Teaching physics according to David Merrill theory of equipping fifth-grade students with applied scientific skills to solve the mathematical problem

By

Ahmed Johar Mohamed Amin1
1University of Mosul / Faculty of Education for Humanities/Iraq

Ali Salim Suleiman2
2University of Tal Afar / Faculty of Basic Education/Iraq
Email: swediali@yahoo.com

Summary

The research aimed to teach physics according to the model of David Merrill in providing students of the fifth grade applied scientific with the skills of solving the mathematical problem, and to achieve the goal of the research the researcher formulated a main zero hypothesis that included three sub-hypotheses each. To verify the hypotheses of the research, an intentional sample of students of the fifth grade of applied scientific at Amer Abdullah Applied High School for Boys in Mosul was selected for the academic year (2021-2022) and its total number reached (60) students. Al-Andalus Preparatory School for Girls in Mosul for the academic year (2021-2022) has reached (66) female students of the fifth grade of applied science, and this sample was distributed among four divisions, two of which are officers and two of them are experimental by (30 males and 33 females) for the two experimental groups and (30 males, 33 females) for the two control groups, and the researcher has conducted the process of equivalence between the members of these four groups in a variable (physics degree for the fourth scientific grade). The two experimental groups were taught according to the David-Merle model in the teaching of physics The two control groups were taught according to the usual method. The research required testing the skills of solving the mathematical problem, and be in its final form of (11) questions type of specific essay The answer measures the five skills to solve the mathematical problem by three questions that measure the first skill, two questions to measure the second skill, three questions to measure the third skill, one question to measure the fourth skill and two questions to measure the fifth skill The total test was characterized by honesty and stability and lasted a full semester (11 weeks) by three classes per week to be the total of (33) classes per group, The experiment was completed on Thursday (20/1/2022) And then the Dimensional Mathematical Problem Solving Skills Test was applied, and after collecting and analyzing data statistically using binary variance analysis and Chevys test of dimensional comparisons, the results showed that there is a statistically significant difference at a level of significance. (0.05) Between the averages for the acquisition of mathematical problem-solving skills as a whole in the members of the four research groups depending on the method and gender variables, and the interaction between them and for the two experimental groups at the two teaching method variables and the interaction between them.

The search problem

Physics education has evolved globally in recent years and continues to develop radically, drawing its origins from the change in the nature of science, and the natural sciences in general have their own composition and thus distinguish them from other branches of knowledge. At the heart of this are the conceptual structures that shape scientific knowledge

and the investigative methods that scientists use in their formation and modification. Physics is particularly demanding in terms of its teaching methods and strategies and is a refinement of its activities and experiences. (Ministry of Education, 2005:42)

By teaching at the Faculty of Basic Education/University of Tal Afar and having direct contact with students in more than seven years, meeting with them and familiarizing himself with research in physics and mathematics, the researcher found considerable weaknesses in solving their mathematical problem at different levels of study. As well as his frequent visits to secondary and middle schools and his meeting with a group of teachers, physics teachers and specialists, he noted the lack of interest in solving mathematical issues in particular, which led to a decline in students' academic attainment. This is due to several reasons that have been diagnosed by studies and research locally, Arabs or foreigners The unchanged adoption of textbook issues prompted students' stereotypical thinking. From this standpoint, the researcher's sense of the problem is compatible with previous studies and recent trends in the teaching of physics. The researcher used one of the modern theories in educational design for the purpose of teaching physics, the David-Merle theory. (CDT) or micro-level component presentation theory in teaching because it focuses on cognitive content and level of performance and is up-to-date and commensurate with the evolution of physics and being a model procedure that presents the material in a sequential manner with the intent to organize the content of the subject into small molecules, each comprising concepts, facts, principles and procedures, thereby enhancing cognitive aspects and Sentimentalism and skill make the student a center of the educational process. From the above, the problem of research can be identified by the following question:

What influenced Davidmerl's theory in providing fifth graders with mathematical problem-solving skills?
The importance of research.
The process of technological and global enlightenment is important for scientific education in all its stages and is a required goal for every student. Therefore, specialists in this field and those concerned with this need to review teaching methods and methodological courses in order to achieve their fundamental objectives and to keep pace with technological progress, because technology has become an activity that shapes human thought and is mediated by the societal movement (Zeton, 2005:3)

Physics is a science that is directly related to man and his living conditions because it is a science that aims to help man understand the natural phenomena surrounding him and increases his ability to make everything measured and appreciated and thus increases his ability to benefit from them. (Quraishi, 2000:3)

