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Extensive Remedial in Factoring Polynomials on STEM Learners: An Action Research

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| Hernando L. Bernal Jr.[1] | Renz Chester R. Gumaru[2] |

[1]*Graduate Studies, National Teachers College, City of Manila, Philippines*

[2]*Mathematics Department, Arellano University Jose Abad Santos Campus, Pasay City, Philippines*

[1]*bhambernal@gmail.com*
[2]*renzchestergumarubsmath@gmail.com*

ABSTRACT

There is a widely belief that high school students find it difficult to factor various kind of polynomials. Different ways of factoring polynomials are also highly considered in this action research. This paper chose grade 11 Science Technology Engineering and Mathematics students as respondents of the study. The study will use Extensive Remedial as the intervention for the problem. Results and Interpretation are obtained by using various appropriate statistical formulas like t-test and standard deviation. The researchers conducted this action research to verify if an extensive remedial will have a positive impact on improving the students' ability to factor different set of polynomials.

KEYWORDS

Action research; polynomials; STEM students; factoring

INTRODUCTION

A mixture of numerous terms and variables connected by addition or subtraction is called a polynomial (Bobis et al, 2023). The fundamental algebraic ability of polynomial factoring is always provide pupils with challenges. There are various techniques for factoring polynomials using techniques like the difference of perfect and common factors square, factoring through grouping, factoring using the sum product technique, and factoring using formula for quadratics. The majority of pupils get the idea of polynomials, yet frequently commit mistakes regarding other matters (Ekamornaroon et.al, 2024**).** According to a study made by Arobo, et.al, implied that if students enjoyed what they are doing in the classroom, they tend to be more engage, and when they are engage, they learned (Arobo et al, 2017). As a result, educators are discovering new traditional and unconventional methods of instruction. similar to flipped classrooms. One method that allows teachers to teach from home is the flipped classroom. as well as in school. Rather from the conventional method of instructing in a classroom and then having independent Practice with a different model at home. Flipped classrooms help students become more accustomed to with education conducted at home as opposed to typical classroom instruction from teachers. (Arbore, 2024). Using geometric models is another innovative method for teaching factoring polynomials. to help students visualize the subject. Using the results of the investigation conducted by Montecillo Jr., students were able to achieve greater scores through the usage of geometric physical models. It suggests that employing geometric physical models outperformed the conventional technique used to teach factoring polynomials. Furthermore, it was determined that the geometric physical models that were created were appropriate for people of all cerebral students (Montecello, 2021). This demonstrates why it is appropriate to let children experience to various techniques and approaches for resolving factoring polynomial difficulties.

According to a study by Ogbonnaya, which supports this, students should be provided chances to experiment with various methods for solving mathematics problems instead of

limit them to using just the tactics found in their required texts (Ogonnaya et al.,2013). In this action research, Grade 11 Science Technology Engineering Mathematics students are chosen as respondents to participate in the study. An extensive remidial was utilized to enable students to improve and enhance their skills and knowledge in factoring different kinds of polynomials using different methods and strategies. The action research aims to significantly positively affect the academic performance of students in mathematics.

Conceptual Framework

Figure 1. Research Paradigm

The data that the researchers will utilize to carry out the action research is presented in the conceptual framework above. A 10-item survey will be used to assess the grade 11 STEM students' factoring abilities for various types of polynomials. Students will first take a pre-test to gauge their current knowledge of the subject. There will be a thorough review to help students remember and refresh their memory on the various techniques for factoring various types of polynomials. The same group of students will take a post-test following the review to see whether the substantial remedial intervention had a favorable, unfavorable, or neutral impact on the scores of Grade 11 STEM students.

Theoretical Framework

Malik and Alam (2019) design theorized that Pre-test/post-test model are valuable evaluation instruments that help in the direct and useful assessment of a subject or lecture to enhance student learning. The main point of pre-test/post-test evaluation model is to measure the basic knowledge of learners at the beginning of a lecture and compare it with the knowledge absorbed after the intervention. Observing the relationship between participants' post-test scores to their pre-test scores enables us to see whether the intervention was successful in enhancing learners' knowledge of the taught subject matter.

Statement of the Problem

This action research was aimed to know if an Extensive Remedial intervention will help Grade 11 STEM students enhance their skills in solving the operation of integers. The goal of the implementation of thus action research is to answer the following questions:

1. What are the performance scores of Grade 11 STEM students in factoring polynomials according to their:
    a. Pre-test scores
    b. Post-test scores
2. Is there a significant difference between the scores of Grade 11 STEM students in their pre-test and post-test?
3. What are the effects of the Extensive Remedial intervention on the ability of Grade 11 students in terms of factoring polynomials?

