring a new behavior, abandoning an old behavior, or modifying a behavior.

The importance of microteaching

• Providing teachers with the opportunity to learn about modern teaching strategies and methods, which helps them develop their teaching methods and make them more effective.

• Developing teachers' skills in developing plans and organizing the teaching process; Which reflects positively on the educational process.

• Taking advantage of the observations of supervisors and other teachers, which help in seeing things from different perspectives, which the trainee teacher may not be paying attention to, and benefiting from them.

• Increasing teachers' self-confidence, and allowing them to gradually teach difficult topics, until they eventually master them and they no longer represent a problem or obstacle for them.

Microteaching skills

These goals are implemented through a set of skills, including:

• Preparation skill.

• Classroom management skill.

• Time management skill.

• The skill of formulating questions.

• Explanation skill.

• Skill in using the blackboard.
• Enhancement skill.
• Closing skill.

Teaching skills is defined as a set of teacher behaviors which are especially effective in bringing about desired changes in pupil-teachers.

1- Skill of writing objectives

2-Organizing the content

3-Skill of Using Blackboard

4-Skill of Reinforcement

5-Skill of Pacing Lesson

6-Skill the Use of Higher order Questions

7-Divergent questions

8-Response management

9-Explaining

10-Illustrating with examples

11-Using teaching aids

12- Stimulus variation

13- Closure Skill

Skill of writing objectives involves the following activities identifying objectives, analyzing the task and writing objectives in behavioral terms with regard to adequate

Organizing the content involve logical organization according to content and psychological organization as per need of the pupil.

Skill of Using Blackboard requires legibility, neatness appropriateness continuity Simplicity of blackboard work. It is very essential skill for a successful teacher. The effectiveness of presentation depends upon the proper use of blackboard.

Skill of Reinforcement involves a number of activities that a teacher performs for creating and maintaining conducive environment for learning in the classroom.

Skill of Reinforcement involves teacher encouraging pupils response using verbal praise , accepting their responses or non-verbal causes like a smile.

Skill of Pacing Lesson means variation in the teaching Speed

Skill the Use of Higher order Questions involves the questions which can be answered by memory or Sensory description. The questions consist of rules, principles and generalization.

Divergent questions requires the respondent to organize elements into new pattern, predict, and infer from the situation. This skill involves higher order of thinking creativity.

Response management is by using techniques like prompting, eliciting further information, refocusing and asking critical awareness questions, accepting -rejecting, and redirection.

Explaining involve Clarity, continuity, relevance to the content using beginning and concluding statements, covering essential points.

An skill of explaining is a set of interrelated statements made by teacher in order to increase the understanding in the pupils about ideas and concepts.

Illustrating with examples involve Covering essential points. Simple, interesting and relevant to the point being explained.

Using teaching aids Relevant to content, appropriate to the pupil's level, proper display and appropriate use.

Stimulus variation involves Body movements, gestures, change in into- nation and pitch, change in interaction pattern and pausing.

The skill Stimulus variation involves deliberate changing of various attentions producing behavior by teacher in order to keep pupils attentive at high level.

In Silence and non-verbal cause Skill we use silence in order to encourage pupil-participation in classroom teaching.

In closure Skill the pupils are able to related new knowledge with previous one.

achieving closure of the lesson include Summarization, establishing link between the present learning with earlier as well as future learning, creating a sense of achievement in pupils.

Types of micro-teaching

• Continuous microteaching: This type of microteaching is included in teacher training programs, and the teacher's involvement in it begins from the early stages of the training program, and continues until he graduates from it.

• In-service/work micro-teaching: This micro-teaching is for teachers who work in schools and practice the teaching profession, in which they are retrained in skills they were previously trained in, or trained in new skills in which they were not previously trained.

• Early microteaching: This microteaching takes place before the teacher graduates, or officially practices the teaching profession; That is, while studying.

• General microteaching: This microteaching does not adhere to the requirements or specificity of any subject, student differences, or even the teacher's specialization, and teachers are trained in the general skills they need, regardless of the differences they may encounter in the educational process.

• Directed microteaching: The supervisor applies a teaching model to the trainee teachers, so that they follow his approach.

• Free microteaching: This type of microteaching is the opposite of directed microteaching, in which the teacher is not obligated to a specific model to follow.

• Summative microteaching: The trainee teacher engages in summative microteaching when he reaches the final semester or year of the training program in which he is enrolled.

How do we teach mathematics?

The answer to this question may seem easy and simple, but in reality it is complex. Teaching mathematics - as we know - aims to develop the student's personality and achieve a number of goals, and the methods used to achieve this differ depending on the educational situation. It is a multifaceted situation that depends on the nature of the circumstances surrounding it. Therefore, the method that is used successfully in one concept or theorem may not succeed or fulfill the purpose if it is

used in another concept or theorem, and the successful or skilled teacher is the one who can recognize the nature of these situations and choose teaching methods in a way that is consistent with them.

The goal of correct teaching is to provide the student with mathematical information that can have a practical impact on his personality, and no mathematical knowledge can have such an impact unless the concepts that comprise it are arranged in a manner consistent with the goal it aims to achieve.

In general, the art of teaching is not only the teacher's knowledge of the subject he teaches, but in addition to that, the experience and teaching methods that he acquired and developed on certain foundations and components are considered important and necessary. But is teaching a science or an art?

Before answering this question, we must define both the concepts of science and art... Science, in its general sense, is represented by facts... laws... and theories... which the human mind arrived at through thinking, research, deduction, analysis, and synthesis, and thus used them during his life in... various fields. By art here we mean all the skills and experiences that an individual has acquired through practice and preparation.

Mathematics is a science in itself because it consists of a set of facts, theories, and generalizations reached by the human mind by research, thinking, and conclusion.

Classification of teaching methods

Teaching methods have preoccupied the minds of educators and teachers throughout different ages and are still preoccupied, as what is suitable for one stage of study in relation to a particular teaching method may not be suitable for another stage, and what is suitable in one time may not be suitable in another time, just as what is suitable for a certain type of learning is not suitable. For another type of education, the teaching methods that are appropriate to follow even in one type of education and in one division of different grades may not be appropriate for another division due to certain circumstances and considerations.

In addition, each teaching method has its supporters and supporters on the one hand, and its opponents and opponents on the other hand. Our statement is supported by the diversity of teaching methods, methods and techniques, and the multiplicity of their classification and tabulation. Some educators are those who try to classify them:

First - according to the type of materials: It includes the following types:

1- Special teaching method:

It is the method that can be used in a specific subject or subject and is based on the quality, nature and circumstances of that subject or subject and the preparation, supplies and means of explanation it requires. Therefore, the method of teaching geometry, for example, is not suitable or suitable for teaching algebra.

2- General teaching method:

It is a method that can be applied in teaching many or different subjects, meaning that it is commonly used in teaching more than one subject, such as the method of reciting and memorizing, and the method of lecturing or recitation, which can be used in most academic subjects, whether theoretical or scientific.

Secondly - according to the axis of the method:

It includes the following:

1- Teacher-centred methods:

2- Methods that depend on cooperation between the teacher and the student.

It is classified according to the degree of stimulating learning effectiveness, and it includes:

1- Traditional triticale methods.

2- Modern teaching methods.

Accordingly, the teaching methods that we will focus on in teaching mathematics are:

1. The introductory method.
2. Method of conclusion.
3. Induction method.
4. Discovery method.
5. Method of solving problems.
6. Cooperative education.
7. Indirect proof method.
8. Discussion method.

(3)
Teaching Strategies

3-1 Teaching Strategies

Teaching strategy, teaching method and teaching style

The difference between strategy, method and method

First: The strategy includes all aspects of the educational process, including goals, methods, technical means or aids, and evaluating the results of the educational process

The strategy is selected according to certain variables and thus guides the selection of the appropriate method, which in turn determines the optimal teaching method, which is selected according to certain factors.

Second: The method is a set of tools, means and procedures that the teacher follows, and it is also the procedures that the teacher follows to help students achieve educational goals.

The method is a general pattern that the teacher adopts in a specific educational situation, and he can choose another pattern if the educational situation changes or if a new educational situation arises.

Examples of teaching methods:

- Lecture method
- Discussion method
- Project method
- Solve problems
- Tell stories
- Self-education method
- Method of class questions
- Mastery learning method

Third: Teaching style

While the teaching method differs from the teaching method, the teaching method is general and broad; Where a number of teachers can participate in following one teaching method, but the teaching method is special and distinct or differs from one teacher to another. It is a

special and distinctive feature of the teacher's person and is not shared with other teachers.

Teaching styles are very diverse, including:

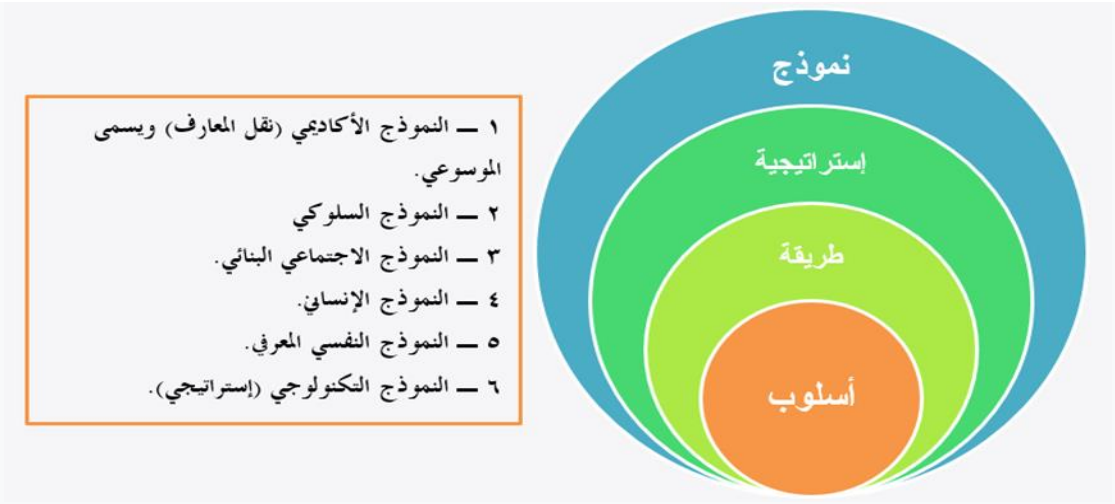
1- Direct teaching method, which is based on several of the teacher's personal ideas and opinions, where the teacher criticizes the student's behavior and directs his behavior.