Merle's theory asserts that each behavioral goal has a certain academic content and a certain level of performance, a unique set of key and secondary forms of presentation that lead to the effective and efficient achievement of the goal. Merle has developed teaching models for each type of content (true-principle-procedure) and corresponds to levels of performance (remember - application of discovery). The importance of this theory is that it classifies learning outcomes in two dimensions: type of content and level of performance Halidatapa who took a one-on-one path. This theory can adapt to the levels of support provided in teaching and provide an opportunity for students to control learning by choosing learning strategies because it takes into account individual differences. Reigelut, 1983: 331))

The importance of component presentation theory (CDT) enables more effective education because it ensures performance levels. (Remembrance-application-derivation) in

learning activities is described as a comprehensive theory that includes a set of. Four main modes of presentation have been developed (rules - *examples - remembranc*e and **practice,)** and five secondary modes of presentation are tribal requirements (*objectives - support - terms feedback, and teaching* accordingly achieves the highest levels of practical learning proficiency (Merrill, 1987:1999).

Teaching educational content, including the conceptualization of factual principles and their teaching mechanisms, is a subject that has attracted the attention of many educators and researchers, particularly the American David Merle, to the multiplicity of teaching methods and strategies. (H.E. and Youssef, 1988:58)

We can say that the interest in solving sports issues in teaching is still substandard in the Arab world and locally because students are still below the required standard. While solving issues, teachers focus only on routine issues, without regard for problem-solving strategies and skills. This has resulted in students not using the different thinking skills that they are supposed to train in. (Abu Zaniyah, 1986:85).

Mathematical problem-solving skills have the potential to understand the verbal formulation of the question, and to assimilate the physical concept. and its applications. And doing mathematical treatments and dealing with graphs and diagrams, so attention to developing those skills was a priority for training in solving the mathematical problem. (Al-Shaya, 2014:486).

In the light of the above, the importance of the present research can be illustrated as follows:
➢ This research is in line with modern objectives that employ teaching theories for the purpose of teaching physics and thus contribute to reducing the obstacles and difficulties that students experience in this subject.
➢ Inform the teacher / teacher of physics in the field of work on modern theories in teaching, including physics for that subject of importance and pumping new ideas, and work to get professors out of their use of their traditional patterns and thus benefit them and their students as well.
➢ Teaching according to David-Merle's theory may contribute to addressing various topics in physics because that theory has the possibility of addressing (facts - concepts - procedures - principles) and that physics in particular is different from other subjects it is not without all those things.
➢ It is possible to count the first research (according to the researcher's scientist) in the use of the theory of David - Merle to teach physics in the middle school

Research Objective
The current research aims to teach physics according to David-Merle's theory of equipping fifth-grade students with the skills to solve the mathematical problem and develop their serious creativity and cognitive beliefs.

Research Hypothesis
There is no statistically significant difference at the significance level (0.05) between the mean mathematical problem solving in the four research groups as a whole depending on the variables of method and sex and the interaction between them.

Research Limits
The current research may be determined by the following:
❖ Spatial Boundaries: Students of the fifth grade of applied science in the morning middle

and secondary schools in the city of Mosul for the academic year (2021-2022).

❖ Temporal Boundaries: First Semester of the Academic Year (2021-2022).

❖ Objective Limits: Chapters: (I, II, III, IV) of the physics book scheduled for the fifth grade of applied science. 7th Edition, 2019.

Defining terminology

David Merle's theory

David Merle's theory is a model procedure that presents a set of issues in a sequential manner with the aim of organizing the content of the subject at the level of small molecules, each molecule comprising concepts, principles, and educational procedures that are taught separately during a forty-five-minute semester. (Al-Abadi and Alia, 2006:45)

The solution to the problem

Defined by: - Ahmed (2015): A cognitive mental activity carried out by the learner to regulate his past experiences using the information given and appropriate mathematical laws and principles and their choices. (Ahmed, 2015:9).

Problem-solving skills:

Defined by Arafat Abu Zeina (2010): The learner's ability to perform arithmetic and solve the problem quickly, accurately and perfectly. (Abu Zeina, 2010:347).

Procedural definition of problem-solving skills:

Organized and sequenced steps performed with mastery and specific time by fifth grade applied science students, which include a mapping of the issue, the skill of standardizing units of measurement, the skill of determining the law used or reformulating as required by the question, the skill of relying on form to find a solution to the mathematical issue and the skill of dealing with the processes and numbers of the mathematical issue A mathematical problem solution prepared by the researcher for this purpose

Theoretical framework

First: David-Merle theory

One of the theories of education design is David-Merle's theory, which summarizes, identifies and explains learner performance, detailing cognitive content and matching content classification with learner performance, and also classifying presentation models. The Performance Content Matrix (CDT) represents the learning results of targets or test parameters and is classified on two dimensions: student performance as well as subject content (concept, principle, procedure, facts). (Merrill, 1996:112)

Educational goals according to David-Merle's theory

Merle set goals based on the level of performance and type of content and included three specifications (behavior condition, standard) and each of them has two fixed and variable dimensions.

