

The Effect Of The Prospective Guide Strategy On Multiple Mathematical Representations Among Fifth Grade Students

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Abstract

This research investigates the impact of a proactive guidance strategy on multiple mathematical representations among fifth-grade students. The study is grounded in two hypotheses: first, that there is no significant difference in achievement test scores between students taught with the proactive strategy and those taught using traditional methods; and second, that the experimental method with two equivalent groups will be employed.

The research sample consisted of 310 fifth-grade students from government primary schools in Maysan, with a focus on Al-Ashbal Primary School for Boys. From this, 72 students were selected, with Class B designated as the experimental group (30 students) and Class A as the control group (30 students) after excluding some participants. The study controlled for external factors that could influence the results.

Over a 10-week period, both groups were taught mathematics, after which a test was administered on April 20, 2025. The results, analyzed using a t-test for independent samples, indicated a statistically significant difference at the 0.05 level, favoring the experimental group that utilized the proactive guidance strategy. The findings suggest that the proactive strategy significantly enhances students' academic performance in mathematics. Consequently, the researcher advocates for the adoption of this teaching method in mathematics education to improve educational outcomes. Recommendations include revising curricula to align with global advancements and encouraging teachers to enhance the realism of learning experiences, which is vital for effective education and the holistic development of students. The study underscores the importance of innovative teaching strategies in fostering academic achievement and personal growth in learners.

Keywords: *The strategy: Proactive Guide Strategy, Multiple Mathematical Representations*

1. INTRODUCTION

1.1. Research Problem

There are a number of problems and obstacles facing students and teachers, including the prevailing traditional method of teaching the subject, the weakness in the use of mathematical representations due to students' lack of understanding of the scientific material, the difficulty of the curriculum, the failure to convey ideas correctly, the confusion between levels, and the lack of completion of the curriculum, which causes a lack of information for the learner, leading to confusion and incomplete information for subsequent levels. In addition, teachers' weakness and inadequacy in the topics of the problems in the curriculum and their failure to solve them for students due to their weakness in understanding, deducing, and interpreting the problems into data to inform the students' ideas. The circumstances of Iraqi society in recent years and the general situation worldwide have also contributed to this. This is due to the repeated closures and openings of schools over successive academic years, from the (2019-2020) academic year to the (2021-2022) academic year, due to the periods of popular demonstrations that prevailed in Iraqi governorates and the impact on schools due to the COVID-19 pandemic. This was followed by the adoption of e-learning and the resulting problems. The inability of teachers to adequately utilize appropriate methods, as well as the lack of a suitable educational environment for this type of education in Iraq, has had a significant impact on students at this educational stage.

Based on the above, the problem of the current research is the weakness of fifth-grade students in using multiple mathematical representations, which prevents them from achieving the desired goals in mathematics teaching. The researcher believes that this requires the use of modern strategies and approaches in mathematics teaching that can contribute to raising the level of achievement in mathematics for fifth-grade students.

Thus, through this research, the researcher seeks to answer the following question:

- Is there an impact of using the proactive evidence strategy on multiple mathematical representations among fifth-grade students?

1.2. Research Hypotheses

There is no statistically significant difference at the significance level (0.05) between the mean scores of students in the experimental group who studied using the proactive evidence strategy on multiple mathematical representations and students in the control group who studied using the traditional method on the achievement test.

1.3. Aims of the Study

The current research aims to identify the effect of the proactive evidence strategy on multiple mathematical representations among fifth-grade elementary school students.

1.4. Strategy

The art of using available resources and means in an optimal manner to achieve desired goals in the best possible way. This means specific methods for addressing a problem, undertaking a task, or practical approaches to achieving a specific goal. ⁽¹⁾

1.5. Proactive Evidence Strategy

A strategy used before reading to activate prior knowledge acquired in previous lessons and build curiosity about a new topic before beginning reading. Students listen to or read several statements about the basic concepts presented in the text, often organized as a series of statements that students can choose to agree or disagree with. ⁽²⁾

1.6. Mathematical Representations

Representing or translating a mathematical idea or problem in a different or new form, which helps in understanding the idea or identifying an appropriate strategy for solving the problem. ⁽³⁾

2. Materials and Methods

2.1. Research Methodology

In the current study, the researcher adopted a two-group design with partial control. In this type of experimental design, two groups are selected, one "experimental" and one "control," and equivalence is achieved between them.

2.2. Research Population:

The current research community includes all fifth-grade primary school students affiliated with the Maysan Education Directorate in the Amara District, which has 310 primary schools for the (2024\2025) academic year.

2.3. Research sample

The school included (72) students in the fifth grade of primary school, and two classes for the class, namely (A, B), with (35, 37) students in each class, respectively. The researcher chose class (B) to represent the experimental group that would study mathematics according to the proactive guide strategy, and class (A) to represent the control group that would study the same subject in the usual way. After excluding (5) students from the experimental group and (7) from the control group due to repeated absences, some of whom had failed from the previous academic year, the number of students in the two groups after exclusion became (60) students, with (30) students in the experimental group and (30) students in the control group.

