

Math Trail Activities and Open-Ended Approach in the Development of Problem Solving Skills in Measurement of Grade 5 Students

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ABSTRACT: This study determined the extent of Math Trail activities and Open-Ended Approach in developing the problem skills in Measurements of Grade 5 students. The researcher utilized the quasi-experimental design particularly a non-equivalent experimental to verify the problem solving skills in measurements through the utilization of Math Trail Activity and Open-Ended Approach. A total of one-hundred twenty (120) selected Grade 5 students was included as research respondents using the simple random sampling and proportionate sampling. The mean, one way ANOVA and t-test were used to analyse the data. Findings revealed that the Mean Percentage Scores of Math Trail Activities in the pre-test was 27.33 which mean Low Mastery and in the post-test was 81.25 which mean Moving towards Mastery. The Mean Percentage Scores of Open-Ended Approach in the pre-test was 33.33 which mean Low Mastery and in the post-test was 79.89 which mean Moving towards Mastery. There are seventy-two (72) or 60% of the Grade 5 students have scored between 35-65 MPS and forty-eight (48) or 40% of the students have score between 66-85 MPS. There is a significant difference between the mastery skills of students in problem solving involving measurements using the math trail and open ended approach and conceptual knowledge assessment.

Key Words: *Math Trail Activities, Open-Ended Approach, Problem Solving Skills, Measurements*

INTRODUCTION

Mathematics is a call for recognizing broad characteristics towards communication, connections, reasoning, and problem solving. A mathematics trail is a walk to discover mathematics. Math trails fit very nicely into the ideas of popularization of mathematics and of informal mathematics education that have been increasingly recognized as valuable adjuncts to improving mathematics education in the schools.

Kenderov et al. (2019) stated that the classroom is just one of the homes where education takes place. The process of acquiring information and promoting knowledge development of students occurs in many ways and in many places. The use of the surroundings as a classroom environment can foster positive attitudes and an additional motivation for the study of mathematics, allowing students to realize the applicability of mathematics and the influence of Mathematics trail.

Open-ended approach is an approach of learning which an open-ended problem is presented first and then many correct answers of it will provide experience in finding something new in the process. This can be done through combining students' own knowledge, skills, or ways of thinking that have been learned. Open-ended problems or incomplete problems are the problems formulated to have multiple correct answers and asked to focus on different methods, ways, or approaches to getting an answer (Ninomiya & Pusri, 2015).

Open tasks give a pupil various possibilities in the statement of the question and in the solving of the problem. Naturally, the open-ended approach is a kind of non-routine pedagogical learning that gives the options to the learners to design their own solutions. It is an introduction into the educational process is connected with a variety of serious problems (Ildar & Irina, 2018).

Gradually, the traditional model of face-to-face teaching and-learning has been revising. It has become more student-centered through math trail activity and open-ended approach.

In line with problem-solving process, the most widely-used strategy of teachers for the learners to learn is referred to as "chug and plug". Learners first find formulas, put the data, and accept answers come out of the calculation. This will induce learners merely memorize the process and automated skills without total understandings. When learners are taken out of the pencil-and-paper, for example, they are asked to design solutions which are related to certain daily problems given by the teacher (Hsu-Wan Chen, 2013).

As experienced, some of those perform well in regular classes may fail to do so. Part of the reason may be that their thinking is restricted to the problem-solving process frequently used in the textbook-problems. As learners encounter real problems which they are unfamiliar with, their thinking is stuck in the same way, rather than doing trial-and-error. Learners are a little bit flaccid and afraid of making mistakes. This leads them to be good problem solvers only in the textbook contexts. It is crucial to think about how to deal with these problems. Thus, learners need to develop systems of concepts which help them learn better. Learners have to broaden applications and to connect ideas across different areas of mathematics.

It has been a long tradition that elementary classes are lecture-based. Students learn only from their textbooks with repetitive practice at solving problems in such classes. In addition, most of the learners go to some tutorial canthers after regular classes at school because of parents' expectation.