Hypotheses

H_0: There is no significant difference between the performance of grade 11 STEM students in their pre-test and post-test about factoring polynomials.

H_1: There is a significant difference between the performance of grade 11 STEM students in their pre-test and post-test about factoring polynomials.

RESEARCH METHODS

The "descriptive method of research" was the research methodology employed in this study. One of the main objectives of descriptive research is to accurately and precisely characterize a population. (McCombes, 2019) defines the descriptive method as a the deliberate collection, examination, categorization, and tabulation of data. Typically, it makes use of survey questions for data collection . The researcher applied the Descriptive Method of research with the questionnaire as the main data-gathering instrument since this study focused on enhancing the skills of Grade 11 Science Technology Engineering and Mathematics students studying mathematics work with whole numbers. This approach explains and evaluates "what is. It is focused on connections or situations that already exist, prevailing customs, convictions, perspectives, ongoing procedures, impacts that are being experienced, or patterns that are evolving. Descriptive systems do more than only collect and compile data. It entails some judgment of the relevance or meaning of what is explained. The survey collects information from a sizable number of instances in a certain moment. It is focused on the generalized statistics that emerge from abstracting data. from the total number of people. Descriptive research is defined as research method that describes the description of the population or phenomenon studied. This methods focuses on the "what" concept of the research subject than the "why" concept of the research subject (Bernal et.al., 2020).

For this research study, 50 STEM (Science, Technology, Engineering, and Mathematics) Students will participate in an exam to test their proficiency factoring polynomials. The Researchers used a questionnaire with questions about factoring several polynomial types. Before the review conversation intervention, a pre-test is conducted to gauge their previous understanding. However, a post-test is administered following the completion of the review. This benefits the researchers to determine and assess the efficacy of the implemented intervention. The extensive remedial will cover all necessary methods and strategies that Grade 11 STEM students need to remember and relearn when they take their senior high school math subjects like General Mathematics, Pre – Calculus, Probability and Statistics, and Basic Calculus. Due to this extensive remedial, students will remember their past lessons about different methods of factoring different kinds of polynomials. Consequently, it is expected for students to at least improve their scores in post – test compared to their pretest after the said extensive remedial intervention. This action research aims to help students in their mastery of different ways or methods in factoring different set of polynomials.

Ethical Consideration

In the process of executing this action research, there are ethical considerations that were noted. The respondents of this study will be composed of Grade 11 STEM students who gave their agreement in participation in this study. For respondents who are underaged (below 18 years old), parental consent is collected to ensure the safety of the respondents' information and data. Furthermore, the results or scores obtained by the students for pretest and posttest will not have any particular effect on the grades of the learners chosen as respondents.

Research Instruments

The tools used to collect the necessary data are called research instruments. In a study, data is essential since it serves as the foundation for observations. The primary research tool employed by the researchers was a questionnaire, which they utilized to collect the necessary data. A 10-item factoring polynomial questionnaire will be used in this paper. The questionnaire will cover every factoring technique known to man, including factoring by grouping, factoring by sum product method, factoring by differentiating perfect squares, factoring by common factor, and factoring using the quadratic formula. Two math specialists were asked to assess the questionnaire in order to ensure the reliability and validity of the aforementioned tool. This is to strengthen the appropriateness of the 10-item questionnaire in terms of the skill level of Grade 11 Science Technology Enginnering Mathematics students.

Statistical Tools/Treatment of Data

This section demonstrates the many formulas and equations that are applied while calculating and analyzing various types of data. It also displays the correlation between the many variables that were examined in the research study.

Percentage Distribution

The fraction of the overall frequency that is equivalent to 100 is displayed using this formula. To obtain the percentage of response frequency for a certain problem, this was required.

Formula: $$\% = \frac{f}{n} x\ 100$$

Where: f – Frequency of respondents
n – Number of the total respondents

Mean

The central tendency of the grade 11 STEM students' academic performance was calculated using the mean. By adding together all of the scores and dividing it by the total number of respondents in the sample, the mean is calculated.

Formula: $$\overline{x} = \frac{\sum x_i}{n}$$

Where: $\sum x_i$ = the sum of all the scores,
n = number of scores

Standard deviation

This formula indicates how closely every example in a given set of data is clustered around the mean.