1) **Condition: -** It is represented by the conditions of learners through which learning is and can be a fixed condition and may be a variable condition.

2) **Behavior:** - is the change that occurs when the behavior of learners after learning educational content for a period of time and it is divided into two dimensions, the first dimension is a fixed behavior represented by the individual's cognitive ability that the learner shows when he learns a unit of study, and another variable such as special and

specific performance shown by the learner when he learns a principle or procedure and concept and fixed behavior is as general goals while the changing behavior is a special behavioral goal that changes according to the given lesson.

3)   *Standard:* - It is the process of judging the performance of learners and indicating the extent of their progress and the quality of their permanent response speed and correctness and error, which are variable criteria and others fixed show the quality of performance. (Merrill, 1996:117).

Educational elements of the David Merle theory:

David Merle pointed out that the educational process consists of several basic elements:

- General information and mechanisms of questioning.
- Questioning Generaliries.
- Teach examples that show general information
- Test examples that relate to general information
- Availability of practice.
- Provide feedback (Druze, 2000: 49-50)

Second: Skills of solving the mathematical problem

The mathematical issue has a great role in various matters because it is the most important area of mathematical knowledge and as stated in the field of school mathematics and its standards issued by the National Council of Teachers of Mathematics in the United States. Therefore, if we want to develop the ability of learners to solve the mathematical problem, we must pay attention to the abilities of the learners themselves in relation to the mathematical issue and pay attention to solving it. (Abed, 2002: 46-47).

In the same context, Arsan and Abu Zeina point out that the sports issue has an important and great role through:

✓   Solving a mathematical problem gives training in computational skills meaning.
✓   The solution of the issue shows new knowledge and skills that learners discover.
✓   Develops the curiosity of the student and helps him in the survey of the educational material.
✓   Expanding the mathematical problem learners of important different mathematical concepts. (Bridegrooms, 2005: 64).

The mathematical issue has a great role in training in computational skills and gives it meaning, and also gives meaning to scientific concepts to become more accurate, accurate and clear and through which the laws and principles learned by students are applied in their new experiences and move them to diverse thinking patterns and develop their sense of intellectual satisfaction, which pushes them to continue and pursue their scientific activity. (Salama, 2003:108).

Problem Solving Skills

The skill represents the ability to perform motor work easily and accurately according to changing circumstances and the skill includes three important elements:

❖   Sensation element.
❖   Precision element.
❖   Time element. (Discursive, 2005: 67).

The importance of problem-solving skills

One of the important things to achieve in learning the skills of solving the mathematical problem are:

❖ Applying scientific laws and helping students to understand their concepts.
❖ Statement of natural phenomena and their interpretation by students.
❖ Develops higher mental processes in students.
❖ Develops reasoning in students.
❖ Helps students arrange, retrieve and organize information.
❖ Encourage self-confidence so that students rely on solving the issue themselves.
❖ The mathematical problem requires abilities that may exceed the students' ability to solve it and thus encourage them to have the breadth and limitations of thinking.
❖ Stimulates diverse intelligences (visual, mathematical, linguistic, natural, kinetic). (Al-Balushi, 2009: 524).

Mathematical problem-solving skills include

a) Select the data.
b) Select what you want.
c) Find the method of solution.
d) Implement the solution method. (Aloul, 2012: 104).
e)

The role of the teacher in developing the skills of solving the mathematical problem

1) Helps his students with patience and reflection and encourages them to do so
2) Encourage them to formulate the issue in their own language
3) Urges them to conjure up the necessary ideas and information that help them solve
4) Helps them draw a shape or illustrative model of the mathematical question
5) Helps them identify and access more than one way to solve
6) Helps them choose the relationships that lead to the coherence of the mathematical problem and reach a solution to it
7) Develops their spirit of teamwork and the distribution of tasks to them in solving the mathematical problem
8) Uses various and customized strategies to solve the mathematical problem and trains his students on it
9) Encourages constructive group discussion to reach diverse ideas that contribute to finding the greatest solutions to the mathematical question.   (Arifaj and Suleiman, 2010:190)

