European Online Journal of Natural and Social Sciences 2022;
Vol.11, No 4 (s) Special Issue on Hybridity in the New Reality
ISSN 1805-3602

Teachers' Responsiveness to Students' Needs in Solving Mathematical Problems under Modular Distance Modality

John Edward A. Combo[1*], Manny A. Esguerra[2], Zenaida Q. Reyes[3]
[1]Maximo L. Gatlabayan Memorial National High School, Antipolo City, Rizal, Philippines; [2]Gen. Emilio Aguinaldo National High School, Imus City, Cavite, Philippines; [1,2,3]Philippine Normal University, Manila, Philippines
[*]combo.jea@pnu.edu.ph

Abstract

This qualitative study explored teachers' responsiveness to students' needs in learning mathematical problem-solving under Printed Modular Distance (PMDL) modality. Mathematics teachers' responsiveness refers to awareness and disposition to attend to and provide an appropriate response based on students' needs. The participants of this study were 20 teachers, comprised of both junior high school and senior high school teachers, who are teaching in two (2) of the public schools in Imus City, Cavite, and Antipolo City, Rizal, respectively. The participants were purposively selected since they handled mathematics subjects under the PMDL modality for the school year 2021-2022. For the data analysis, the audio record, as well as the field notes, were transcribed into words and then examined by looking for indications of categories and different codes. It was concluded that despite the challenges in the new modality, teachers continue to respond and find ways to address the needs of students and that their awareness guides them on how they respond to and address these needs of the students in solving mathematical problems under modular distance learning. These findings were used as a basis for crafting an action plan to better support teachers in implementing responsive instructions to students under modular distance learning.

Keywords: teachers' responsiveness; distance learning; modular modality; problem solving; action plan

Introduction

Mathematics is a subject that comprises not only basic concepts and theories but also its application to real-life situations. This application is usually in the form of problem-solving, where it necessitates learners to think more critically and to analyze situations that likewise involve other mathematical concepts. Problem-solving plays a very significant role in mathematics education; thus, making it the center of the discussion develops the higher-level thinking skills of every learner, which subsequently allows them to perform the problem-solving processes through self-learning (Ersoy, 2016). In essence, this skill helps the learners solve problems they experience on a day-to-day basis with the application of the other mathematical skills they were able to master (Osman *et al*., 2018). However, due to the shift of the modality that concomitantly limits teacher-student interactions, the development of the aforementioned skill is evidently compromised.

The outbreak of the Covid-19 pandemic was one of the most remarkable events in the history of mankind that had affected not only the health sector but, more significantly, the education sector. Individual and social threats were brought about by this kind of disease that entirely reshaped how people live (Bayram, 2020). In this regard, administrators, schools, and even teachers have resorted to certain alternatives just to ensure that education will undoubtedly continue. It is undeniable that everything in the transition phase happened abruptly, whereas some anticipated challenges that were part or even not part of the Learning Continuity Plans (LCP) had occurred along the way. The sudden shift from usual face-to-face education to various distance learning modalities yielded issues

that are primarily on maintaining the quality of education and pedagogy, including the utilization of technologies and other print or non-print resources (Budnyk *et al*., 2021).

Considering the emergence of problems and challenges during the implementation of the Printed Modular Distance Learning (PMDL) modality – one of the most popular and preferred modalities in Philippine education (Pe Dangle & Sumaoang, 2020 & Statista Research Department, 2021) – is inevitable, solutions to it should just be made instead. Further, both teachers and learners were forced to elevate their respective homes into a new learning environment, whereas different experiences and challenges were determined and emphasized through various media (Pe Dangle & Sumaoang, 2020). In addition, this transition impacted the mathematics subjects, specifically the development of students' problem-solving skills. Compared with simply learning the key concepts, applying and solving mathematical problems is found to be way harder to achieve if it is learned through PMDL since it requires an in-depth understanding of the processes and key concepts (Esguerra & Combo, 2021). Teachers are the ones who are directly involved in this process which means that the action to solve the identified problems will depend on how they would respond to it.

All effective instructions are enabled by teachers' responsiveness to students' mathematical needs. The responsiveness of mathematics teachers in this regard is their awareness and disposition to attend to and provide an appropriate response based on students' needs (Gehrtz, 2019). There have been limited studies that empirically looked at responsive teaching in the classroom; nevertheless, there are a number of research areas that focused on investigating this aspect in terms of teacher practice. It gained attention in the educational literature during the last few decades (Ball, 1993; Hammer, 1997; Lampert, 1990; Levin, 2008; Pierson, 2008; Ruiz-Primo & Furtak, 2007). It has been proven that instructional approaches that are responsive to students' thinking are helpful for student learning, improving conceptual understandings (Carpenter, Fennema, Peterson, Chiang, & Loef, 1989), promoting student agency and voice (Coffey, Hammer, Levin, & Grant, 2011), and promoting equitable participation (Empson, 2003; Robertson, Scherr, & Hammer, 2016). In the study of Robertson *et al*. (2016), teachers who display high levels of responsiveness stimulate and enquire into students' cognitive needs and highlight student ideas, whereas teachers who demonstrate low levels of responsiveness only evaluate these needs. Moreover, although both new and experienced teachers have proved that they are capable of attending to and responding to student needs, studies have shown that this practice takes time to acquire (Fennema *et al*., 1996; Jacobs, Lamb, & Philipp, 2010; Levin, Hammer, & Coffey, 2009).