2- Indirect teaching method, where the teacher directs the students and encourages them by involving them in the learning and teaching process. This method is used in the process of individual learning and self-learning.

3- Teaching method that is based on feedback and determining the student's level.

4- The teaching method is based on criticism and praise, which is the use of punishment and reward.

5- The teaching method that clarifies the presentation or presentation, which boils down to explaining the academic material



Fourth: Teaching model

A model is defined as a framework that summarizes a set of quantitative or qualitative logical relationships that define the main features of the reality of interest.

Fifth: teaching approach:

The teaching approach represents the general intellectual framework behind which any teaching method lies. Because each of these methods is based on specific theoretical foundations and principles, this necessarily means multiple approaches to teaching. There is the exploratory approach to teaching, the integrative approach to teaching, the social, environmental, and technical approaches to many other teaching approaches. Although they are related, overlapping, and close concepts, the difference between them can be summarized in that the teaching strategy is more

comprehensive than the method, and the method is broader than method.

In light of the teaching strategy, the teacher chooses the appropriate method, which in turn determines the optimal teaching method for the learner to follow.

The strategy, then, is a general plan for teaching, while the teaching method is closer to being a means of communication in order to reach specific, pre-arranged goals, while the method is how the teacher approaches the teaching method.

Teaching strategy, teaching method and teaching style

It is a context of teaching methods, methods, and classroom activation techniques that change according to several criteria, perhaps the most important of which is the teaching situation.

It is the teacher's style in the way he teaches the subjects to achieve the desired educational goals. It is also the means, tools and procedures that he uses to assist him in his task. It is also the general atmosphere inside the classroom that helps to reach - in an organized and sequential manner - acceptable educational outcomes in light of the available capabilities.

It is all of the above, but in short, it is the advance planning and plan that the teacher follows to achieve an educational goal.

Although they are related, overlapping, and close concepts, the difference between them can be summarized in that the teaching strategy is more comprehensive than the method, and the method is broader than method.

The strategy is a general plan for teaching, while the teaching method is closer to being a means of communication in order to reach specific, pre-arranged goals, while the method is how the teacher approaches the teaching method.

No matter how diverse and diverse modern teaching strategies are, the quality and nature of the educational session, its purpose and content, the level of the learners, and the specificity of each classroom environment remain the determinant of which strategy we use. This is, of course, up to the teacher as long as he is most familiar with the requirements of his classroom.

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1-Brainstorming strategy:

It is also called brainstorming, and it is intended to put the mind in a state of excitement in order to think in all directions and possibilities to reach - in an atmosphere of freedom - the largest possible number of ideas and opinions on a specific problem or topic, followed by the stage of collecting and discussing proposals.

The most important goals of teaching using this method are:

- Make the learner active and effective in educational situations.
- Teach students to respect different opinions and appreciate others.
- Accustom students to respecting different opinions and appreciating others.

- Benefiting from other people's ideas and information.

2-Modeling learning strategy:

It is also called social learning, which is the individual's acquisition and learning of new behavioral responses and patterns within a social context or situation through observation and attention (such as a child learning a language through listening and imitation).

3-Teamwork strategy/ Cooperative Learning

It is also called cooperative learning, and it manifests itself in dividing learners into small groups, often consisting of 3 to 4 members. They are given specific duties (common goals) and they must rely on cooperation (exchange of knowledge and skills) in order to accomplish the task required of them.

Among its most important goals are:

- Relying on active learning.
- Exchanging ideas (dialogical method) and encouraging acceptance of others' ideas.
- Developing the spirit of responsibility and cooperation among learners.
- Building positive relationships between learners (respect for others).
- Encouraging self-learning.
- Practice problem solving and decision making.
- Adopting active learning.

4-Discussion strategy

It is an ancient method attributed to the philosopher Socrates, who used it to guide and encourage his students. It can be considered as a development of the rhetorical method through the use of discussion in the form of questions that arouse learners' motivation.

This strategy depends on pushing students to think, discuss, express opinions, ask questions and provide answers, and involve them in preparing the lesson, paying attention to research, collecting information and analyzing it, following the main steps:

- preparation.
- Discussion.
- Calendar.

5-Hot seat strategy:

It is a strategy based on asking questions to a specific student, with the aim of developing several skills, the most important of which are constructing questions, exchanging ideas, and reading.

It is one of the most important steps of the hot seat strategy

Place chairs or tables in a circle, and place the "hot chair" in the center of the classroom.

The stage of asking questions related to the lesson topic after it has been determined by the teacher (who plays the role of activator)

6-Numbered heads strategy:

It is a form of cooperative teamwork, and is manifested in:

- Divide students into groups of 4 members. Each member bears a number from 1 to 4.
- Asking a question or clarifying the task to be accomplished.
- Members of each group collaborate to find solutions.

What is active learning: its importance, foundations, strategies, and advantages

Almost all educational actors are certain that teaching strategies and methods that seek to involve the learner in his learning are the most effective, and that they create

real learning, unlike their traditional counterparts, whose critics increase day after day.

In general, we cannot be certain that traditional education methods have become obsolete or unhelpful, nor can they be underestimated in any way. Indeed, it may be minor, but the time to put it aside on the shelf has not yet come.

7-Reciprocal teaching strategy

This teaching strategy also depends on:

- Interest in thinking and mental processes.

– Linking students' new information to their tribal gains.

- Observation, planning and evaluation.

While the reciprocal teaching strategy is conducted as follows:

– Summary.

– Generate questions.

- Clarification.

8-Educational bag strategy

They are also called educational packages. It is an educational unit (an integrated, well-organized structure) that directs the learner's activity by adopting self-learning and providing individual learning opportunities. It includes various educational and cognitive materials

that take into account individual differences, reinforced with pre- and post-tests, and various educational activities and means that help in downloading the school curricula.

9-Discovery learning strategy

This strategy calls for the use of logical thinking (inductive or deductive) and encourages critical mental thinking that is far from myths and assumptions, addressing higher mental levels such as analysis and synthesis. This strategy seeks to put the learner at the heart of the educational process and increase his motivation.

10-Conceptual mapping strategy

It is a teaching strategy that uses shapes, lines, pictures, arrows, colors, and language (linking words) to represent knowledge and provide information. It can be invested in deepening understanding, summarizing information, and deducing relationships between concepts.

11-Listening triangle strategy

It is another form of working in groups or cooperative work, and it is done by dividing students into groups of 3 members, with each student having a specific role:

The first student: He is the speaker. His task is to explain the required lesson, question, concept, idea, or task...

-The second student: He is a good listener, and his role is to clarify the idea/task by asking questions to the first student/speaker.

-The third student: He is the observing observer, and his role is to provide feedback to his two colleagues in the group, benefiting from the notes that he took during the discussion among the team members.

12-E-learning strategy

It can be defined as: "an educational system that relies on interactive information and communications technology such as (the Internet, television channels, e-mail, computers, teleconferencing...) in providing educational or training programs to students or trainees at any time and in any place, using a synchronous or "Not synchronized."

It is a modern method of education, in which modern technologies and communication mechanisms are used to support the educational and training process to raise the quality of operations and share information. E-learning is an integrated system of virtual courses and classes that

are presented through the electronic portal, and extends beyond the management of education processes.

E-learning and learning management systems

Learning management systems are one of the requirements for e-learning, and they emerged as a result of the urgent need to organize electronic educational content and manage the educational process, in addition to following up on students and trainees and preparing the necessary reports and tests.

LMS is an abbreviation for Learning Management System. It is a software program designed to help manage, monitor and evaluate training, continuing education and all learning activities in various educational and training facilities. Interaction with trainees also enables discussion of topics, virtual meetings, and forums.

Types of e-learning

• Synchronous education: Education at a specific and scheduled time, regardless of geographical distance, as the trainer communicates with the trainees at the same time through virtual classes.

• Asynchronous learning: Asynchronous learning means that the trainee chooses the appropriate time for learning as there are no scheduled dates. He learns through the

learning management system and studies interactive materials and has the freedom to choose the appropriate time and place for him.

13-Think-Pair-Share strategy(TPS)

The strategy can be summarized in:

-Think and write.

-Discuss with your colleague.

–Share with your group and then your class.

14-K.W.L. strategy

A strategy based on 3 basic axes:

What I already know (previous acquisitions and experiences) is an extremely important step in understanding the new subject and accomplishing tasks. The learner is invited to know his potential so that he can invest it in the best way.

– What I want to Learn? This is the stage of determining the task expected to be accomplished or the problem that must be solved...

– What I Learned What have I already learned? This is the stage of evaluating the knowledge, tasks and activities previously discussed, and knowing the extent to which the set goals have been achieved. It is also a stage

for acquiring correct concepts and correcting wrong representations...

15- Gamification in education

Gamification in education is an educational approach to motivating students to learn using game elements in learning environments, with the aim of maximizing enjoyment and engagement by attracting learners' interest to continue learning. In the educational context, gamification can influence student behavior by motivating him to attend class with greater desire and enthusiasm, focusing on useful educational tasks and taking initiative.

Gamification in education can be achieved through several means and techniques, including:

• Add points to assignments and assignments

• Determine badges and award them to outstanding students after meeting specific criteria
• Creating a ranking list for outstanding students
• Set levels for repeating tasks or performing more difficult tasks
• Linking the obtained badges to entry into higher levels

Benefits of gamification in education

Among the benefits of gamification in education that make initiatives to implement it successful in classrooms are the following:

• Giving students complete freedom to own their learning
• Motivate them for continuous self-learning
• Giving the opportunity to learn using virtual characters
• Expanding the margin of freedom to make mistakes and try again without any negative repercussions
• Multiply opportunities to increase fun and joy in the classroom
• Learning through different educational methods
• Linking education to real life and practical application
• Providing an appropriate and unlimited range of tasks for students
• Inspiring students to discover their own motivations towards learning.

16- STEM- learning

It is defined as: a curriculum based on a structural unit that combines: (science, technology, engineering, arts, and mathematics) for fifth-grade female students, so that the content is addressed in an integrated manner from different aspects.

One of the goals of the STEAM approach is to focus on practical application and linking learning to life. Through this, all students can benefit from the STEAM program by developing students' skills of investigation, dialogue, critical and creative thinking, and it promotes true innovation that results from the merging of the mind of the scientist and technician with the mind of the artist and designer. It contributes to improving students' achievement in science and mathematics and increasing their inclinations towards them. Acquiring life skills and ecosystem concepts, as well as the educational curricula, activities and teaching strategies based on education according to the STEAM approach, which relies on the innovative modern scientific method, which helps students perceive and understand the educational material in an interactive manner that is integrated with the environment, to form in the learner modern qualitative skills related to his life activities.

