



Interactive Learning Materials During Synchronous Class Sessions: Positive Effect on Students' Performance in Mathematics

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Abstract. One of the impacts of COVID19 in the education sector is its movement to use online platform. Adjustments in the new learning and teaching environment are done and the search for appropriate learning materials and learning assessments on the online platform are continuous. There has been challenges when it comes to assessments. In learning mathematics, immediate feedback is necessary during formative assessments for constant practice that is needed in the improvement of the skills of the students. This study aimed to see the effect of utilizing the interactive learning materials during Mathematics synchronous class on students' performance that were identified to be struggling in the class. A one group quasi – experimental research that employed a pre-test post-test design was utilized. There was a dynamic interaction fuelled by the use of interactive learning materials during their online discussions. Through the findings, it showed that the use of the interactive learning material during the synchronous class could help in their performance, and there's a significant relationship between the average scores in the interactive learning materials and their performance.

Keywords: assessment for learning · assessment practices · formative assessment · interactive · mathematics instruction

1 Introduction

Last March–April 2020, when COVID19 peaked, one of the priorities for a large number of countries was the continuing education for students. In response to help in continuing the education of over 1.6 billion out of classroom students, many countries decided to move online the learning and assessments [1].

Educational technology had been popular prior to COVID19 related lock down. Online campuses were created in 1989 as another way to achievable and convenient education for people who are already working but still want to continue their learning [2]. Still, many educational institutions gone through difficulty with the move to online platforms, caused by several issues such as the lack of resources, lack of training, and lack of funds.

By the time of the preparations for the start of new school year and it was obvious that COVID19 would still be there – meaning, the online distance learning would still be

implemented, institutions had to think about measures on how to adjust in the new learning and teaching environment. One of the things that had to be considered was the assessments. Finding balance between positive learning and sustaining academic integrity can become a struggle [3]. The unusual movement towards online learning environment has led to a new phenomenon called contract cheating, described by Hill et al. [4] as students paying other people to complete their assignments, tasks, and exams. This type of cheating can take various forms and does not necessarily involve financial transactions.

When attending lectures, discussions, and working in group, students may at times feel discouraged and afraid by the lack of critical thinking or the lack of its application. Park and Lee [5] encouraged the involvement of the students in the search for the information and their engagement in the learning process by assigning tasks that need investigation of approaches and solutions. This could prevent the students from looking for support elsewhere since they were helped to become confident in their own abilities and work.

The Department of Education of Philippines included the guidelines for formative assessment strategies to promote growth and mastery which includes the providing of timely and effective feedback and engage learning in improving and assessing each other's work. It was cited in the memorandum that formative assessments, based on Christodolou (2016), should be frequent, specific, repetitive, and free from the restrictions of grading, thus it was emphasized that formative assessments should be primarily for helping the students in getting better.

Classroom interactions among teachers and students, or among students themselves, is the most common method of formative assessments. This approach provides opportunity to reveal and analyze the students' thinking, hence enabling the teachers to examine and determine room for improvements. They engage freely in such an exchange because they know that the goal is to improve their learning [6]. But during Mathematics teachers' department learning action cells and online class observations, only a few students participate in the discussion. The learners are not required to turn on their camera during synchronous classes due to internet connectivity issues making it difficult for teachers to monitor if learners are still paying attention to the class discussion. It has come to attention that there's a real challenge exercising formative assessment during synchronous class because there is a need to ensure student engagement.

This research has been conducted as a response to the need of developing formative assessments that would help educators in providing of timely and effective feedback and engage the students in learning in improving and assessing each other's work during synchronous class.

Interactive learning materials are resources that are created and designed to teach a particular learning objective [8]. They can consist of single page or multiple pages, and may include images, text, videos, self-assessment questions, and other interactive activities. Typically, they are intended for self-study and can be accessed through different online platforms. However, in this study, they were utilized during synchronous class sessions, where the materials were accessed simultaneously by all participants through video conference platform.