Previous studies

First: Studies on David Merles theory
Study (2016) Jalilehvand

This study was conducted in the Islamic Republic of Iran in the city of Tehran. It aimed to identify the impact of Merle's principles in the development of creativity for first-year high school students in Tehran, the study sample consisted of (52) students who were intentionally selected from the schools of the sixth district in Tehran and were distributed into two groups, the first experimental and the second controlled, as the experimental group was studied according to Merle's theory of the first and second semesters of biology, while the control group was studied in the usual way, and to achieve the goal of the study was prepared a tool consisting of the creativity test of Abdi (1993), which It contained (60) questions of three choices for four

sub-tests, namely (fluid expansion - innovation flexibility) based on the Torrance tests of creativity and scores (1 - 3 for creativity) where (1) specialized creativity (2) medium creativity (3) high creativity. After the implementation of the experiment and its performance before and after on the research sample and the analysis of its data using. Heterogeneity Analysis (ANcava) The study reached the results...

There is a statistically significant difference at a level of significance (0.05) between the nitrogen and control groups in the creativity test and for the benefit of the experimental group studied according to Merle's theory.

Second: Studies on the skills of solving the mathematical problem
Eid Study (2017)
This study was conducted in the State of Palestine by the Islamic University of Gaza. It aimed to identify the impact of two types of infographics in light of the entrance to develop the skill of solving the mathematical problem among the students of the eighth grade in Gaza. The study sample consisted of (123) female students of the eighth grade who were randomly selected. They were divided into three groups, the first experimental group studied according to the fixed pattern of the infographic, the second experimental group studied according to the moving pattern of the infographic, and the third group was the control group which was studied according to the usual method. To achieve the objective of the study, a tool was prepared to test the skills of solving the mathematical problem consisting of four skills (data identification - determination of the required - determination of the law - implementation of the solution) consisting of (30) questions distributed to the four skills. After applying the study and analyzing its data statistically using monovariance analysis, the results showed.

A.   There is a statistically significant difference at the level of significance (0.05) between the average scores of the test of mathematical problem-solving skills between the three groups and in favor of the students of the two experimental groups.
B.   There is a statistically significant difference at the level of significance (0.05) between the average scores of the test of mathematical problem-solving skills between the experimental group with a fixed pattern and the experimental group with a moving pattern and in favor of the students of the experimental group with a moving pattern.

Research Procedures:
Experimental design to achieve the objectives of the current research The researcher adopted the experimental working design (2×2) which contains two independent variables, the first is a method and two levels (model, the usual method) and the second gender (male, female) called Equivant Groups Design with two tests before and after because it is suitable for current research and achieves its goals

Identify the research community
It is necessary to know the research community in educational research so that the sample is determined later, so the current research community identified all the students of the fifth grade of applied science in the day schools in the city of Mosul numbering (2920) students for the academic year (2021-2022) distributed to the preparatory schools for boys and girls, according to the neglected facilitation letter issued by the General Directorate of Education of Nineveh and numbered (11/11/949) dated 2/11/2021, which number (89) preparatory schools for the applied branch by (38) schools Preparatory School for Girls Applied and (51) Preparatory School for Boys Applied.

Selection of the research sample

The sample is a part of the community and is the number of cases taken for the original community and through which data is collected with the intention of studying the characteristics of the original community. (Gharaiba et al., 2010: 43)

After the research community was identified, they are the students of the fifth grade of applied science. The researcher intentionally chose Al-Andalus Preparatory School for Girls and Amer Abdullah High School for Boys to carry out the experiment for the following reasons:

1. Both schools have more than three study divisions for the fifth grade of applied science
2. The administrations of these schools and their teachers have shown cooperation in providing all facilities with the researcher for the purpose of implementing the experiment and achieving its goals.
3. The geographical location of these schools is considered to have a social environment that includes all members of the community because it is one of the schools of good attraction
4. The existence of integrated laboratories, especially for physics and the possibility of benefiting from the procedures of experiments, and after the researcher was briefed on the two schools and their capabilities and the number of people in them, the researcher randomly chose two divisions from each school, thus reaching the research sample (126) students distributed among the four research groups randomly according to the variables of method and gender. The experimental group was female (33) female students, and the control group was female (33) students. While the experimental group reached males (30) students and the male control group (30 students), noting that there are no failed students in those four groups.

Group parity

The researcher conducted the equivalence of the research groups in (the degree of physics for the fourth scientific grade) and after extracting the arithmetic averages of the four research groups and standard deviations using the analysis of the single variance, the results showed the equivalence of the research groups at this variable at the level of significance (0.05) and the degree of freedom (3,122).