The STEM approach constitutes the integrated multidisciplinary cognitive structure in which students combine mathematics, engineering, science, arts, and technology with some other disciplines in modern content in which the educational and learning process is practiced in a practical manner through experimentation, investigation, and designing innovative projects.

Steps to explain a lesson according to the STEM approach

The STEM approach is based on integration between: (sciencSe, technology, engineering, arts, and mathematics), which are the five basic pillars of the STEM approach and must be employed in an integrated manner. This can be applied in a practical and easy way through the following steps:

1. Brainstorming: In this step, the teacher brainstorms many ideas, topics, and areas that he can focus on within the subject to be taught comprehensively. Then he creates a list of ideas that he wants to implement and determines where each idea is in science, technology, engineering, arts, and mathematics, and then chooses The idea that employs the five themes together. At some stages of the lessons, students may participate in brainstorming and selecting topics.

2. Verification: In this step, the teacher verifies the ideas and their relevance to the main topic. He may seek the help of teachers from different specializations to improve the idea and the method of implementing it.

3. Application: It applies the five pillars of the STEM curriculum, which are science, technology, engineering, arts, and mathematics. It identifies which ones you can bring into the lesson in a meaningful and relevant way. Not all lessons will include all four pillars together, but it is possible to achieve a STEM goal by relying on two pillars.

4. Implementation: The teacher implements his lessons and may discover some mistakes and must be prepared to discover new things as well. The role of the teacher is to assist and facilitate the educational process.

5. Feedback: In this step, the teacher thinks about what he succeeded in and what he did not succeed after each lesson, determines the best methods for his students, anticipates what can be accomplished at the appropriate time, and understands what attracted his students' interest and stimulates their motivation to learn.

17- Enjoyable learning:

Enjoyable learning is not only learning with humor and fun, but it is more comprehensive than that, as it is based

on the fact that no person is 100% auditory, 100% kinesthetic, or 100% visual. Rather, a single individual combines all of these senses, but to varying degrees, and whenever Learning saturates all of these senses, the more attractive and interesting it is, and this is confirmed by the connectionist theory, behavioral theory, and constructivist theory of learning.

Enjoyable learning is a comprehensive approach to education that aims to nurture the passion for learning and continuous development throughout life. It contributes to raising the motivation to learn and creating a state of flow and active participation using fun and innovative methods of learning, which transforms the educational situation with all its elements and educational content in a disciplined and consistent manner into flexible and enjoyable educational experiences. Share The student determines its components; For the purpose of gaining knowledge while achieving enjoyment, it is also a strategic work that aims to develop the educational situation accurately through an organization that aims to entertain learners with what they are learning, and break the feelings of boredom or frustration that may accompany educational

materials of an academic nature based on reasoning and logic.

Perhaps the urgent necessity to change the stereotypical educational situation and innovate and innovate in it to create a state of balance between the learner's reality enhanced by all modern technologies and attractions and his classroom, which has remained typical, has made enjoyable learning a requirement and a necessity. Therefore, the theoretical frameworks on which enjoyable learning is based were formulated, as indicated by it. Educational literature. Perhaps the most important of these theoretical frameworks are the following:

Experience Economy: Given that enjoyable learning is based on the learner going through the educational experience himself, which gives him a better opportunity to acquire and absorb knowledge.

Flow Experience: Flow is achieved through the learner's emotional integration into educational situations in a way that maintains his mental activity in an attempt to acquire knowledge.

Emotional Effect: which is achieved through practices through which the learner realizes himself when sharing with his peers his feeling of joy of achievement and competition.

Cognitive curiosity (Curiosity): The nature of fun learning experiences that are based on competitions, simulations, and data collection naturally imposes on learners a state of cognitive curiosity in order to acquire the intended knowledge and skills.

Intrinsic Motivation: Learning with pleasure stimulates the learner's intrinsic and internal motivations in the educational situation, given that these motivations accompany the learner's participation in the process of learning with pleasure thanks to the emotional and academic integration of the learners.

How does education become fun?

Education for fun has attracted global attention among educators, which has prompted them to establish rules that make learning fun, which Janelle Cox presented in the following points:

1. Integrating technology into education to help enjoy and engage in learning.
2. Building a fun classroom environment by incorporating fun scientific activities into lessons.
3. Assigning learners to conduct experiments themselves because they find pleasure in practice.
4. Review lessons in a fun and enjoyable way through active learning strategies.

5. Departing from the traditional atmosphere of the class through scientific trips, both in reality and hypothetically.
6. Forming work teams and cooperative groups that contribute to developing communication skills.
7. Give a break to learners' brain through routine-breaking activities.
8. Establish learning centers, because they give learners multiple options for learning.
9. Introducing learners to their highest abilities through multiple intelligences that guide the way they learn.
10. Limit your classroom rules There are too many rules and expectations that can hinder learning.

Perhaps the application of these rules requires the teacher to have full knowledge and knowledge of enjoyable learning strategies and methods, which include learning through entertainment, scientific anecdotes, scientific theatrics, learning with songs and poems, learning with mathematical riddles and riddles, role-playing, learning by playing, educational story, cooperative learning, learning by doing, maps. Thinking, cartoons, infographics and effective teaching.

Learning is fun when:

• You love what you do: When you are passionate about something, the learner feels fun, rewarded and easily reaches further to learn more.
• Feel safe: A supportive and safe environment makes us feel free to explore and set new goals.
• The environment is inspiring: Our physical and digital environments should be designed to support all learners. It should inspire and support different learning strategies.
• You are valued for who you are: Positive learning thrives in an atmosphere of respect and appreciation among fellow learners.
• Freedom to fail: Mistakes are allowed to be made in a safe atmosphere to foster creativity and innovation.
• You can choose how you learn: Learning strategies are subjective and based on our individual strengths. By understanding this, we can choose the most effective way to address a problem and learn something new.
• It becomes a healthy addiction: We should engage in lifelong learning, and we can achieve this when we feel satisfied, able and competent to learn more.

Evaluation of learning outcomes

The novelty of enjoyable learning is consistent with modern evaluation methods such as diagnostic evaluation, formative evaluation with projects,

presentations and interviews, concept maps, performance evaluation through presentation, presentations, simulations, and debate, paper and pencil, product or project evaluation, achievement files, and the triple emotional thermometer strategy (happy, neutral, Unhappy) to know the learners' impressions about the class.

18- Active learning strategies

An application for active learning. In general, it is a general plan of action whose goal is to engage students to obtain better productivity by involving learners in activities and making them the main actor in them. It is characterized by several specifications, including comprehensiveness, its connection to goals, positivity, effectiveness, flexibility, adjustability, development, and attractiveness (fun and suspense)...

Examples of these strategies include hot chair, role playing, numbered heads, problem solving, cooperative learning, brainstorming, reciprocal teaching, and discovery learning...

(Listen, Share, Discuss), (Think, Pair, Share), (Role Play), (Concept Grid), (Questions and Answers), (Brainstorming), (Cooperative Learning), (Walking

Gallery), (Find the Error) , (trilateral interview), (peer thinking aloud)...etc.

Foundations of active learning

Active learning focuses on the learner as he is the focus of the educational process, and therefore relies on many foundations, including:

• Students' participation in choosing the work system and rules.

• Involving students in setting their educational goals.

• Diversity of learning sources.

• Using student-centered teaching strategies that are appropriate to his abilities, interests, learning, and intelligence.
• Relying on students' evaluation of themselves and their classmates.
• Providing communication in all directions between learners and the teacher.
• Allow students to self-manage.
• Creating an atmosphere of reassurance, fun and enjoyment while learning.
• Each student learns according to his own abilities and speed.
• Helping the student understand himself and discover his strengths and weaknesses.
• Principles of active learning

Principles of active learning

Active learning has many principles, including:
• Students learn through it the positivity of acquiring experiences, skills, values and attitudes.
• The student does not receive ready-made knowledge negatively, but rather does his best to ensure that his role in receiving it is positive.

• The student builds a cognitive structure for himself and organizes it self-organizing, while finding links between them.
• The student's new experiences and knowledge that he has acquired are integrated with his previous knowledge and integrated with each other.
• Students actively participate in discussions, solve exercises, infer and discover information in order to learn better.
• The student cooperates with his colleagues in a group form in which he bears a degree of responsibility for completing the tasks assigned to the group.
• Every individual helps and presents his suggestions to the group, and has the right to ask his colleagues for help and assistance, and extends his hand to help others, and does not finish his task until everyone has finished.
• Students' participation in setting educational goals and choosing the work system and rules under a type of self-management.

The role of both the teacher and the learner in active learning

A- The role of the teacher

In active learning - as it focuses on the learner's effectiveness and positivity - the teacher is no longer the

prompter and the only source of information, but rather he has become a guide, guide, motivator and facilitator of learning. The teacher does not control the educational situation, but rather manages it intelligently and directs the learners towards the goal smoothly through:

- Ask appropriate questions.
– Designing motivating and interesting educational situations.
- Effective selection of educational methods.
– Diversifying teaching methods and classroom activation techniques.
Encouraging and motivating learners.

B- The role of the learner
The learner in active learning is positive and involved in the educational process:
- He initiates, interacts, discusses, and asks questions.
- Searches for information from multiple sources.
-Practices self-evaluation and peer evaluation.
- He works in groups and cooperates with his colleagues.
- Participates in lesson planning and implementation.

19- Advanced organizations:

Comprehensive introductions or interconnected scientific material at a high level of abstraction, generality, and comprehensiveness, formulated in specific, clear phrases that are familiar to the learner and including concepts, rules, generalizations, principles, or rulings.

The organizations developed in this study are defined procedurally: as an introductory material presented to the learner at the beginning of the class and at a high level of generality, comprehensiveness, and abstraction, through which the teacher attempts to link the new topic to the learner's previous experiences with the topic of the lesson.

Types of advanced organizations:

First: The explanatory organizations:

It is used when the (new) educational material is unfamiliar to the learner, helping him connect the new knowledge with the cognitive foundation.

Second: Comparative organizations:

It is used when the new scientific material is familiar to the learner. It helps him. It is used as a basis for comparison in a good understanding of the new knowledge, even if it is familiar

Advantages of using advanced organizations:

1- Facilitating the educational process for the teacher.

2- Achieving goals: Advanced organizations of various types achieve the goals of teaching mathematics, including growth in knowledge, skills, and attitudes.

3- Training in mental processes such as observation, measurement, comparison and deduction, and developing scientific attitudes such as accuracy, objectivity and reliance on sufficient evidence before judging things.