Interactive learning materials are developed and designed to stimulate and engage student's involvement in learning. These materials provide immediate feedback to the learners that can be viewed by the teachers in real time which can help save time and effort

both for the students and the teacher. This also promotes student engagement during the synchronous class sessions. Kaplar and colleagues [9] noted that previous studies have demonstrated the benefits of interactive learning materials and their positive impression by students. However, they also pointed out that further investigation is necessary, despite the positive overall impact.

There has been a lot of applications, software and websites that allows creating interactive learning materials. In this research, worksheets from liveworksheets.com was chosen to be utilized during the synchronous class because its free subscription allows for the creation of unlimited interactive learning material as long as it is shared with others. The Liveworksheet allows transforming a printable learning material into interactive online exercises that is also self-correcting. The interactive learning material may include videos, sounds, multiple choice, matching by joining with arrows, drag and drop exercises, and even speaking exercises, where the students will accomplish using the microphone. Learners can work on the learning material online and send to the teacher their answers. The features are good for motivating students, as well as for teachers as it saves time in retrieving and checking responses.

With the challenges and considerations on maintaining to observe formative assessment during synchronous class, the researcher thought of utilizing the interactive learning material to improve delivering Mathematics instruction online.

The basis of this study is the framework of Antoniou and James [10], in which they identified a sequence of five interconnected processes that are present in each instance of formative assessment (as shown in Fig. 1). The initial stage involves communicating expectations and criteria for success, followed by obtaining and gathering information. During this stage, the class met synchronously through video call conferences. They start exploring with interactive learning material involving the problem-solving topic for the specified day. Each student gets access to their own copy of the interactive material online. The teacher guides the students in accomplishing the interactive learning material and checks the real-time responses of the students. Upon submission, students get immediate feedback and a chance to see their scores and a summary of their work.

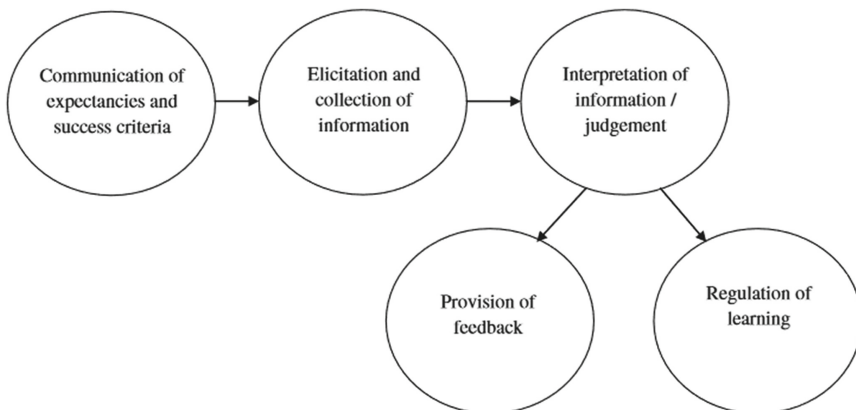


Fig. 1. Theoretical Framework for Formative Assessment

PROBLEM SOLVING #1

Salt is important in bread baking because it has a strengthening effect on the gluten in the dough and controls yeast growth. Based on the recipe, $\frac{1}{4}$ teaspoon of salt is needed for one batch of cookies. How many teaspoons of salt will be needed if you will bake 3 batches of cookies?

What are the given?

$\frac{1}{4}$ teaspoon of salt for one batch of cookies
Make 3 batches of cookies

What is asked?

How many teaspoons of salt will be needed if you will bake 3 batches of cookies.

What is plan?

What operation to be used? Multiplication

Form an equation: $\frac{3}{4} \times 3 = 7$ teaspoon of salt for 3 batches of cookies

Solve:

Final Answer (use improper fraction)
 $\frac{9}{4}$ teaspoon of salt for 3 batches of cookies.