Experimental Design Safety Procedures

After the researcher conducted equivalence for his four research groups for a number of variables that were determined by the researcher. However, there are extraneous variables that may affect the results of the experiment on the independent variable and how it affects the dependent variables. This led the researcher to conduct a set of procedures to verify the internal and external integrity of the experimental design to give control over the influences objectively and generalize them in similar situations and as it comes

Interior safety of the design

Achieve the internal integrity of the design by making sure that the internal factors have been controlled for the experiment so that they do not have an impact on the dependent variables except that of the independent variable. (Al-Azzawi, 2008: 118)

To achieve this, the researcher conducted the following:
a) Distribution of the sample members The researcher will follow the random method in his distribution of his four research groups in terms of subjecting them to the same time period of the experiment and making equivalences between those groups in the physics

grade variable of the fourth scientific grade, as well as tribal changes

b) Concomitant accidents the researcher will prepare the procedures of the experiment and plan them in advance to reduce the impact of factors related to the conditions of the experiment or the associated incidents.

c) The researcher will make sure that the research sample of the four groups did not have the absence of students to reduce the factor of experimental extinction.

d) The researcher will use the same measuring instrument for exactly the same conditions for all four members of his research groups.

External Safety of Design

Achieving the external safety of the experimental design occurs when there is no effect of the external factors, and this is done by controlling them during the application of the experiment. (Al-Zobaie and Mohammed, 1981:100)

To achieve this, the researcher conducted the following:

a) Instructor to eliminate the effects of experimental procedures and conceal the research character of the procedures will assign the researcher/school of physics within the research sample schools to apply the experiment himself to the students of the four research groups. Through the study plans prepared by the researcher without the students feeling that they are undergoing a sample experiment, the researcher briefed the teacher/school of physics on the teaching mechanisms according to David Merle's theory through the teaching plans provided by the researcher for this purpose.

b) The physiological conditions are that the four research groups will be taught for the duration of the experiment in classrooms prepared and prepared in advance by the researcher to ensure that the four groups possess the same environmental conditions within each classroom.

c) The duration of the experiment is to ensure that the four research groups are equal to the educational content to which they are exposed.

d) Bias The weekly course schedule for physics will be arranged in agreement with the Department of Management so that the classes for the four research groups will be equal to 3 per week.

Research Requirements:

In order to achieve the goal of the research and its hypotheses, this requires the creation of requirements, namely:

1. Determination of the scientific material:

The researcher determined the educational material covered by the research, namely the chapters (first, second, third, fourth) of the textbook scheduled for the fifth grade of applied science. (Mohammed et al., 2019 As follows

➢ Chapter One (Vectors)
➢ Chapter Two (Laws of Movement)
➢ Chapter Three (Friction)
➢ Chapter IV (Balance and Resolve)

Analysis of the educational material

After the researcher determined the chapters for the educational material, the researcher analyzed the content of those chapters and extracted from them (concepts - laws - procedures - principles) and for the purpose of ascertaining their validity and conformity with what is

allocated to them, the researcher presented those matters to a group of arbitrators with experience and competence, and their opinions were compatible with what the researcher prepared on all paragraphs.

3. Formulation of behavioral purposes

Behavioral purpose is an accurate statement that describes the change required to occur in a student's behavior due to an observable and measurable learning experience. (Zeitoun, 2005: 51).

In the light of the analysis of the educational material and based on the special objectives of the teaching of physics within the classes determined by the researcher, the researcher formulated the behavioral purposes covering the scientific material and has reached (112) behavioral purposes in its initial form according to Merle's classification within the levels of (remembering - understanding - exploration) and those behavioral purposes were presented to a committee with experience and competence within the field of teaching methods, measurement and evaluation to know their views on the extent of their formulation and achievement of the objectives of the lesson and in the light of what the arbitrators came up with the behavioral purposes in their final form consist of (83) Behavioral purpose.

Search Tool

Testing the skills of solving the mathematical problem: In order to determine the skills of solving the mathematical problem, the researcher reviewed a number of tools in previous studies and did not measure what achieves the objectives of the current research, so the researcher decided to build a test of skills to solve the mathematical problem according to the following steps

A. *View the studies:* The researcher was briefed on the studies, frameworks and literature that dealt with the skills of solving the mathematical problem, including the study of Hammoud (2013), Al-Bashti (2007), Al-Shafei (2010), Juma (2015) , Al-Muqaf (2016)

B. *Determining the skills of solving the mathematical problem:*

In the light of the foregoing of these studies and literature, most of them referred to the adoption of the basic skills agreed upon by all those studies as skills to solve the mathematical problem, namely (the skill of determining the data - the skill of determining what is required - the skill of choosing the law - the skill of standardizing the units of measurement - the skill of solving the problem - the skill of applying the law - the skill of validating the solution).