With this idea, the researcher intend to promote connection with a contextualized mathematics from everyday features, walking through and analyzing the surroundings of the school, linking some of its details with exploration tasks and activity in measurements . The main purpose of the study was to construct math tasks associated to a trail outside of the classroom and open-ended approach, to foster a new attitude towards mathematics, through the observation and exploration of learners in the open area, it is an opportunity for them to formulate problems, which involves making decisions about what to consider and what to ignore in the situation under study, applying and mobilizing the personal mathematical knowledge, in a situation that is, in this particular case, realistic.

Conceptual Framework of the Study

The Mathematics Trail is a school-based activity that is conducted to expose learners in different stations with different problems to be solved. . The activity is usually conducted within the school compound, school neighbourhood, or at various parks or places of interest. The Mathematics Trail provides a good opportunity for pupils to experience the relevance of Mathematics in real life. It emphasizes skills such as estimation and hands-on activity. At the Trail, pupils will use creative thinking skills to design feasible methods of solving real-life problems. They will also employ mathematical skills to make good estimates of the measurements needed. Open-ended problems or incomplete problems are the problems formulated to have multiple correct answers and asked to focus on different methods, ways, or approaches to getting an answer. The open-ended problems were classified into three types: (1) Finding relations problems: students are asked to find some mathematical rules or relations, (2) Classifying problems: students are asked to classify according to characteristics, and (3) Measuring problems: students are asked to measure a certain phenomenon.

The Math trail and open-ended approach will be used in developing the problem solving skills in measurements of learners in Grade will be based on curriculum especially in 4th quarter. The coverage is based on the lessons such as: (1) Circumference and area of the circle, (2) Volume of Cube and rectangular prisms, (3) Area of trapezoid, square and rectangle.

The above cited concepts anchored the present undertakings of the study on math trail activities and open-ended approach in developing the problem skills in measurements of Grade 5 learners.

Figure 1 depicts the independent and dependent variables of the study. The independent variables are the two approaches such as math trail activities and open-ended approach in teaching problem solving skills. The dependent variables will serve as determinants of the development of the problem solving skills of Grade 5 students in Measurements. The dependent variables is the extent of problem solving skills in Measurement using the pre-test and post-test as well as the conceptual knowledge assessment.

The following diagram depicts how the two variables will be treated and the relationship of the independent and dependent variable.