4- Active learning: The learner builds his knowledge, his role is positive, and learning is based on understanding and experience, which facilitates the transfer of the impact of learning and the expansion of concepts. He also retains what he has learned longer and forgets less.

4- It provides an opportunity for communication between the teacher and learners and to clarify, enhance or modify ideas.

• The role of the learner when using advanced cognitive organizations in the teaching process:-

The learner responds to the teacher's questions and has the opportunity to ask validation questions, but his role is not great, as he is an active receiver.

• The role of the teacher when using advanced cognitive organizations in the teaching process:

- He plans, implements, evaluates, and prepares the educational environment if the learning requires scientific activities.

Teacher's Guide

Dear teacher, this guide includes the three stages of teaching the space unit to second year middle school students

The advanced organizations are as follows: -

The first stage: introducing the advanced organizer:

They include the following:

♣ Determine the objectives of each unit lesson, which are formulated in a behavioral form.

♣ The advanced organizer is formulated through three patterns: concept definition, generalization, and simile.

♣ Use of educational tools and methods.

♣ Introducing the advanced organizer.

♣ Give examples.

♣ Stimulate the learner's awareness by trying to link new information to previous information.

The second stage: Presentation of the educational material:

There are important procedures at this stage, which are:

ϖ Maintaining learning attention while presenting the scientific material.

ϖ Explaining the organization of the scientific material to the learner so that he has a comprehensive meaning of the lesson topic.

ϖ Arranging the scientific material logically so that it becomes clear to the teacher how to link the ideas together.

ϖ Determine the scientific material presented to the learner.

ϖ Presenting scientific material.

The third stage: Strengthening the cognitive organization:

The procedures for this stage include:

♣ Using the principles of sequential connection and complementary reconciliation with the aim of summarizing the main ideas of a topic

Study and show similarities and differences.

♣ Encourage receptive learning by making the learner passive and this is done by asking him questions

About deducing scientific material and asking the learner to give additional examples of the concepts present in the topic

The new lesson.

♣ Using the critical approach, which leads to greater understanding and works to confirm new ideas
For the lesson topic.
♣ Clarification, students may wonder about unclear ideas, and the teacher can clarify this using
Other presentations and giving new additional examples.
♣ Evaluation, by diagnosing weak points and trying to treat them.

Below are some general guidelines to help you teach the "Spaces" unit according to advanced cognitive organizations.

First: Before the class:-

A- Familiarity with the strategy of advanced knowledge organizations used in teaching and the scientific content of the space unit, the subject of the current research.

B- View the student's book and learn about its contents and the activities that students perform in each lesson.

C- Providing and equipping the educational tools and means necessary for educational activities and presenting systemic plans.

D- Directing students to ensure order in the classroom during the lesson and when using tools, and to ensure the safety of the devices.

E- Ensure that the sub-systems presented to students are appropriate for the concepts included in the lesson that will be taught.

Second: During the class:-

1- Start the lesson with an introduction and an appropriate activity, preferably in the form of introductory systematic diagrams, to determine the extent of their knowledge and awareness of the previous concepts.

2- Give your students an opportunity while presenting the main system to learn about the concepts included in the current lesson.

3- Give your students an opportunity to read engineering exercises.

4- Discuss with your students the conclusions and observations they reach after solving each scientific discussion exercise.

5- Discuss with your students the relationships that link the concepts to each other, whether in the main or sub-system.

6- Observe your students while solving various engineering exercises and problems.

7- Discuss with your students the enrichment activities available after each lesson.

8- Direct your students to design and create new systems to link concepts.

Third: Before the end of the class:

1- Discuss with your students their answers to the final evaluation.

2- At the end of the lesson, I present the scientific and mathematical concepts included in the lesson in an organized manner through systematic planning.

3- Make sure to use questions of application, analysis, and synthesis of knowledge. Use advanced cognitive organizations to develop higher levels of thinking.

Area unit formulated according to advanced cognitive organizations

General objectives of the unit:-

After studying this unit, the student is expected to be able to:

First: Cognitive objectives:-

1- Remembers some geometric concepts such as (parallelogram - rectangle - square - rhombus - trapezoid - triangle - area - perimeter - height - .....).

2- Explains the engineering concepts included in the unit.

3- Connects different concepts in the form of relationships.

Second: Skill objectives:-

1- Deduce the geometric mathematical relationships that link the geometric concepts included in the unit area.

2- Acquires the skills of drawing geometric shapes.

3- System and accuracy are sought when solving engineering exercises and exercises.

4- The scientific method is used to solve problems.

5- Draw new systemic plans.

6- Deduce different methods for solving engineering exercises.

Third: Emotional goals:

1- Appreciates the efforts of scientists to enrich knowledge.

2- It arouses his attention towards engineering theories and their importance in practical life.

3- Develops positive attitudes towards teamwork while participating in solving physical exercises.

Educational tools:-

Teaching the space unit, the subject of the current research, requires some educational tools, including the following:

1- Teacher's Guide 2- Student's Handbook

3- Educational tools 4- Educational whiteboard

5- Computer and display screen. 6- Models of cognitive organizations.

20- Educational scaffolding:

Educational scaffolding is one of the educational applications of constructivist theory, through which the focus is on how to acquire knowledge, on making meaning of various phenomena, the importance of the social construction of knowledge, encouraging competition in the educational situation, and looking at the learner from a broad perspective.

The teacher uses it temporarily, through which he presents a group of activities and programs that increase the student's level of understanding to the extent that allows him to continue performing the activities on his own. Within the framework of this concept, the teacher provides the temporary assistance that the student needs with the aim of giving him some skills and abilities that will enable him and qualify him to continue the rest of his learning on his own.

Educational scaffolding calls for learning to take place only by identifying the learner's previous experiences and starting from them to focus on active learning and social learning, whether with the teacher or with peers, and then reorganizing the student's experiences to move to the stage of self-reliance, thus achieving continuity of

learning. By providing temporary and temporary assistance to the student.

Educational scaffolding is an application of Vygotsky's theory of social learning, in which he explained that learning occurs through participation in social experiences. The student does not learn independently and separately from others, but rather actively and in participation with the rest of the students who are more knowledgeable or capable of influencing their way of thinking and interpretation of different situations, which It is done through patterns, scaffolds and supports to make the student able to solve the problems he faces.

Educational scaffolding was given this name because it focuses on temporary support for the student by providing a set of activities and programs and then leaving him to complete the rest of his learning relying on his own abilities.

Educational scaffolding objectives:

Educational scaffolding aims to provide the student with the opportunity to develop his mental skills and special abilities, the most important of which are:

- The ability to link different ideas and concepts.
- The ability to critically evaluate facts and information.

- The ability to draw new conclusions to solve problems.
- The ability to confront complex problems.
- The ability to understand new situations.

Educational scaffolding works to provide temporary support for the student during learning, with the help of others, and then he is left to complete the rest of his learning on his own alone, relying on his own abilities. They are called educational scaffolding or scaffolding.

First: The first step (pre-lesson stage):

- Identifying the students' cognitive background and linking it to current information.

Second: The second step (the stage of presenting the teaching model):

- Using hints, connotations, and questions.
- Thinking out loud about the mental processes and skills involved in the task.
- Writing the steps that will be followed in performing the task (the teacher asks the students to write what they know about it and what they want to know).
- Providing a model for learning mental skills and targeted operations.

Third: The third step (the stage of group practice directed at scientific content and various tasks):

- The student works with his friend and then in small groups.

- Observing and monitoring students' mistakes and working immediately to correct them.
- Directing students to ask questions and self-inquiry when performing the task.
- Group students practice tasks and activities under the supervision of the teacher.
- The teacher participates with the students in reciprocal teaching.

Fourth: The fourth step (the stage of giving feedback):

- The teacher gives corrected feedback to the students.
- The teacher uses correction lists that include all the steps in performing the task.
- Helping the student evaluate his work using previously prepared models.
- Providing the student with the opportunity to use self-review.
- Re-present the correct teaching model when needed.

Fifth: The fifth step (the stage of increasing the student's responsibilities):

- This includes some consolidation and enhancement activities in order to link procedures and processes together.
- Work to gradually cancel the support provided to the student.

- Review student performance.

Sixth: The sixth step (the stage of giving independent practice to each student):
- The teacher facilitates the application of another task and a new example (enrichment aspects of the topic).
- The teacher gives the student an opportunity to practice learning in an intensive and comprehensive way.

Procedures for teaching unit lessons according to educational scaffolds:
1- Prepare the students by presenting a brief idea about educational scaffolding, explaining its concept, importance, stages, and how to learn through it. This is done in the first meeting between you and the students, and it serves as an introductory session.
2- Divide the students into groups that are not homogeneous in terms of knowledge. Each group includes (6) students, and each group has the freedom to choose its members, name its group, and designate a leader for each group who is responsible for organizing the work among its members.
3- Organize the group session so that its members sit in a circle or facing each other, depending on the nature and space of the classroom.

4- Make sure to move between the groups to ensure that all students participate in the group work.

5- Ask the students in every lesson to respect and listen to each other's opinions.

6- Direct the students to answer the evaluation questions in their booklet, provided that the answers are done individually to ensure that the students master the skills they want to develop during the lesson.

21- CoRT Program:

First: Introduction to the program

This program is considered one of the most famous modern international programs for teaching thinking. It was designed by the English scientist Edward De Bono, and the letters that make up the program (CoRT) refer to the Cognitive Research Foundation that he founded (Cognitive Research Trust), and this program helps the teacher explain topics in a way Different, modern, and advanced, moving away from the usual methods of teaching, and developing the teacher's performance in the classroom. This program works to change the teaching method and creates a student-centered classroom.

Second: The importance of the program

The program benefits teachers in:

1- Build sufficient experience and possess the necessary tools to explain topics in a different way.

2- Identifying students' abilities, discovering talent and developing it.

3- Students' understanding of the academic content, which thus leads to raising their level of academic achievement.

4- Influencing students' minds, thoughts, and behavior, learning and developing thinking, and freedom from stereotyped thinking.

5- Understanding students' ideas and listening to them with focus.

Third: The role of the teacher in the CORT program

• Clarifying instructions and guidelines.

• Establishing order and calm within the classroom.

• Providing the means, tools, and worksheets necessary for the lesson.

• Stirring students' motivation.

• Follow the course of the lesson in a logical sequence, organize the time needed for each step, and do not move to the next step until after ensuring that the students understand it.

• Providing life examples that suit the content of the topic.