Authenticity of the test:

Because of the large number of studies and literature that dealt with the skills of solving the problem and because the researcher is keen not to repeat those same skills, the researcher decided to update new skills to solve the mathematical problem in the topics of physics for the fifth grade of applied scientific which are (the skill of drawing a diagram of the mathematical problem - the skill of standardizing the units of measurement for the mathematical problem - the skill of determining the law used or reformulating it as required by the question - the skill of relying on the form to find a solution to the mathematical problem - the skill of dealing with the processes and numbers of the mathematical problem)

Apparent honesty

To verify the apparent honesty of the skills, the researcher presented skills in solving the mathematical problem in addition to that he combined two skills together and retained the rest of the skills mentioned and were all presented to a committee of experts and specialists in

the field of teaching methods as well as teachers of physics. The researcher adopted an agreement rate (80%) as a criterion for accepting the skill or not. So those five skills got that percentage, so the test now contains five skills to solve the mathematical problem, which is

1. Skill charting the question of sport.
2. The skill of standardizing units of measurement for the mathematical issue.
3. The skill of identifying or reformulating the law used as required by the question.
4. The skill of relying on form to find a solution to the mathematical problem.
5. The skill of handling processes and numbers for the mathematical issue

Authenticity of the content

The tests consist of five skills agreed upon by experts, while each skill consists of specific essay questions The answer included three questions for the first skill, two questions for the second skill, three questions for the third skill, two questions for the fourth skill, and two questions for the fifth skill. In order to achieve the truthfulness of the content, the researcher presented the test with the methodological book scheduled for the fifth grade applied scientific and behavioral purposes to a committee with experience and competence in the field of teaching methods and the researcher took a percentage (80%) or more to accept the paragraphs or not, all the questions got that percentage except for the second question of the fifth skill and therefore was deleted and the test was later characterized by the sincerity of the content

Exploratory Application and Statistical Analysis

In order to verify the psychometric characteristics of the test, the researcher applied the test to a survey sample of students of Dar es Salaam Preparatory School for Boys and Cordoba Preparatory School for Girls on Thursday 30/12/2021, and the sample consisted of (40) students of the fifth grade of applied scientific school randomly selected until the extent to which students understand the test paragraphs and determine the time it takes for this and it turns out that all the test paragraphs are clear and that the time taken for it (30) minutes.

Constructivism.... (Internal consistency)

We can call it the sincerity of the factor because through it it is clear the strength of the correlation of the scores of each field with the total score of the test as well as the degree of correlation of all the test paragraphs with the total score to which they belong. (Al-Zuba'i et al., 1981،43)

Since the test consists of five skills that include (11) questions, it has been confirmed that each score of each question is linked to the total score of the test by applying it to a sample consisting of a sample of students of Dar es Salaam Preparatory for Boys and Cordoba Preparatory School for Girls on Sunday 2/1/2022 consisting of (60) students of the fifth grade of applied scientific selected randomly and thus the correlation coefficients ranged between (0,425 – 0,868) and thus prepared the correlation coefficients statistically significant It is good when compared to the tabular value (2,002) and the degree of freedom (58). The researcher also made a correlation of the question with his skill and thus the values of the correlation coefficients ranged between (0,621 -0.876) and the results of the T test showed that it is a statistical function.

Distinguishing Strength

The researcher calculated the discriminatory strength of the questions to test the skills of solving the mathematical problem by means of a survey sample of students of Dar es Salaam Preparatory for Boys and Cordoba Preparatory School for Girls on Sunday 2/1/2022 consisting of (60) students of the fifth grade of applied scientific grade were randomly selected and the

test was applied to them and their forms were corrected and arranged descending from the highest to the lowest score and the T test was used for two independent samples and the results showed that all the test questions were values The calculated T between (3,509 – 13,512) is greater than the tabular value of (2,002) at the level of significance (0.05) and the degree of freedom (58)

Coefficient of ease

The researcher was able to extract the coefficient of ease from the data of the members of the same survey sample by applying the special equation of ease for the paragraphs of the article specified the answer and its percentage ranged between (0.36 - 0.70) and Hem acceptable values depending on the ratio spoken (0.20 - 0.80) (Samara, 1989: 109) and thus the researcher verified the ease of the questions, which are (11) questions.