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{(n)}}$$

Where: x= ungrouped data
$\bar{x}$= mean of the data
s= Standard Deviation
n= number of measurements

T-Test

This formula is employed to determine the statistically significant variation between groups. The researchers utilize it to determine how these elements differ when compared to only two variables.

$$t = \frac{|\bar{x}_1 - \bar{x}_2|}{\sqrt{\frac{(s_1)^2}{n_1} + \frac{(s_2)^2}{n_2}}}$$

The primary statistical analysis in this action research study will be the t-test. This instrument will ascertain whether the student's performance on the pre- and post-tests differs noticeably. Furthermore, this will assess whether the review discussion intervention has any impact on the improvement and growth of grade 11 STEM students' abilities to solve problems and carry out integer operations.

RESULTS AND DISCUSSION

Grade 11 STEM Students' Performance in Factoring Polynomials

The researchers used a 10-item questionnaire about factoring polynomials to test and evaluate the skills of grade 11 Science Technology Engineering Mathematics students in performing different methods of factoring different set of polynomials.

Table 1. Performance of Grade 11 STEM Students in Factoring Polynomials Based on Their Pre – Test and Post Test

Test	Mean	No. of Students
Pre – Test	2.08	50
Post – Test	6.14	50

This study computed the mean of the scores achieved by the grade 11 STEM student respondents. There are 50 students who took the pre – test and post – test about factoring polynomials. In the pre-test, the students have a mean score of 2.08 over 10 points. Comparitively, the students perform better in post test with a mean score of 6.14 out of 10 points.

Table 2. The Difference between the Scores of Grade 11 STEM Students in Their Pretest And Posttest about Factoring Polynomials

Test	No. of Students	Mean	Standard Deviation	T	Df	P
Pre – Test	50	2.08	1.43	- 9.72	49	.0001
Post – Test	50	6.14	2.55			

Aside from mean and standard deviation, this action research also uses t test and p value to determine the significant difference between the performance of Grade 11 STEM students in their pre – test and post – test. Based on the results, the t computed value is -9.72 which can be interpreted as there is an extreme difference between the performance of the respondents during their pre – test and post – test examinations. Additionally, the p value computed .00001 is less than .01 or 1%. This implies that the extensive remedial intervention has a huge significant effect on the development and enhancement of the skills of Grade 11 STEM students in terms of performing different methods and strategies in factoring different kind of polynomials. This mirrors the output of a peper written by Kumari which concluded that remedial is a powerful tool in improving the growth of students in terms of enhancing their ability and attitude to formulate and solve mathematical problems (Kumari, 2009).

Table 3. Impact of Review Discussion Intervention on the Scores of Grade 11 Students in Factoring Polynomials According to Their Mean Scores

Test	Mean	No. Of Students	Standard Deviation
Pre – Test	2.08	50	1.43
Post – Test	6.14	50	2.55

This study computed the mean and standard deviation of the scores achieved by the Grade 11 STEM student respondents. There are 50 students who took the pre – test and post – test about factoring polynomials. In the pre-test, the students have a mean score of 2.08 over 10 points. Comparitively, the students perform better in post test with a mean score of out of 10 points. The standard deviation in pre - test is also significantly lower which implies that the spreadness of scores are more scattered during the post - test. Consequently, it can be assumed that in the pre-test, there are more students whose scores are nearly equal to the mean which is 2.08. Therefore, it can safely be concluded that the review discussion intervention has a positive effect on the enhancement and development of skills of Grade 11 STEM students in terms of solving and performing different methods of factoring different kinds of polynomials. A related study made by Barros, et.al., arrived with a similar conclusion that a creative intervention like integrating a game in teaching factoring polynomials will have a positive effect on students performance in their pre -test and post – test (Barros, et.al, 2019).

CONCLUSION

Following the results' analysis and interpretation, the researchers developed the ensuing conclusions:

1. The scores of Grade 11 students in the pre-test are less scattered than their scores in the post-test.
2. The scores of Grade 11 students in the pre-test are significantly lower than their scores in the post-test.
3. The Extensive Remedial intervention has a positive effect on developing and enhancing the skills of Grade 11 students in performing different methods of factoring different kinds of polynomials

Recommendation

Following the results' analysis and interpretation, the researchers developed the suggestions listed below:

1. Give Students pre-test examinations about pre-requisite math topics.
2. Use Extensive Remedial as an intervention in enhancing the forgotten mathematics skills of students.
3. Conduct a post-test examination on the chosen math topics that needs to be relearned.
4. In reviewing factoring polynomials, make sure that different methods are presented and explained well in order for students to apply those methods in different polynomials.

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