• Ensure that all students participate in the discussion, and respect all opinions.
• Encouraging students and providing them with feedback.
• Recording students' results.

Fourth: Program content

The program contains six parts, each part includes ten lessons. The lessons in this unit were prepared using the first part (expanding the field of perception) and the second, organization.

• Part (1): Expanding the field of perception and includes (10) lessons.
• Part (2): Organization, which includes (10) lessons.
• Part (3): Interaction and includes (10) lessons.
• Part (4): Creativity includes (10) lessons.
• Part (5): Information and feelings, which includes (10) lessons.
• Part (6): Work, which includes (10) lessons.

22- Differentiated instruction (DI)

Differentiated instruction (DI) is an instructional approach that focuses on recognizing and celebrating the diversity of students' learning needs and abilities within a single classroom. Teachers who adopt a differentiated instruction approach to teaching customize content, process, and product according to the needs of individual students.

How to Differentiate Instruction:

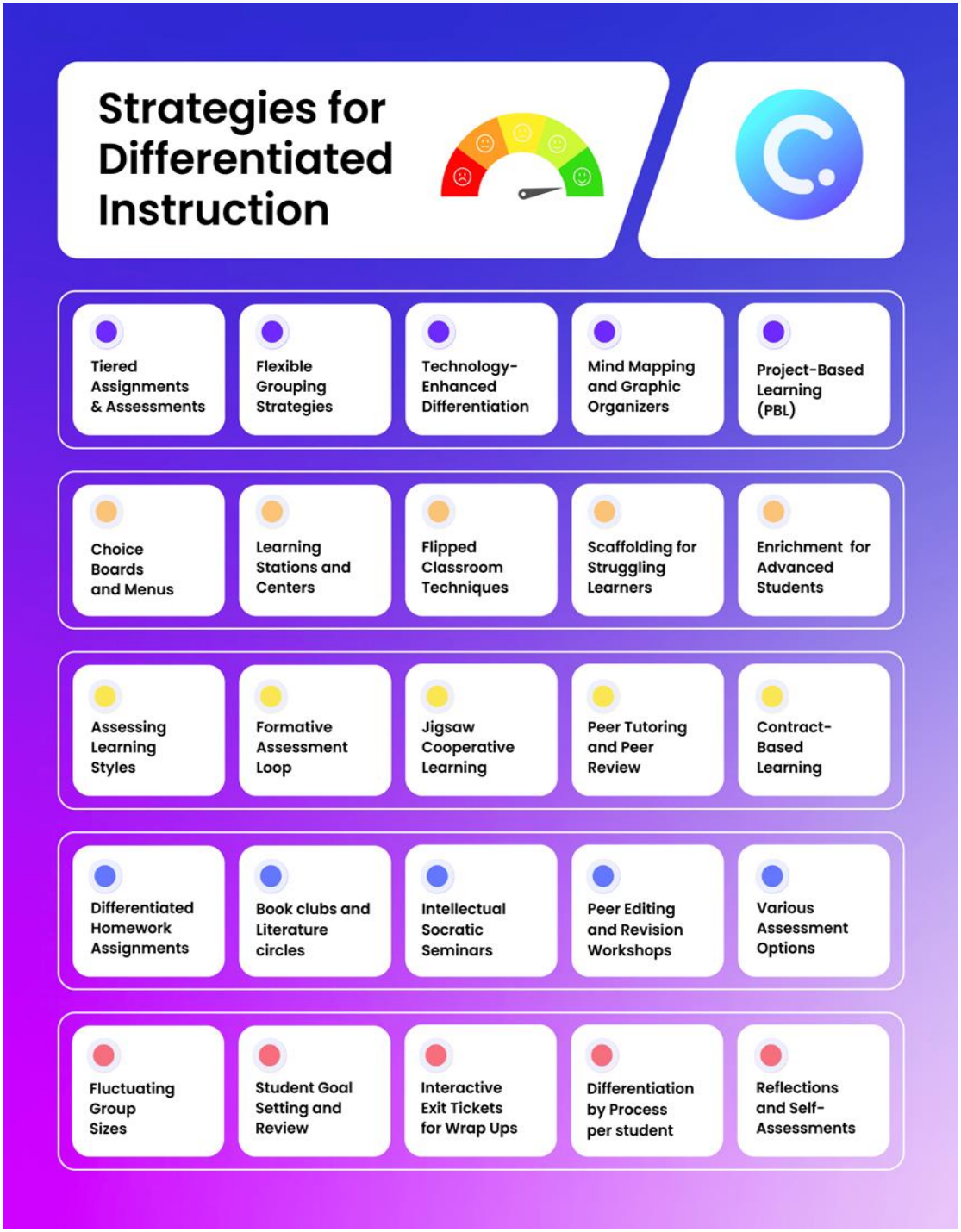
The Three Key Principles of Differentiated Instruction

Content: Doha Institute recognizes that not all students are in the same place in their learning journey. This means offering a variety of content options to meet students where they are. Some may need more challenging material, while others need additional support to understand the basics.

Process: Learning does not have to follow a one-size-fits-all model. DI allows flexibility in how students access and process information. This may include different teaching methods, different levels of scaffolding, or even allowing students to choose the path that suits them best.

Product: In the world of DI, students are encouraged to express their understanding and display their knowledge in different ways. This may mean offering different types

of assignments, projects, or assessments to meet diverse interests and talents.



23- Vee Map Strategy

The strategy vee shape map helps students understand the objectives of practical experiments (Novak and Gowin, 1984) It helps students understand how to achieve new empirical knowledge by focusing on what they already know and through research questions and interpretation of data they arrive at new knowledge that integrates previous knowledge.

The importance of the shape map (vee):

1- It helps learners understand practical lessons and facilitates their understanding of the methods through which knowledge can be produced.

2- The learner organizes his thinking better

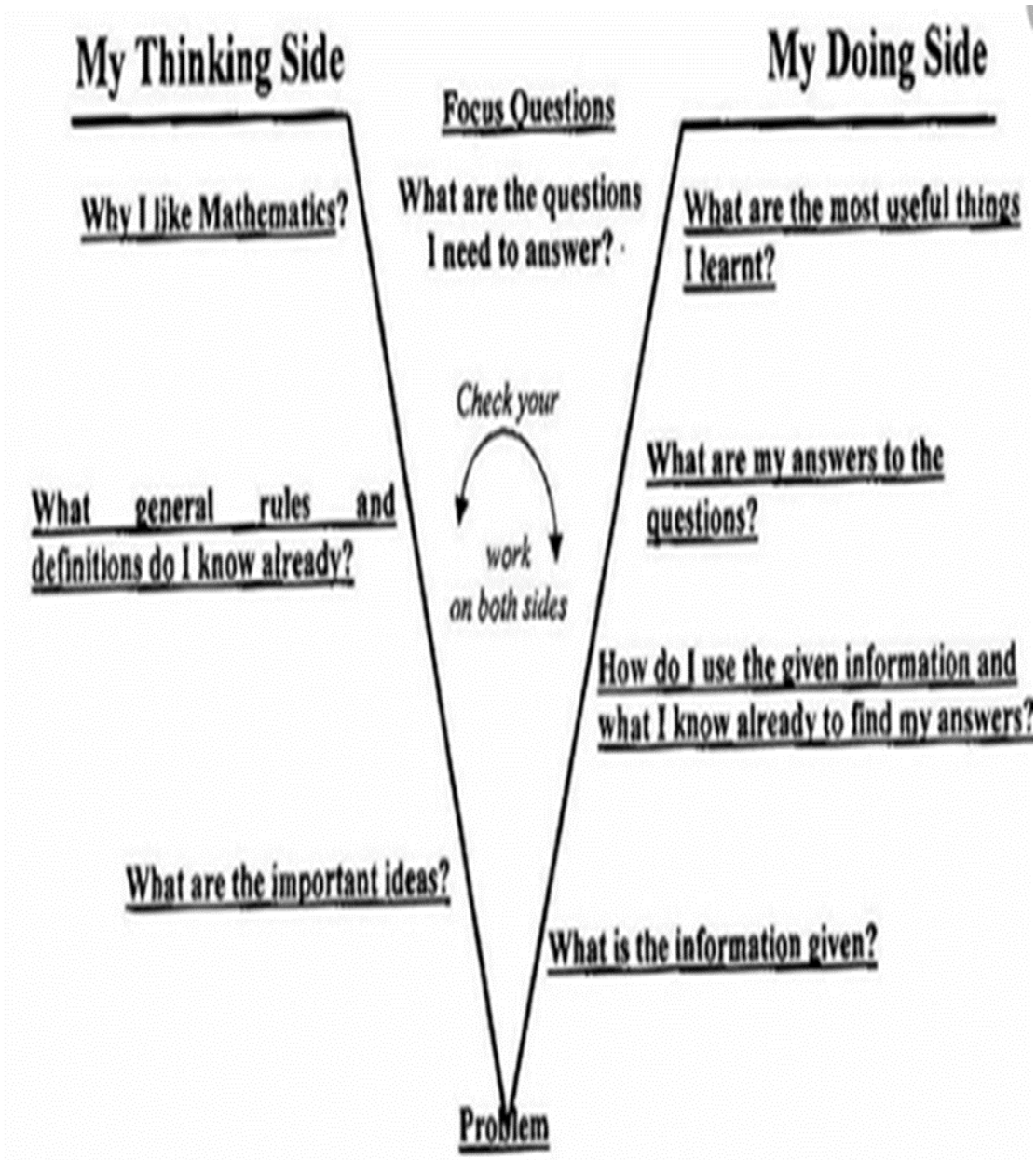
3- It is considered a method of discovery as it helps learners understand the interaction between previous knowledge and the new knowledge that they are trying to understand.

4- It helps the science teacher to estimate the extent to which his students participate in knowing some scientific principles.

5- Encouraging learners to achieve meaningful learning.