REMEMBER Rules in Division of Fractions

Invert the fraction that you are dividing by: $\frac{4}{5} \div \frac{2}{3} = \frac{4}{5} \times \frac{3}{2}$

Multiply the numerators and denominators: $\frac{4}{5} \times \frac{3}{2} = \frac{12}{10}$

Simplify the fraction if necessary: $\frac{12}{10} = 1\frac{1}{5}$

DIVISION OF FRACTIONS

Rewrite the fractions then drag the correct answer in the yellow box.

1. $\frac{2}{3} \div \frac{4}{9} \Rightarrow \frac{2}{3} \times \frac{9}{4} = \frac{3}{2}$ (reciprocal)

2. $\frac{5}{3} \div \frac{3}{2} \Rightarrow \frac{5}{3} \times \frac{2}{3} = \frac{10}{9}$ (reciprocal)

3. $\frac{9}{4} \div \frac{1}{4} \Rightarrow \frac{9}{4} \times \frac{4}{1} = 9$ (reciprocal)

4. $\frac{10}{7} \div \frac{5}{14} \Rightarrow \frac{10}{7} \times \frac{14}{5} = \frac{5}{1}$ (reciprocal)

5. $\frac{5}{7} \div 7 \Rightarrow \frac{5}{7} \times \frac{1}{7} = \frac{5}{49}$ (reciprocal)

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Fig. 2. Sample of accomplished interactive learning materials used during synchronous class

The third part is interpretation of information/judgement, followed by providing feedback. Finally, taking action/regulation of learning is conducted to close the sequence of process. The teacher gets to see all the responses and can immediately identify as to what needs further discussion or explanation without the need of asking all the learners one by one. Interactive learning materials can be set up to allow multiple submissions, which was utilized by the teacher on letting the students go through their work and investigate what they did correctly and what could be done to make it better. They go through the lesson and discuss based on the results of their accomplished interactive learning material, as exemplified by Fig. 2.

This research aimed to determine the effects of the use of interactive learning materials on students' performance in mathematics.

Specifically, it attempted to answer the following questions:

1. What is the mean score performance of students in pretest and posttest?
2. Is there a significant difference in the student performance before and after the implementation of the interactive material in their synchronous class session?
3. Is there a significant relationship between the average scores of the interactive learning material accomplished during synchronous class to the student performance?

2 Methods

This study used a one group quasi-experimental research approach comparing pre and post-test scores. The reason for choosing this experimental method was its suitability to establish the effect of a specific variable on another variable. Furthermore, such method fits the objective of the study, namely to discover how interactive learning materials affected the students' performance and availability during synchronous class sessions.

The sample initially consists of 36 Grade 7 and Grade 8 students selected and identified by their Mathematics teachers as struggling learners that needed help to improve their basic numeracy skills. Purposive sampling method was decided since they were the only available students for remedial class.

A researcher developed the interactive learning materials covering the following topics:

- 1) Addition and Subtraction of Integers integrated into Money Problem;
- 2) Multiplication and Division of Integers integrated into Conversion of Length, Mass, Weight;
- 3) Addition & Subtraction of Rational Numbers integrated into Basic Work Problem; and.
- 4) Multiplication and Division of Rational Numbers integrated into Conversion of Capacity.

During the synchronous class through video call conference, the teacher utilized the interactive learning material. The students get to have their own online copy of the interactive material for the specific topic of the day. During discussion, they accomplish the interactive learning material. The teacher receives the result in real-time and uses it as guide on how the discussion will be – what needs further explanation, or needs emphasis. After they go through what worked and what they could do to improve, the teacher let the students answer the interactive learning materials again.

The researcher-made pretest and posttest were digitized through google form and administered synchronously via video call conference. The gathered data from pretest and posttest were summarized by mean and standard deviation.

To be able to measure the effectiveness of the utilization of the interactive learning material during the synchronous class session in the performance of the identified Grade 7 and Grade 8 struggling students, pretest and posttest were treated with paired sample t-test.