2.4 Research Tools

The researcher used objective multiple-choice tests to measure Bloom's cognitive levels. The total number of multiple-choice test items (Appendix 7) consisted of (16) alternatives, (4) of which were true and (12) false, distributed over 10 questions.

2.4.1. Facial Validity:

"This is validity based on the apparent view of the test by specialists. It focuses on examining the instructions and test time, identifying and excluding inappropriate items." ⁽⁴⁾ Therefore, the researcher presented the multiple mathematical representations and behavioral objectives test items to a group of experts and specialists in general curricula and teaching methods, mathematics curricula and teaching methods, and educational and psychological sciences, as in Appendix (4), to determine the suitability of

the items for measuring the content of the material, the soundness of their construction, and the extent to which they correspond to the level of fifth-grade primary school students.

Table 1. The Apparent Validity of The Items of The Multiple Mathematical Representation Test

Significance level (0,05)	Chi-square value		Percentage	Number of arbitators			Sequence of item
	Chi-square	Value of square		Disagree	agree	total	
Significant	3.84	22	%100	0	22	22	(24,23,18,15,14,13,9,7,4,2,1) 39,38,37,36,32,31,30,28,27,26
Significant	3.84	18.182	%95	1	21		(33,21,20,17,10,8,5,3)
Significant	3.84	14.727	%90	2	20		(25,22,19,16,12,11,6)
Significant	3.84	11.636	%86	3	19		(40,35,34,29)

2.4.2. Statistical Significance

To calculate the time required to respond to the test items, and to ensure its validity in terms of its clarity and the validity of its instructions in directing students to the correct method for responding to its items, the time allocated to answer the test was (40) minutes, and this was determined by recording the exit times of the first and last students.

2.4.3. Second Survey Sample

For the purpose of statistical analysis of the test, the researcher applied the Multiple Mathematical Representations Test to a survey sample of (80) fifth-grade students at Al-Sha'baniyah Elementary School for Boys. The test was conducted on the second sample of the survey application on Sunday, November 10, 2024. The test was conducted after agreement with the school administration and the subject teacher after the students had finished studying the subject and informing the students of the date of the mathematics test a week before the specified date.

2.4.3 Sample Statistical Analysis of the Test:

The analysis of the test items provides statistical significance based on which items are either deleted, modified, or retained. Given that the test includes a set of vocabulary items, paragraphs, or questions, the characteristics of the test depend on the characteristics of its vocabulary. To develop an effective test, the vocabulary items must be carefully examined using quantitative methods for analyzing the test items. ^{(5), (6)}

A. Difficulty Factor

It is important to determine the difficulty level of each item in the Multiple Mathematical Representations Test. This indicates to the teacher how students perform on the task the item measures, and helps in understanding the overall performance level of the class on these items. The primary goal of determining the difficulty level of the item is to help identify items that may be difficult or easy for students. The difficulty of the item is expressed through the percentage of students who answered it correctly. ^{(7), (8)}

The researcher calculated the difficulty coefficient for each item in the test and found that it ranged between (0.25) and (0.79). Since a good test includes items with difficulty ratios ranging from (0.20) to (0.80), the researcher decided to retain items that fall within this range.

B. Discrimination coefficient:

This refers to the item's ability to discriminate between low- and high-performing test subjects in their responses to the item. The researcher extracted the discriminating power of each item in the test using special discrimination to distinguish items with low discriminating power and exclude them. Its value ranged, as shown in Table (10) below, for all items. According to (2023), the discrimination coefficient of an item is acceptable if its discriminating power is 20% or more. ^{(9), (10)}

The researcher calculated the discrimination coefficient of the test items and found that the discrimination coefficient of the items ranged between (20%) and (70%). (0.22 - 0.45). Therefore, the researcher decided to retain the items that fell within this range.

C. Effectiveness of false alternatives

The difficulty of a multiple-choice item depends on the degree of similarity and apparent convergence between the alternatives, which distracts a respondent who is not proficient in the subject matter from the correct answer. An incorrect alternative can be considered effective when it attracts the largest possible number of students from the lower group as the correct alternative, while at the same time attracting a small number of students from the upper group. When an alternative does not attract anyone from either the lower or upper groups, it is clearly incorrect and should be replaced from the item. ^{(11), (12)}

After applying the equation for the effectiveness of false alternatives, the researcher found that the results were negative, meaning that it attracted students from the lower group more than students from the upper group. Therefore, he decided to retain the negative results.

D. Test Reliability

Reliability is defined as the degree of consistency in measuring the trait being measured from one time to the next, even if the instrument is re-administering a number of times, or, in short, the accuracy of the measurement. ^{(13), (14)}

After transcribing the data, the researcher applied the split-half method. (Kuder-Richardson (20) to extract the reliability, as the reliability coefficient reached (0.95), and thus the test is considered good, as the test is characterized by reliability if its reliability value is (0.67) or above.