6- The learner is satisfied with himself because they can control their learning and therefore know what to do

7- It represents an educational tool to clarify the interaction between the conceptual structure and the procedural structure of scientific knowledge



Shapemap structure (vee):

Gowin's map of the figure (vee) consists of two aspects so that it integrates two aspects of science and learning, knowledge and work, which are

1- The left side represents the theoretical conceptual side and consists of:

(a) Concepts included in the lesson.
(b) Theoretical principles
2- The right side, which represents the procedural (practical) side, includes:
(a) Cognitive requirements
(b) Value requirements
(v) Registrations
(w) Transfers
It depends on what is seen in the educational situation
3- The right side is linked to the left side with events and things that fall into the focus of the figure (vee).
4- The interaction between the right and left sides occurs through the main question, which is located at the top of the map between the conceptual and procedural sides
The question is its focus
- What do I want to know?
- What do I know about this topic?
- How can I answer my question?
-And in which direction am I heading?
- How can I access meaningful records and transfers?
- How do I link concepts and events?
These questions direct the learner where he is going and where he wants to go in an organized and specific way to reach new knowledge
5- The conceptual aspect:

Here the learner records what he knows about the subject in terms of concepts, principles and theories

As follows :

This part includes concepts specific to the subject of the lesson and indicates abstract components taken from multiple situations and events. It includes:

Principles: A principle represents a meaningful relationship between two or more concepts and guides us to understanding the meaning of the situation and events.

Theories: The theory represents a set of hypotheses that integrate with each other to explain the relationships between the set of laws and the changes within its field, and by it the concepts and principles are organized in the educational situation for the sake of related events and requirements.

6- The procedural (practical) aspect:

This is where new knowledge is determined

This aspect includes:

1- Cognitive requirements: These are the answers to the main question or questions raised. These requirements are also useful in asking new questions that will lead to new research operations. These requirements are based on laboratory experiments.

2- Value requirements: Feeling and emotion represent an essential part of it and can be positive or negative, such

as the feeling towards smoking. Value requirements give the answer to the value of the question, such as is it beneficial or harmful? According to the above, it can be said that requirements and values are not independent of each other, and even though they represent different components, there are overlapping relationships between them.

Novak, Gowin, and *Johansen* (1983) identified the main requirements for a V-shaped map, which are:

- Research question (lesson).
- Events and things that are observed.
- Understanding appropriate concepts and theories.
- Recording data (recordings) and transferring recordings.
- Cognitive and value claims.

Uses of V shape map

- *Educational tool*

The V-map is used as an educational tool to build a learning program from primary source material and process it in a way that makes it useful. Therefore, it is useful in analyzing primary sources of information to reach appropriate educational planning.

- *Evaluated tool*

The V-shaped map is an evaluation tool that expresses the value of knowledge and judgment on this value. The evaluation method is unconventional, as the student's learning is judged by covering the elements of the V-figure and not by its achievement.

- *Methodological tool*

The V-shaped map is used to develop the curriculum by analyzing study materials according to the following questions:

- What is the main question surrounding a particular topic?
- What are the basic concepts to be learned in this topic?
- What methods are used to answer the main question?
- What are the main cognitive requirements for learning this subject?
- What are the main value requirements for learning this subject?

Question: Explain with examples how you use the V-shaped map to develop a mathematics curriculum?

3-2 Modern teaching methods

The teaching process in general is sequential methods and procedures carried out by the teacher to provide the student with various knowledge and skills. Recently, modern teaching methods have become the approved ones to reach the required educational goals and achieve remarkable achievements in developing the level of education. They have become the leaders in the development witnessed by education.

Because the teacher is the basis of everything, no one controls the quality and efficiency of education except him, his methods used, and the modern and traditional teaching methods he uses in his classroom and with his students, and choosing what is appropriate to their skills and level of knowledge.

The teacher's familiarity with multiple and unique teaching methods results in the formation of his own educational personality that suits the nature of the lessons provided, in addition to their suitability to the nature of his students. This also helps to transfer the impact of the educational material with the student beyond the class session, in addition to eliminating routine and boredom during the semester.

Advantages of modern teaching methods

Modern teaching methods that are increasingly used in education have proven their efficiency, and many advantages have been noted, such as:

• It makes the student more creative, because it enhances his abilities and thinking, observation, and deduction skills.

• Enables the student to identify the problem and find a solution to it.

• It takes into account the levels of students and the individual differences between them if used in the best way.

• Expands students' awareness and gives them many different sources to understand the practical material more and become proficient in it.

• Developing the student's self-education skills.

The importance of modern teaching methods

1- Using modern teaching methods, such as differentiated education, makes modern teaching methods more efficient because it takes into account individual differences among students, especially those with special needs.

2- It makes students more cooperative, and gives them many skills such as problem solving, creative thinking, acting, and designing and implementing projects.

3- It enhances the student's self-learning and develops in him a love of research and discovery on his own.

4- It makes the student connect scientific and practical life, and how to apply and use what he has learned in practical life in a more efficient and understanding manner.

5- Keeping pace with technological developments and expanding students' awareness of the great future of technology.

6- Saves time and effort in the educational process.

7- It addresses all of the student's senses, which makes the scientific material more understandable and thus confirms the information for a longer period.

8- It makes the teacher more capable of coordinating and organizing the scientific material and using different educational methods in his class.

9- Teaching methods are the link between the student, the curriculum, and the teacher, so the appropriate methods must be carefully chosen.

10- Paying attention to modern teaching methods makes education more effective and has an impact on the student's knowledge and skills.

11- Types of teaching strategies: It makes modern teaching methods more effective and provides the student with multiple options for receiving information, and develops many of his skills and experiences.

Types of modern teaching methods

Because of the progress that occurs continuously, and the student's increasing need for a diversity of ancient and modern teaching methods, it is important for the teacher to familiarize

himself with the types of modern teaching methods and modern teaching strategies, and to integrate them and use them appropriately within his methods and educational system, in order to enable him to develop his students' skills and provide their knowledge in a more advanced manner. It suits the times we live in.

Let us learn about some types of modern teaching methods that the teacher can use in a simple way:

• The method of finding and solving the problem. This method is one of the modern teaching strategies that is based on motivating the student to find practical and scientific solutions to the problems he faces by thinking and cooperating with his colleagues. This method is considered ideal for enhancing the student's confidence and linking what he learns to practical application in his life.

• E-learning, which is a method that uses modern technological means and links them to education, so that the information reaches the student anywhere and at any time with the least time, effort and cost. This method has the advantage of providing greater educational opportunities to students as it does not require the student to attend a specific place.

• Cooperation among students in education, which is one of the modern, purposeful teaching strategies that enhances in the student the love of cooperation, participation, and working in the spirit of one team.

It also makes students exchange experiences among themselves, and instills a spirit of competition among them.

• Brainstorming method, which is a method that relies on deep thinking to find new and creative ideas. It also gives the student the freedom to express his opinions and ideas and respect and accept the opinions of others.

• Acting, which is one of the modern methods in education where students conduct an acting dialogue that presents a specific academic topic in a more luxurious and creative way.

• Creating projects for each unit studied, as they enhance students' thinking and transform the scientific talk they have studied into something practical that can be applied.

• Differentiated education to take into account individual differences among students, and placing each student in the appropriate place according to his experience, skills and knowledge.

• Educational Packags,

Among the modern methods of teaching mathematics are the following:

- **Learning by playing**, playing with educational materials makes it more exciting and exciting for the learner, It is also an entertaining way that makes the

student love science and search for it without getting bored, and it enhances social participation among students and positive thinking full of activity and vitality. Games used during class can fill the classroom with excitement and suspense of all kinds. These games may be:

- Online games designed specifically to turn mathematics into an adventure that students can practice individually or collectively by applying the mathematical facts they have learned to complete specific tasks, as a result of which they achieve rewards.
- Movement games that the teacher himself applies during the class.

- **Using visual aids,** such as pictures, graphs, charts, and picture books, is a smart choice to present some mathematics topics in a modern and entertaining way. The teacher can use such aids to introduce some new concepts by presenting them using projectors, a smart board, or tablets.

- **Use of modern technology**

Smart phones and tablets that are widespread in the current era provide an opportunity for students to deal with mathematics according to their inclinations and desires, and this is what the teacher can invest in creating new opportunities for students to

interact with the world of mathematics around him through a group of mathematics applications that balance achieving fun and excitement, and providing them with skills. Sports at the same time in different ways such as games, solving puzzles,

- **Use word puzzles**

Using word puzzles is a great way to stimulate students' thinking and encourage them to participate, especially if these puzzles are linked to the reality of the students' lives and interests.

Making models

One of the most successful methods of teaching mathematics is asking students to make models of specific geometric shapes, and showing them how to do so with videos showing architects making three-dimensional shapes.

- **Storytelling**

Storytelling is one of the best and most successful methods for presenting educational content, especially if abstract experiences and concepts are linked to real life, making them easier to understand and closer to students' minds.

- **Use motor activities**

The teacher may find using movement activities such as singing accompanied by rhythmic movements as a way to apply the concepts of patterns in mathematics.

- **Connecting art with mathematics**

Mathematics is linked to all areas of life, of which art and architecture are one of them, and the teacher can exploit this in many ways.

- **Connecting mathematics concepts to life**

The teacher must link mathematics concepts to daily life, especially those concepts that are naturally related to each other, such as speed, distance, and time, and familiarize students with the nature of this connection through simple experiments that they carry out on their own.

- **Mind mapping strategy**

Mind mapping strategy in teaching; It is a teaching method that relies on planning and simulating the brain in a non-linear way. It is used to improve students' abilities to think organized and process information in a good way. It is a fast method that helps the learner build new knowledge and broad skills.

- **Characteristics of the mind mapping strategy in teaching**

The mind mapping strategy in teaching is characterized by a set of characteristics, the most prominent of which are the following:

Inclusion

This strategy gives a complete and general overview of the topic.

Abbreviation

This strategy works to summarize a large amount of information.

Organization

This strategy organizes ideas and information in an enjoyable way.

The focus

This strategy gives the ability to focus, as it transforms audio, read, and visual information into a mind map.

Continuity

This strategy helps retain information.

The speed

This strategy increases the speed of remembering information.

The role of the teacher and the learner in the mind mapping strategy in teaching

- **The role of the teacher**

It consists of the following:

- ✓ Measure learners' readiness to study a new topic.
- ✓ Activate students' background knowledge.
- ✓ Directing learners to read a specific topic.
- ✓ Helping students design and build the map.

- **The role of the learner**

It consists of the following:

- ✓ Listen to the teacher's instructions and apply them.
- ✓ Discussing ideas and classifying them into similar groups.
- ✓ Discuss with fellow students about ideas and examples.
- ✓ Linking previous knowledge with current knowledge.

Theories on which the mind mapping strategy in teaching is based

Ausubel's theory

Ausubel's theory is known as the theory of meaningful learning, as the scientist *Ausubel* focuses on the relationships between concepts and the connection between them, as he assumes that the learner's mind stores information in a sequential and hierarchical manner, moving from the general to the specific.

Piaget's theory

Piaget's counterpart is known as constructivist theory, which is a theory concerned with mental development and its stages. For Piaget, learning represents a development process to provide the learner with appropriate educational experiences, and this enables him to practice certain cognitive and mental processes.