Average scores of the interactive learning material accomplished during synchronous class was collected then a correlation analysis was done to see if it has a significant relation to student performance.

3 Results and Discussion

During the implementation, the sample was down to 24 participants due to various factors such as a limited internet connection and could not attend on the synchronous class schedule due to other responsibilities at their home.

Analysis and interpretation of the gathered data were summarized in the following tables:

Table 1 shows the pretest and posttest scores of the 24 respondents on a 25-item test. The pretest had a mean score of 9.04 with a standard deviation of 3.64, while in the posttest, the mean score was 11.17 with a standard deviation of 3.05.

Table 2 above reveals the comparison of the computed means of the pre-test and posttest scores of the students. As shown, the computed t-value is 2.579 with p-value of 0.017. Since the p-value is less than 0.05, the null hypothesis that there is no significant

Table 1. Pre-test and Post-test scores of participants on a 25-item test.

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 POSTTEST	11.17	24	3.0456	.6217
PRETEST	9.04	24	3.6413	.7433

Table 2. Test of difference of the pre-test and post-test scores.

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 POSTTEST-PRETEST	2.12500	4.03584	.82381	.42081	3.82919	2.579	23	.017

difference in the pre-test and posttest scores is rejected. The result further suggests based on the computed means, that the posttest mean score is significantly greater than the pre-test-score. This result implies that the use of interactive learning materials during synchronous class sessions significantly improves students' learning in Mathematics.

The p-value denoted by "Sig. (2-tailed)" for the Posttest and Pretest is 0.017. So, if the population means are equal, there's a 1.7% chance of finding this result. Therefore, reject the null hypothesis. Thus, there is a significant difference between the means of Posttest and Pretest, $t(23) = 2.579$, $p = 0.017$.

A Pearson correlation coefficient was computed to assess the relationship between the Average scores of the Interactive Learning Materials accomplished during synchronous class and the posttest scores.

Table 3. Relationship between the Average Score of the Interactive Learning Material Accomplished During Synchronous Class and Posttest.

		Activity	Posttest
Interactive Learning Material Activities	Pearson Correlation	1	.846**
	Sig. (2-tailed)		.000
	N	24	24
Posttest	Pearson Correlation	.846**	1
	Sig. (2-tailed)	.000	
	N	24	24

**, Correlation is significant at the 0.01 level (2-tailed).

Table 3 shows that there was a positive correlation between the two variables, $r = 0.846$, $N = 24$; and there was a significant relationship ($p = 0.000$) between the average scores of the interactive learning material accomplished during synchronous class to the student performance.

4 Conclusion

In this study, the utilization of the interactive learning material during the synchronous class session was explored. Based on the findings, this could be an effective intervention to the formative assessment during the synchronous class leading to a better mathematical performance of the learners. Aside from being able to get immediate results and feedback, it also helped in keeping the learners interacting with the class discussion even on a virtual class setup. Students participated and had self-confidence during their Math online classes which contributes to the mathematics learning achievement of the learners [10].

There was a significant relationship between the average scores in the interactive learning material accomplished during the synchronous class and the posttest based on the data. It shows that the use of interactive learning materials during synchronous class improves student's performance. This could be from ensuring a dynamic interaction during the discussion, wherein the students have the liberty to answer again the interactive learning material or directly join in the oral discussion of their class on the ways how to improve their work.

It is recommended to conduct a more detailed study to further understand and have insight into the students' understanding of the material and reasoning. The study was done during pandemic wherein classes were held through an online distance learning. The participants were struggling learners selected to take remedial class but due to various factors some learners were not able to participate on the said study who were given printed modules to work on instead. Further research could include what happens when virtual interactive materials are used with students versus non-virtual interactive materials. Having a larger scale of participants should also be considered. Moreover, more specific study could be done to see other effects of utilizing interactive learning materials in classes.

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