3. RESULTS

• Null Hypothesis

There is no statistically significant difference at the significance level of (0.05) between the average scores of students in the experimental group who studied using the proactive guide strategy in multiple mathematical representations and students in the control group who studied using the traditional method.

To achieve this hypothesis, the researcher resorted to using the second test (t-test) for two unequal independent samples. After applying the multiple mathematical representations test to the students of the primary sample, the scores of the experimental and control groups were monitored. The arithmetic mean of the total scores obtained by the students of the experimental group was (32.8000) with a standard deviation of (7.47594), while the arithmetic mean of the total scores obtained by the students of the control group was (28.1333) with a standard deviation of (8.45162). The calculated t-value was (2.265), which is higher than the tabular value of (2.000), and it is statistically significant in favor of the students of the experimental group at a significance level of (0.05) and a degree of freedom of (58). This means that students in the experimental group who studied using the proactive guide strategy performed better in the multiple mathematical representations test than students in the control group who studied using the traditional method. Therefore, the null hypothesis of no difference is rejected and the alternative hypothesis is accepted. The researcher attributes this to the following reasons:

1. The multiplicity of activities and exercises, their diversity in form and challenge, and their gradual increase in difficulty during the implementation of the procedural steps of the proactive guide strategy.
2. The proactive guide strategy, during the educational situation, contributed to enhancing positive participation and constructive interaction among students.
3. The proactive guide strategy contributed to developing the experimental group students' abilities to organize the solution steps in a systematic and organized manner, by focusing on how to construct solutions step by step and using various mathematical representations to illustrate each stage.
4. Students in the experimental group were the focus of the educational process, as learning proceeded based on their effectiveness and self-activity in educational activities and situations.

4. CONCLUSIONS

Based on the results of this study, the researcher reached the following conclusions:

1. The results showed that using the proactive proof strategy enhances students' understanding of various mathematical concepts and develops their ability to connect different mathematical representations (such as graphs, equations, etc.).

2. The proactive proof strategy was effective in raising the achievement level of fifth-grade students compared to the traditional method.
3. The proactive proof strategy helped students plan the steps of the solution before beginning implementation.
5. Teaching using the proactive evidence strategy leads students to sense the importance of the academic topics and their relevance to their lives. It also encourages students to enjoy studying the topics, providing them with ongoing benefits.
6. The proactive evidence strategy helped organize the learning process in a sequential, interconnected, and integrated manner. The sequential stages gave students the opportunity to use them in a way that facilitated their understanding of various mathematical representations.
7. Teaching using the proactive evidence strategy allows the teacher to gradually transition from one stage to the next in an organized and planned manner, making teaching more effective.
8. The proactive evidence strategy achieves the principle of cooperation between the teacher and students. The teacher's role in this strategy is to guide and monitor students when they work within this strategy.
9. The proactive evidence strategy can be applied in mathematics curricula due to its effectiveness. It can serve as a model for developing and designing mathematics lessons to enhance understanding and problem-solving.

5. Recommendations

Based on the results of the study, the researcher recommends the following:

1. The necessity of using the proactive evidence strategy in teaching mathematics due to its importance in achieving educational outcomes. It effectively contributes to improving the achievement level of fifth-grade primary school students.
2. Increase the Ministry of Education's and the General Directorates of Education's focus on training teachers and educators in the governorates on the optimal use of modern teaching methods and strategies, especially the proactive guide strategy, incorporating educational innovations into the teaching process, and creating motivation among learners to achieve the desired educational goals.
3. The Ministry of Education should review the current curricula and change them to align with the global scientific developments.
4. Urge primary school mathematics teachers to focus on increasing the realism of learning among students, given its impact on achieving effective learning, the goal of the educational process, and its role in building the learner's personality in its various cognitive, social, and psychological aspects, in addition to its contribution to increasing achievement, which is one of the most important goals of education.
5. Recommendation to the University of Maysan, Colleges of Basic Education, and other universities and colleges to include the teaching of the proactive guide strategy in their teacher preparation programs to ensure that graduates have a deep understanding of this strategy and how to implement it.

6. Suggestions

To expand the scope of the current study, the researcher proposes the following:

1. Conduct studies to identify the impact of using the proactive evidence strategy in mathematics on other variables such as creative thinking, decision-making, motivation, attitudes toward mathematics, and transfer of learning.
2. Conduct studies to determine the effectiveness of using the proactive evidence strategy in mathematics in other grades at the elementary, middle, and secondary levels.
3. Conduct comparative studies between the impact of the proactive evidence strategy and other instructional strategies on multiple mathematical representations at different educational levels.
4. Conduct a similar study to this one to identify the impact of the proactive evidence strategy on achievement in other subjects.
5. Develop an educational program based on two strategies: proactive evidence and another strategy in multiple mathematical representations.
5. Conduct future studies to evaluate the impact of the proactive evidence strategy in multiple mathematical representations on specific mathematical skills, such as verbal problem-solving, geometric comprehension, or mathematical reasoning ability.

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