Mind mapping strategy methods in teaching:

The mind mapping strategy in teaching includes a group of distinct methods that contribute to improving the educational process:

Visual learning:

This method relies on the use of graphics and colors in designing mind maps, which helps students stimulate visual memory and enhance creative thinking.

Organizing ideas:

Maps are used to arrange ideas and concepts logically and clearly, making it easier for students to analyze content and encouraging deep understanding of topics.

Intellectual connection:

This method encourages finding relationships between different ideas, which enhances the development of analytical skills and helps students build integrated knowledge.

Visual thinking:

This approach focuses on using pictures and symbols to represent concepts, which helps students organize information in a clearer and easier way.

Interactive learning:

Through the use of information organization activities and analytical projects, students can also actively participate in building mind maps, which enhances interaction between them and helps develop thinking.

The importance of mind maps in education

- ✓ Organizing mental chaos: Mind maps represent a magical haven for organizing this creative chaos, as they help you collect ideas and arrange them in a visual way that makes the information organized in the mind.
- ✓ Stimulating comprehensive thinking: Mind maps enable learners to think comprehensively and see the relationships between different concepts, connect the dots between ideas and understand how information is intertwined, which enhances critical thinking.
- ✓ Enhancing creativity and future thinking: Mind maps play a crucial role in stimulating creativity and directing learners towards future thinking, which contributes to preparing them to keep pace with ongoing technological transformations.

Uses of mind maps in education

- ✓ Brainstorming to generate ideas Mind maps provide an inspiring journey of ideas, which learners can use to stimulate creativity and explore different worlds of knowledge.
- ✓ Simplify difficult concepts

  Mind maps help simplify difficult concepts, as learners can transform dense texts into visual, easy-to-understand

diagrams. Learning becomes inspiring and less complicated.

- ✓ Stimulate interaction and participation

  Mind maps enable learners to actively participate in the learning process, adding their own ideas and vision, creating an interactive and dynamic learning environment.

- ✓ Provide visual presentations

  Mind maps are an excellent tool for creating exciting and engaging presentations. Teachers can design maps that facilitate the explanation process and make the information clearer to learners.

Electronic mind mapping programs

Application is the foundation of the learning process, and it is our vision and concept of effective learning.

Therefore, I present to you the most important of these electronic mind mapping tools.

MindMeister

MindMeister allows you to create beautiful mind maps, store them in the cloud, and collaborate with others effectively.

XMind

The site provides you with the ability to add images and links, which enhances the attractiveness of the maps and makes them effective for expressing ideas.

Coggle

The program is characterized by its simplicity of use and its ability to create group mind maps. Users can collaborate in real-time, making it an excellent choice for group projects.

Mindomo

Mindomo offers an easy-to-use interface and extensive customization capabilities. Users can add audio notes and attachments, enriching the mind mapping experience.

Biggerplate:

Biggerplate: allows users to explore ready-made mind maps and share their creativity. It brings together a huge library of pre-made mind maps.

FreeMind

It is considered one of the first mind mapping programs, and it is characterized by simplicity and ease of use. Provides powerful customization and organization options.

Scapple

The software offers a unique approach as it allows users to freely connect ideas using a free interface. This approach enhances creativity and allows ideas to be arranged in an unconventional way.

3-2 NCTM Principles and Standards

Principles are specific statements that reflect the basic rules of world-class mathematics education. They include the following main principles:

Equity Principle: Excellence in mathematics requires equality, high expectations, and strong support for all students.

Curriculum Principle: The curriculum should be consistent, focus on important mathematics, and be coherently linked across grades.

Teaching principle: Effective mathematics teaching requires understanding what students know and what they need to learn, then challenging and supporting them to learn it well.

Learning principle: Students should learn mathematics with understanding and effective construction of new information from previous experience and information.

Assessment Principle: Assessment should support the learning of important mathematics and provide useful information for both teacher and student.

The principle of technology: Technology is considered an essential element in teaching and learning mathematics, as it affects learning mathematics.

As for the standards, they describe the understanding, information, and mathematical skills that students must

obtain from pre-kindergarten through the twelfth grade. The standards are divided into:

1. Content standards: These standards describe what students should learn, and include:

Numbers and operations, algebra, geometry, measurement, data analysis and probability.

2. Process standards: These standards include methods of acquiring and using knowledge related to the content, and include: problem solving, mathematical thinking and proof, communication, linking, and representation.

(4)
Evaluation in mathematics teaching

4-1 Evaluation in teaching:

The process of evaluating academic achievement is associated with many problems and difficulties, which vary depending on the philosophy and purpose of measurement, whether they are: problems associated with evaluation tools such as achievement tests or problems associated with the criteria used to interpret the grade that a student obtained in a test.

When talking about evaluation, we must distinguish between three sequential processes. The first is the measurement process, which is the process that helps us describe things or people quantitatively using special tools such as a scale to measure weight, a meter to measure height, and tests to measure achievement. As for the second process, it is evaluation, which means issuing a judgment on things or people in light of the quantities that the measurement provides us with, and this judgment is in the light of a standard, touchstone, or level, such as the teacher converting his students' grades into ratings such as excellent, very good, good, acceptable, and weak. The evaluation process does not depend on measurement alone, but rather it can depend on information that we can obtain from case studies, examination of records, teachers' opinions, or interviews.

The third process is Evaluation, which includes the previous two processes in addition to determining a plan for treatment and follow-up to achieve the objectives of the course. This may require the learner to study the course again, or study some topics, or undergo training of a special type, or a special remedial program.

The concept of evaluation includes the process of issuing judgment on the value of things, people, or subjects, and in this sense, it requires the use of standards, levels, or criteria to estimate this value. It also includes the meaning of improvement, modification, or development that depends on these provisions. Accordingly, evaluation in the field of education plays an important role in the educational process, and it is one of its most important facts. Educators often say that developing assessment is the real gateway to developing education.

Evaluation is the diagnostic, therapeutic and preventive process that the teacher resorts to determine the extent of his success in achieving the educational goals he seeks. The purpose of the evaluation is to help both the student and the teacher alike in knowing the extent of their progress towards achieving their goals and trying to identify the factors that lead to or prevent students'

progress. This means that evaluation is a process aimed at diagnosis, treatment and prevention.

As for evaluation or measurement, it is the process of estimating things of unknown quantity and quality using numerical units, and measurement, despite its accuracy, only gives us a partial idea of the thing being measured because it deals with a limited aspect of it, such as (the student's weight, height, age, grade...).

As for evaluation, it gives us an honest picture of all the information and data that are related to students' progress toward its goals, whether this information is quantitative or descriptive, and whether it is by measurement, observation, or experimentation. It becomes clear to us that evaluation is more general, comprehensive, and has a broader meaning than measurement.

- Measurement: - It is the process of assigning different numbers or levels to the measured characteristic depending on the individuals and using a tool, which is the test. Example: - To measure a student's ability to solve first-degree equations with one variable, we need a tool, which is the test.

- Test: - It is an organized procedure or method to determine the student's level of achievement of information and skills in a study subject that the student has learned through his answers to a sample of questions

that represent the content of the study. That is, the test is one of the measurement tools, which is: a set of questions. Standardized and to be answered, which leads to a measurement process that is in digital form

Evaluation: It is a process subsequent to and subsequent to measurement. It is a diagnostic process that takes place in light of the information obtained from the measurement tool.

Evaluation = measurement (test) + diagnosis (evaluation) + treatment (feedback)

Evaluation: It is the process of issuing a judgment about a thing or person in light of the degree of measurement, in light of pre-determined goals, and in light of other information obtained from various sources.

Evaluation is a process that helps measure learners' achievement of academic content and indicates their progress in it. It provides the teacher with feedback on his performance and the effectiveness of his teaching. It also provides those responsible for developing the curriculum with feedback on the levels of the applied curriculum.

Feedback: It is informing the student of the result of his learning by providing him with information about the progress of his performance on an ongoing basis to help

him confirm that performance if it is moving in the right direction, or modify it if it needs to be modified.

Foundations and characteristics of educational evaluation:

1. The evaluation must be comprehensive: that is, it should pay attention to all aspects of the student's personality, including physical, psychological, and social development, in addition to his mental development.
2. That the evaluation be integrated and continuous with teaching: It is necessary that the evaluation be continuous with teaching and not disconnected from it so that the teacher can diagnose strengths and weaknesses immediately and be able to treat them.
3. The evaluation should be built on a democratic basis:

a. The evaluation should be based on freedom of thought

a. Evaluation should be based on freedom of thought: This principle requires that the student be aware of the objectives of evaluation and participate in developing an appropriate plan for it and choosing methods.

b. To be cooperative: All individuals cooperate in achieving common goals so that each individual does the best that his ability qualifies. The school, the student, and the home cooperate with each other to give their best to achieve the set goals.

c. To take into account individual differences: Attention should be to the student's progress in all personal aspects within the limits of his capabilities and not to compare him only to others, and the evaluation should be with himself and his ability to progress towards the desired goals.

d. The evaluation should be built on the basis of the scientific method by fulfilling two conditions:

• Validity: That is, the evaluation tool measures what it was designed to measure and is not affected by other factors.

• Consistency: If the tool gives the same results when used repeatedly or an equivalent image is used after a period of time.

4. The evaluation must be economic:

The economy includes three aspects: expenses, time, and effort. Evaluation tools, whether tests or other means, must be inexpensive and do not take a lot of time or effort for the teacher to prepare and correct.

Types of educational Evaluation:

1. Preliminary assessment: This is done before starting the educational process to evaluate the student's mastery of the previous requirements of the new content.

2. Formative (formative) evaluation: It is carried out several times during the educational process with the aim of developing the student's knowledge and presenting new concepts and their consistency with previous concepts in a way that ensures their construction in the learner's mind in a meaningful way through review, modification, reinforcement and feedback.

3. Final (post) evaluation: At the end of the educational process, we judge the extent to which learners have acquired new knowledge and information, and then take the appropriate decision regarding continuing, stopping, or amending it. The final evaluation answers the question: To what extent have the desired goals been achieved?

4. Follow-up evaluation: It means continuing the evaluation to determine the long-term effects of the educational process, and its application by learners in other life and educational situations. This evaluation answers the question: Is the scientific material and technology used in it employable and appropriate for the development of society in light of the ongoing developments and changes?

Exercise: Watch a secondary mathematics lesson and determine the type of assessment the teacher uses in it.

Evaluation methods:

1) School card: recording the student's conditions, environment conditions, health status, and academic progress.