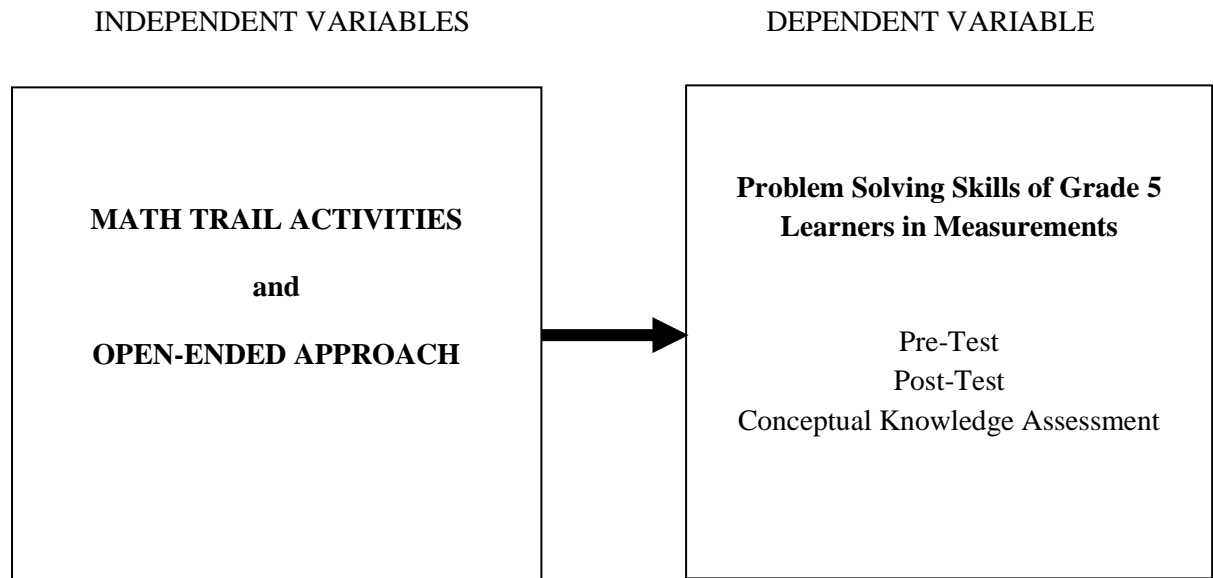


Figure 1. Research Paradigm

Statement of the Problem

This study determined the extent of Math Trail activities and open-ended approach in developing the problem skills in measurements of Grade 5 learners. Specifically, this study sought to answer the following questions:

1. What is the pre-test and post-test scores of students in problem solving skills exposed in using Math Trail Activities?
2. What is the pre-test and post-test scores of students in problem solving skills exposed in using open-ended approach?
3. To what extent is the conceptual knowledge assessment of the students in problem solving skills?
4. Is there a significant difference among the mean percentage scores of students in problem solving skills exposed in math trail and open ended approach during the pre-test?
5. Is there a significant difference among the mean percentage scores of students in problem solving skills exposed in math trail and open ended approach in the post-test?
6. Is there a significant difference among the mean percentage scores of students in problem solving skills exposed in math trail and open ended approach during the conceptual knowledge assessment?

METHODOLOGY

Research Design

The study utilized the quasi-experimental design particularly a non-equivalent experimental to verify the problem solving skills in measurements through the utilization of math trail activity and open-ended approach. It was a three-group design composed of two experimental group and one control group. Mean gain scores which was the most important data needed in the study was computed by getting the absolute difference of the pre-test and post-test scores of each group.

Locale of the Study

The study was conducted at Esperanza Central School in Esperanza District I for the school year 2019-2020. The school is biggest elementary schools in municipality of Esperanza. It has a population of 1, 865 learners. The school is offering curriculum for Special Education (SPED). It is located in the Poblacion of the municipality.

Respondents of the Study

The respondents of the study were Grade 5 learners who were exposed to math trail activities and open-ended approach exercises to develop their problem-solving skills in measurements. The respondents were selected from all sections. A total of one-hundred twenty (120) selected Grade 5 learners was included as research respondents. Table 1 presents the distribution of respondents. The table reflects that out of one hundred twenty (120) respondents, 79 are males and 41 females. Each group has the same number of learners.

Table 1. Distribution of Respondents

Groups	Male	Female	Total
I	25	15	40
II	28	12	40
II	26	14	40
Total	79	41	120

Data Collection Instrument

The quantitative data that was utilized in the study was collected and analyzed using a researcher-made test to measure the problem-solving skills of learners. The researcher-made test initially consisted of 30 items, 6 items per objectives. In the conceptual knowledge assessment test was taken from the standardized test. The items were based on Curriculum Guide of Grade 5 Mathematics during third and fourth quarters. To ensure proper distribution of the test items, Table of Specification (TOS) was prepared following the competencies for Grade 5.

In the open-ended approach, the researcher made the 15-tem test utilized during the pretest and posttests assessment. In the Math Trail Pre-test and Post-test, rubrics for scoring was used to check the outputs of the respondents. The math trail problems composed of five stations.

The research instrument went through validation process, which was the most important feature of an instrument. The items was reviewed and validated by at least 3 Mathematics Experts. After the validation process, the reliability test was conducted.

The learners' scores in the pre-test, post-test and conceptual knowledge assessment were converted into Mean Percentage Score (MPS) and dichotomously categorized, described and interpreted following the criteria adopted from National Educational Testing Research Council (NETRC). Table 2 presents the criteria.