Stability of the test

In order to know the stability of the test, the researcher applied the test of skills of solving the mathematical problem to a survey sample of (30) students of the fifth grade of applied science, namely students of Dar es Salaam Preparatory for Boys and Khadija Al-Kubra Preparatory School for Girls on Wednesday 5/1/2022. Their data were corrected and the researcher used the alpha-Cronbach equation to calculate the stability and the value of stability (0.83) which is good and thus the test possessed the qualities of honesty and stability in its final form consisting of five separate skills to solve the mathematical problem by three questions for the skill of drawing a diagram of the mathematical problem, two questions for the skill of standardization of units of measurement, three questions for the skill of determining the law or reformulating it as required of the question, one question for the skill of relying on form to find a solution to the mathematical problem and two questions for the skill of dealing with operations and numbers for the mathematical problem Thus, the total sum of paragraphs (questions) is (11) questions, so that the test of problem-solving skills is ready in its final form for application to the research sample.

Test correction

The test of skills to solve the mathematical problem is one of the essay tests that contain specific answers, where its scores ranged between (0 – 34) degrees so that (34) is the highest score for the test and the grades were distributed to all five skills

Procedures for applying the experiment

After the researcher has selected the research sample that will study the duration of the experiment and distribute it into four equal groups in a number of variables mentioned above. Prepare internal and external safety. As well as research tools and teaching plans according to the David-Merle model and the organization of the lesson schedule for the four research groups. The researcher assigned the teacher of physics at Amer Abdullah Applied High School for Boys and the School of Physics in Al-Andalus Preparatory School for Girls to implement the experiment starting from its first day as follows:

The researcher conducted the study in the first half of the academic year (2021-2022) where he did the experiment at Amer Abdullah Applied High School for Boys as well as Andalusia Preparatory for Girls for the four research groups and the tribal test was applied for serious creativity and the scale of cognitive beliefs.

The researcher conducted the experiment on Monday 1/11/2021 and continued until Thursday 20/1/2022 and it took time to implement the experiment. 11 weeks with three classes

per week, according to the schedule prepared in advance, so that the total of the total classes 33 classes per group. The lessons contained steps and procedures in accordance with the study plans provided by a teacher/school of physics for the pilot group and the control group in accordance with the usual method, as well as the researcher's preparation of a scheme for teaching the two pilot research groups (Male-female) According to David Merle's theory of teaching (concepts-principles-actions-facts)

Application of the research tool

After the researcher completed the experiment, the Remote Mathematical Problem Solving Skills Test was applied to the research sample members on Saturday 22/1/2022 at Amer Abdullah Applied High School for Boys and Sunday 23/1/2022 in Andalusia Preparatory for Girls.

Statistical Methods

- T test for two independent samples
- Alpha-Cronbach equation
- T test for the significance of the correlation coefficient
- One-way variance analysis test
- Test binary variance analysis with interaction
- Schiffe test for dimensional comparisons
- Pearson's equation for calculating stability

View and interpret results

There is no statistically significant difference at the level of significance (0.05) between the average acquisition of skills to solve the mathematical problem as a whole in the members of the four research groups according to the variables of method and gender, and the interaction between them" To verify this main hypothesis and its subsidiaries, the researcher extracted the arithmetic average and standard deviation of the degrees of acquisition of mathematical problem solving skills for the members of the four research groups and the results were included as in Table (1)

The arithmetic mean and standard deviation of the members of the four research groups as a whole in the acquisition of mathematical problem-solving skills

Standard deviation	SMA	N. O	Group	
2,17324	21,9667	30	Male	Experimental
2,18639	20,9697	33	Female	
2,21998	21,4444	63	Total	
1,09387	1000,17	30	Male	Control
1,99621	17,8788	33	Female	
1,66436	17,5079	63	Total	
2,98849	19,5333	60	Male	
2,59621	19,4242	66	Female	

In order to identify the difference between the averages of the four research groups, the research applied the two-way analysis of variance test, and the results were included as in Table (2).

Table (2). *results of the two-way analysis of variance for the average acquisition of mathematical problem-solving skills for members of the four groups*

Indication	F value		average sum of squares	sum of squares	Degree of freedom	Contrast sources
	Tabular	Calculated				
Significant		134,544	497,538	497,538	1	**Group**
Non significant		3,076	11,374	11,374	1	**Gender**
Significant	3,84 1-122 (0,05)	6,700	24,776	24,776	1	**Group ×gender**
			3,698	451,152	122	**Error**
				984,840	125	**Total**

Table 2 shows that the calculated F value at the group variable amounted to (134,544) The gender variable is 3,076, and the interaction between the two variables is 6,700 compared to the tabular and adult AF. (3.84) at a level of significance (0.05 degrees of freedom) 122 - 1) This means that there are statistically significant differences, thus rejecting sub-hypotheses I and III and accepting their alternatives, whereas the AF calculated in the gender variable has reached (3, 076 this means that there is no statistically significant difference depending on the gender variable, thus accepting the second sub-hypothesis and rejecting its replacement.