2) Teachers' opinions to determine the student's progress and ability to continue learning.

3) Student reports and study and research projects required in the academic subject.

4) Achievement tests of various types.

5) Purposeful observation of student behavior in the classroom, laboratory, or arena.

6) Personal interviews, group and individual meetings.

7) Measures of tendencies and trends.

Types of achievement tests:

First: Objective tests:-

Answering this type of test does not require the student to come up with long answers, but rather relies on short answers prepared for him in advance, or completing incomplete answers with a single word or phrase, or matching answers to each other, and other important objective tests, which are:

A- Right and wrong:

A test that measures the student's ability to make the correct choice between true and false. The student is

presented with a set of statements, some of which are correct and others are incorrect. The student is asked to put a mark (true √) in front of the statement that he believes is correct, and a mark (false X) in front of the statement that he believes is incorrect. .

Conditions that must be met in the true-false test:

1. The test should include a large number of statements, no less than (50) statements. To avoid guessing, the error must be corrected.
2. The correct and incorrect answers are not arranged in an organized manner that is easy for the student to discover.
3. The number of correct statements should be approximately equal to the number of incorrect statements.
4. The phrase must contain only one idea.
5. The statement should not contain some words that are definitive or suggest an answer.

B- Multiple choice:

A test based on measuring the student's ability to answer and choose the correct answer. The test consists of two parts, the first is an incomplete statement or question, and the second is a number of possible answers and choices, one of which is the correct choice.

This type is considered one of the best types because it is more flexible and is suitable for measuring the student's ability to understand, distinguish, make sound judgment, balance, as well as achievement. This type requires skill in its preparation.

Conditions that must be met when developing this test:

1. The number of choices should not be less than four or five, so that the chance of guessing is reduced.
2. All choices must be possible from the student's point of view.
3. The question must be clear and precise, free of complexity and deception.
4. That none of the questions include an answer to a previous question.
5. It is preferable for the possible choices to be short, and it is okay for the question to be long.
6. Avoid grammatical cues that suggest the correct answer.
7. The correct answers must be irregular and distributed randomly.

C- Completion :

In this mode, the student produces the answer instead of selecting it in the multiple choice or true/false mode. In this mode, the word is in the form of a phrase that is

incomplete in its meaning and needs to add a short, complementary answer in order for the meaning to become complete.

Conditions that must be met in the completion test:

1. The space must be in place of a basic word in the phrase.
2. It is better to have one space in the sentence and not more so that the idea does not become complicated.
3. It is preferable that the length of the space be equal in all expressions.

D- Matching (pairing):

In this type of test, the student is given two separate lists of words and phrases and is asked to match each of these words or phrases in one of the two lists with those in the other list on the basis of the connection or relationship between them. The conditions that must be met in this type are:

1. All statements in the question must be homogeneous, that is, revolve around one topic.
2. It is better for the number of answers to be greater than the number of questions to reduce guessing.
3. Avoid grammatical implications of the answer, for example, the singular or plural form, or the masculine and feminine form.

4. Make sure that each statement in the first list cannot be associated with more than one answer.
5. The relationship between the phrases or words in the two lists should be strong and clear.

Advantages of objective tests:

1- It is not affected by the personal factors of the proofreader.
2- Easy to correct.
3- It is characterized by honesty and stability if it is well prepared.
4- Its inclusion of parts of the course.
5- It requires a short time to correct.
6- It measures the speed of thinking if the time factor is taken into account.
7- It is suitable for learners who are not good at expressing, presenting and arranging their ideas.
8- It removes learners' fear of tests.
9- Enables the learner to examine himself.
10- The teacher is able to diagnose the strengths and weaknesses of his students.
11- The learner feels the justice of the correction and saves the corrector from accusations of bias and fanaticism.

12- It helps learners express an opinion and pass judgment on a statement or idea.

13- It prevents the learner from circumventing, twisting, turning, and evading the answer.

14- Ease of performing statistical analysis of learners' performance or results.

15- Determine the answer in advance so that no two people disagree on it.

16- Be able to use the computer for correction.

Disadvantages of objective tests:

1- Its preparation requires a long time and high design skill.

2- Do not train the learner to use linguistic sentences and phrases.

3- Easy to cheat.

4- It allows for guesswork and coincidence.

5- Financially expensive.

6- It takes a long time to display.

7 - Not providing the learner with the opportunity to express himself.

choose a topic in secondary school mathematics and write five paragraphs for each type of objective test.

Second: Essay tests:-

It is the traditional type of test that is widely used in our schools, in which the student is asked to provide the information he has or to practice aspects of thinking according to what the test questions require, such as asking the student to explain, reason, distinguish, solve, prove, or something else.

Advantages of essay tests:

1- The student's freedom to answer, as it does not limit the student to a specific number of responses that he is asked to choose, as is the case in some objective tests, but rather releases his freedom to address the problem posed in the question.

2- Essay tests are used to evaluate goals that cannot be evaluated with objective tests, the most important of which are those goals that usually fall under the name of higher mental processes, such as the ability to analyze ideas and link them and the ability to produce new ideas (innovation), in addition to being used to evaluate the ability for written expression.

Disadvantages of essay tests:

1- Estimating answers in essay tests depends on the judgments of the grader (teacher), which are affected by contingent factors or personal factors.

2- The student's grade may be affected by his style, handwriting, and his ability to be verbal in speech. In this case, the test is not honest in measuring goals that have nothing to do with handwriting and style.

3- The test contains a small number of questions when compared to objective tests.

4- Due to the small number of questions, most of them are shrouded in ambiguity and generality.

5- One of the aspects of criticism directed at it is that correcting it requires a great deal of time and effort when compared to objective tests.

Choose a topic in secondary school mathematics and write five essay questions.

Third: Performance tests (practical tests):

Performance means what an individual does in a field that requires action, action, or achievement. Performance tests are the type of tests that aim to measure the learner's performance, skills, and action and production. Or that type of test that deals with skill requirements.

Areas of use:

Performance tests are used in a number of areas, most notably the following:

A - Scientific experiments related to science, such as dismantling, installing, and operating some devices, dissecting an animal, plant, or insect, preparing a chemical compound, or making and drawing mathematical models and geometric shapes, and so on.

B - Scientific activities related to various academic subjects, such as writing reports and research, using computers and modern tools, and so on.

D- Diagnosing delays in some practical skills.

E- Predicting the extent of an individual's future success in a particular profession, in this case standardized scientific tests are used.

F- Self-evaluation, assessment of inclinations, personality, opinion, and trends.

G- Curricula evaluation and planning.

Advantages of performance tests:

1. Direct assessment of the learner as he is in real life or as he simulates it, in which the cognitive, performance, and emotional skills are based, and thus it is characterized by its credibility.

2. An integrated evaluation that focuses on evaluating processes and outcomes.

3. It allows the learner to play a positive and effective role in researching and processing several sources.
4. It enables the learner to carry out the process of self-evaluation while carrying out a task, work, or project.
5. The learner participates with the teacher in setting performance evaluation standards and performance levels based on these standards.
6. It gives the learner and the teacher the opportunity to modify procedures and assessment tasks, based on feedback on either of them, thus encouraging the learner to reach a high level of quality.
7. It gives the learner room to defend his performance with arguments and evidence to justify it logically and practically.

Disadvantages of performance tests:

1. Constructing performance tests is more difficult than achievement tests, as they require longer to prepare and implement.
2. Ineffective, and relies on subjective judgments such that it is difficult to always trust its results.
3. The next steps are often affected if the student makes a mistake in one of the previous steps, which results in a weakness in the objectivity of measurement and evaluation.

Choose a topic in secondary school mathematics and put two questions in the practical tests.

4-2 Table of specifications for testing

Prepare a table of specifications for testing

The specifications table generally achieves the following benefits:

• Help in constructing a balanced test.

• Giving real weight to each topic of the educational content.

• Achieving content validity for the test and distributing it across the content topics with balance.

• Giving the learner confidence in the fairness of the test.

Steps to build a table of specifications

The specifications table includes two dimensions, the first is horizontal, and represents behavioral educational objectives. The second is vertical and represents the topics of the academic subject. There are some tasks that must be done before starting to build the characteristics table:

1- Determine the topics of the study subject

The specifications table can be built at the level of a study unit, or an entire educational curriculum. To do this, the curriculum is divided into educational units, the

units are divided into courses, and the lessons are divided into topics, as the topics are the smallest part.

2- Determine the relative weight of the subjects of the study

This is done by:

Calculating the number of pages for each topic or lesson in the content of the academic subject, usually represented by the textbook or subject book.

Estimating the number of teaching hours or classes in which each topic or lesson in the subject is taught.

The relative weight of each subject is calculated by dividing the number of classes or number of pages by the total number of classes or pages and multiplying the result by one hundred.

The relative weight of the importance of the topic = the number of shares of the topic / the total number of shares of the subject x 100.

3- Determine the relative weight of the objectives of the study subject

1- The behavioral educational objectives for the subjects of the study are limited within the analysis stage in the steps of instructional design.

Bloom's classification of objectives in writing the famous EDUCATIONAL OBJECTIVES TAXONOMY is

considered one of the most famous classifications in the field of identifying and defining educational objectives.
He believes that there are three domains for educational goals: the Cognitive Domain, the Affective Domain, and the Psychomotor Domain.
2- The number of objectives in one subject is determined for the subject topics that were identified in the previous step, and their weight is calculated in the same way.
The relative weight of the objectives of each subject is determined by dividing the number of objectives of each subject by the total number of objectives of the subject, and multiplying the result by one hundred.
The relative weight of the importance of subject objectives = number of subject objectives / total number of subject objectives x 100.
3- Determine the relative color of behavioral objectives at different levels using the following equation:
The relative weight of objectives at a particular level = number of objectives for the level / total number of objectives for the subject x 100.
4- Determine the number of questions
The total number of test questions is determined in light of the time available to answer, the type of questions, the age of the student, and other influential variables.

The number of questions for each subject of the study subject at each level of the objectives is determined according to the following equation:

Number of questions on the topic = the total number of questions x the relative weight of the importance of the topic x the relative weight of the objectives of the topic

Required to build a table of specifications for an educational unit in mathematics. Note that this unit consists of three main topics, which are taught in eight sessions distributed among the topics as follows: the first topic (3) lessons, the second topic (3) lessons, the third topic (2) lessons.

The unit contained (25) behavioral objectives distributed as follows: remember (8), understand (6), apply (5), analyze (3), synthesis (2), and evaluate (1).

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