Table 2. Students' Competence Criteria

Mean Percentage Score (MPS)	Descriptive Rating
96 – 100	Mastered
86 – 95	Closely Approximating Mastery
66 – 85	Moving Towards Mastery
35 – 65	Average Mastery
15 – 34	Low Mastery
5 – 14	Very Low Mastery
0 – 4	Absolutely No Master

Sampling Technique

This research study was employed the simple random sampling using lottery method that was utilized to identify the three (3) sections and also applied to determine the actual student-respondents. Thus, proportional sampling procedure was used to obtain the number of student-respondents per group.

Statistical Treatment

The mean along with standard deviation was used in determining the level of the pre-test and post-test for both the experimental groups. To determine the significant difference in the pre-test and post-test and conceptual knowledge assessment mean scores one-way ANOVA and t-test was used.

DISCUSSION OF RESULTS AND REFLECTION

Action research questions were categorically answered by the following tables. Systematic analysis and comprehensive interpretation for each table were presented to provide good implication and finally to seek answer to the main problem of the research.

Pre-test and Post-test Scores of students in Math Trail Activities

Table 3. Pre-test and Post-test Scores of students in Math Trail Activities

Math Trail Activities	MPS	Description
Pre –Test Assessment	27.33	Low Mastery
Post-Test Assessment	81.25	Moving Towards Mastery

Table 3 shows the results of pre-test and post-test scores of Grade 5 learners exposed to Math Trail Activities. The Mean Percentage Scores in the pre-test was 27.33 which mean Low Mastery. The MPS in the post-test was 81.25 which mean Moving towards Mastery. This finding means that the learning skills of students before the exposures Math Trail activities has lack of knowledge about the in problem solving in measurements. Yet, after their exposures to the Math Trail activities their level of Mathematics achievement in problem solving of Measurements increased. This implies that using Math Trail activities could help learners understand the problem-solving involving Measurements such as area, volume and conservation of units.

Pre-test and Post-test Scores of students in Open-Ended Approach

Table 4. Pre-test and Post-test Scores of students in Open-Ended Approach

Open Ended Approach	MPS	Description
Pre –Test Assessment	33.33	Low Mastery
Post-Test Assessment	79.89	Moving Towards Mastery

Table 4 shows the results of pre-test and post-test scores of Grade 5 students exposed in Open-ended Approach. The Mean Percentage Scores in the pre-test was 33.33 which mean Low Mastery. The MPS in the post-test was 79.89 which mean Moving towards Mastery. This finding means that the learning skills of students before the exposures Open Ended Approach has lack of knowledge about the in problem solving in measurements. Yet, after their exposures to the Open-Ended Approach their level of Mathematics achievement in problem solving of Measurements increased. This implies that using Open Ended Approach could help learners understand the problem-solving involving Measurements such as area, volume and conservation of units. The strategy could be recommended for mathematics teachers as useful in teaching Measurements.

Conceptual Knowledge Assessment of the Students in Problem Solving Skills

Table 5. Conceptual knowledge assessment of the students in problem solving skills

Mean Percentage Score (MPS)	Frequency	Percentage	Descriptive Rating
66 – 85	48	40.00%	Moving Towards Mastery
35 – 65	72	60.00%	Average Mastery
	120	100	

*MPS=60.28- Average Mastery

As shown in Table 5, there are seventy-two (72) or 60% of the Grade 5 students have scored between 35-65 MPS and forty-eight (48) or 40% of the students have score between 66-85 MPS. This means that majority of the Grade 5 students have Average Mastery during the conceptual assessment in the problem-solving involving measurements. This result is supported by the overall MPS with 60.28 which mean Average Mastery. Furthermore, findings revealed that the level of Grade 5 students exposed to Math Trail and Open-Ended Approach have high conceptual skills in measurements wherein they belong to Average and Moving towards Mastery.