Results of the Chevy test of the first subtopic on teaching method:

The researcher used the Chevet test for dimensional comparisons, which is used for comparison of computational averages, whether equal or unequal in size, and we recognize the direction of differences (Al-Bayati, 2008:266).

Table (3). *Chevy Test Results for Group Arithmetic Averages*

Indication	Critical Chevy Value	Chevy calculated value	SMA	N. O	Group
Experimental	3,84	131,997	21,4444	63	Experimental
			17,5079	63	Control

Table 3 shows that Chevys calculated value (131,997) is greater than Chevys tabular value (3.84). This means that there is a difference between the average acquisition of skills in members of the pilot and control groups and in favour of the experimental. The results of this test coincided with the results of a number of studies that dealt with the use of Merle theory as a study, Jalilehvand (2016), or in which other strategies were used as a feast study (2017) and the level of performance. The members of the two experimental groups have been exposed to a holistic conception of the physical issue and to familiarization with it in terms of events, scientific level and procedures that can be used to achieve the right solution. On the other hand, the researcher believes that teaching in the Merle model makes fifth graders familiar with the scientific terminology of physics through an advanced organizer who begins with the teacher/school to review previous concepts Thus, identifying the necessary needs and requirements of students and identifying their basic needs and weaknesses in the relevant previous physical concepts of the fifth grade science curriculum, as well as thoroughly analysing the content of physical concepts, initiators, laws, language and terminology. The model also directs the physics teacher to develop key material projections enhanced by photographs and models expressing physical concepts and their connotations. The teacher in the course of this model also requires that the principle of immediate or deferred feedback be adopted and that students be helped to correct the misunderstanding generated by them as well as to help them transfer the knowledge acquired to other areas. In this direction, Merrill, 1996) noted that his theory is one of the theories of educational design, which explains, identifies and

summarizes the performance of the learner, as well as detailing the cognitive content, matching the content classification with the performance of the learner, and also classifying the presentation models. The Performance Content Matrix (CDT) represents educational outcomes of objectives and selection elements and is classified on two dimensions: student performance and subject content (concept-principle-procedure-fact) (Merrill,1996:112).

In the view of the researcher, the gradual resolution of the physical problem based on the Merle model by presenting the basic basis of the issue followed by presenting a number of examples of it, clarifying its concepts and linking it to its principles and laws has helped students with its resolution skills and knowledge of its basic requirements. As well as the distribution of tasks between the physics teacher and his or her students in forming a holistic perception of the physical issue and the appropriate strategies to solve it, the role of the teacher/school was to engage students in the exercise and training of mathematical problem-solving skills through in-class examples as well as enrichment exercises.

Results related to the Chevy test of the third sub-hypothesis on interaction between the two:
The researcher used the Chevy test for dimensional comparisons and the results were listed as table (4)

Table 4. *Results of Chevy test of the computational averages of their interaction*

ZA	ZY	TA	TY	SMA	N.O	Group
23,670*	32,024*	1,408		21,9667	30	TY
14,209*	21,211*			20,9697	33	TA
0,859				17,1000	30	ZY
				17,8788	33	ZA

Table 4 shows that the calculated values of the tele-comparisons between males and females and females compared to male and female officers were the largest tabular value (3.84). This means that there are statistically significant differences in favour of the male and female experimental groups separately. This means that there is a statistical interaction between method and gender variables.

The researcher attributes these findings to the interaction between method and gender variables in the four research groups and shows that the method had a significant role in the interaction that showed that members of the two experimental groups of males and females were able to solve physical problems appropriately. The results show that the gender variant has no influence on physical problem-solving skills. The researcher attributes this to the fact that school conditions in boys' and girls' schools are close, relying mainly on the prescribed book, leaving male and female students on a single initiation line to acquire physical problem-solving skills.

Conclusions

❖ The possibility of applying the Merle model to the teaching of physics for the fifth grade of applied science in middle and high schools in the Iraqi education system.

Recommendations

❖ Instructing the Directorate of Preparation and Training in Nineveh Education to open specialized courses for physics teachers to train them in modern teaching models, including the Merle model

❖ Emphasis on physics teachers in adopting the Merle model in teaching fifth graders

Proposals

❖ Design of a training programme based on Merle theory for physics teachers and its impact on the development of their creative teaching skills and professionalism
❖ Comparing the Merle and Raigloth models of providing fourth graders with physical concepts and developing their serious creativity

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