Significant Difference among the Mean Percentage Scores of Students in Problem Solving Skills in the Pre-Test of Math Trail and Open-Ended Approach

Table 6. T-test Analysis on the Pre-test of Math Trail and Open-Ended Approach

Source of Variation	MPS	p-value	t-computed	t-critical	Interpretation
Pre-Test Scores	30.33	0.102	1.66	1.98	Not Significant

**= 0.05 Level of Significance*

It can be shown in Table 6 that the pre-test scores in Math Trail and Open-Ended Approach finds not significant having the t computed value of 1.66 is less than the t-critical with 0.102 probability value higher than the level of significance set at 0.05. The scores in Math Trail and Open Ended Approach of Grade 5 students shows no significant difference. This means that the result of their level of mastery and skills in solving word problems in measurements before exposing to the two approaches was almost the same. Furthermore, the Grade 5 students have low mastery in solving word problems in measurements.

Significant Difference among the Mean Percentage Scores of Students in Problem Solving Skills in Post-Test of Math Trail and Open Ended Approach

Table 7. T-test Analysis on the Post-test of Math Trail and Open Ended Approach

Source of Variation	MPS	p-value	t-computed	t-critical	Interpretation
Post-Test Scores	76.07	0.000*	14.86	1.98	Significant

**= 0.05 Level of Significant*

It can be shown in Table 7 that the post-test scores in Math Trail and Open Ended Approach finds significant having the t computed value of 14.86 is greater than the t-critical of 1.98 with probability value of .000 lower than the level of significance set at 0.05. The scores in Math Trail and Open Ended Approach of Grade 5 students shows significant difference. This means that the result of their level of mastery and skills in solving word problems in measurements after exposing to the two approaches is not the same. The mastery level of students exposed to Math Trail Activities is higher than compared to their mastery level exposed to Open Ended Approach.

Significant Difference among the Mean Percentage Scores of Students in Problem Solving Skills Exposed in Math Trail and Open Ended Approach and Conceptual Knowledge Assessment

Table 8. Analysis of Variance on the MPS of Students Using the Math Trail and Open Ended Approach and Conceptual Knowledge Assessment

Assessments	MPS	P-value	F	F-crit	Interpretation
Math Trail	81.25	0.000*	294.92	3.92	Significant
Open-ended	79.89				
Conceptual	60.28				

***=.01 Level of Significance*

It can be shown in Table 8 that all types of assessment tools gave significant increase in the Mastery skills of students in problem solving involving measurements as indicated by the p-values of 0.000 which are all less than $\alpha = 0.05$, thus there is a significant difference between the mastery skills of students in problem solving involving measurements using the math trail and open ended approach and conceptual knowledge assessment. This means that regardless of assessment method, students really learned from the teachers’ discussion in problem solving of measurements topics. This further means that math trail activities and open-ended approach were all effective in improving the mastery skills of Grade 5 students in problem solving involving measurements.

CONCLUSION/REFLECTION

Using Math Trail activities could help learners understand the problem-solving involving Measurements such as area, volume and conservation of units. The Grade 5 students exposed to Math Trail and Open-Ended Approach have high conceptual skills in measurements wherein they belong to Average and Moving towards Mastery. The mastery level of students exposed to Math Trail Activities is higher than compared to their mastery level exposed to Open Ended Approach.

RECOMMENDATION

1. The Mathematics teachers are encourage to utilize Math Trail Activities and Open-Ended Approach in teaching measurements.
2. Appropriate strategies in teaching Mathematics should be utilized in order to develop the critical and conceptual skills of the students.
3. The school should conduct training and seminars in utilizing the different teaching strategies in Mathematics.
4. Activity materials must be crafted and provided to other teachers in the district. This activity sheets are helpful in problem solving skills and the conduct of math trail activity to the learners. This would lessen the burden of teachers in making activity e to the learners.
5. Institutionalization of Math Trail in School must be encouraged to expose the students in real-life situation and hands-on activities that merely could not be experienced in the four walls of the classroom.

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