It is essential for educational researchers to become fully aware of and communicate how teachers exhibit their responsiveness to their students in various ways to support mathematics educators in demonstrating and becoming more responsive. However, empirical research in this area is limited, particularly in mathematics teaching. One source of this limitation is a lack of appropriate techniques for identifying teachers' responsiveness in this discipline. It appears imperative that researchers' work must focus on characterizing mathematics teacher responsiveness. Thus, this study will primarily explore how teachers exhibit their responsiveness to students' needs in learning mathematical problem-solving under modular distance modality. By better understanding how teachers with a variety of experiences and perspectives enact responsiveness, it can gain a more thorough understanding of the responsiveness itself. More so, the results of this qualitative study will serve as a basis for crafting an action plan to better support teachers in their implementation of responsive instructions to students under modular distance learning which will be advantageous to both ends since it will ensure that quality education is still upheld despite the continuous aggravation of the pandemic.

This study made an assumption that all effective instructions in mathematics are enabled by teachers' responsiveness to students' mathematical needs. The shift of teaching modality from face-to-face to distance teaching approaches widened teachers' responsiveness toward the needs of their students. Under modular distance learning, the learners become independent to where different learning needs arise, particularly when they solve mathematical problems to which the teachers need to respond. The responsiveness of mathematics teachers in this regard is their awareness and disposition to attend to and provide an appropriate response based on students' needs (Gehrtz, 2019). Awareness and attending to students' needs are the two constructs that comprise teachers' responsiveness. According to Smith (2018), awareness is described as a teacher's knowledge, sensitivity, and recognition of students' needs which can allow the teacher to adequately prepare themselves for modification of pedagogy and instruction. On the other hand, Przybyla-Kuchek, Hardison, and Bishop (2016) explained that attending is the teachers' move that exhibits the range to which students' needs are taken up for instruction.

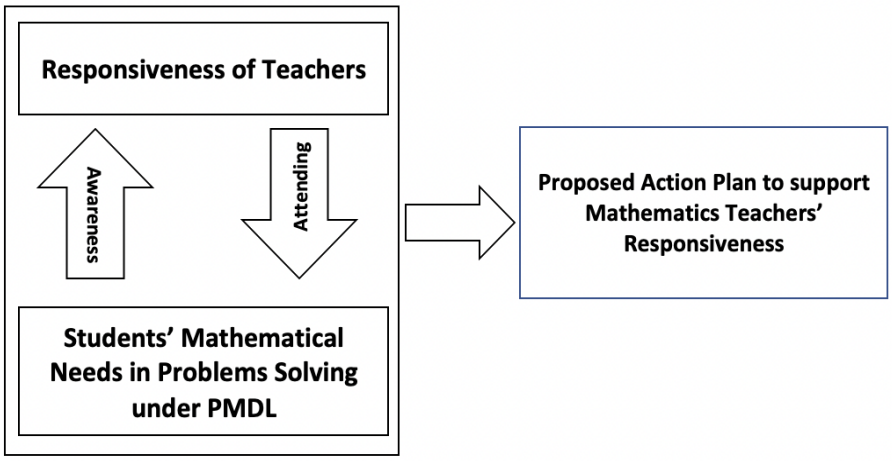

Figure 1: Framework of the Study Anchored with Gehrtz's Concept of Teachers' Responsiveness

Figure 1 depicts the framework of the study, illustrating Gehrtz's concept of teachers' responsiveness being the central concept for this research. From the framework, it can also be gleaned that these emerged teacher enactments and challenges in exhibiting responsiveness to students' needs in solving mathematical problems under modular distance modality guided the study to formulate a proposal to provide assistance to teachers in enacting responsiveness to students under modular distance learning.

Thus, this study explored teachers' responsiveness to students' needs in solving mathematical problems under modular distance modality. Specifically, this study sought answers to the following questions:

1. How do mathematics teachers exhibit responsiveness to student needs in solving mathematical problems under modular distance modality?
2. What are the challenges experienced by mathematics teachers in exhibiting responsiveness to student needs in solving mathematical problems under modular distance modality?
3. What action plans can be made to support the mathematics teachers' responsiveness to students' needs in solving mathematical problems under modular distance modality?

Materials and Methods

According to Creswell (1994), qualitative analysis is an inquiry process based on building a complex, holistic picture formed with words reporting detailed views of informants and conducted in a natural setting. As its purpose, the study sought to explore teachers' responsiveness to students' needs in solving mathematical problems under modular distance modality. The researchers believed in the importance of teachers' voices; therefore, a qualitative approach is suitable for the study, particularly narrative analysis. Narrative analysis is an approach that seeks to stimulate the telling of stories about the lives or events around the participants (Brymann, 2008).

The study utilized a focus group discussion (FGD) which is one of the major qualitative methods to gather data from the participants. In order to approximate their experiences in exhibiting responsiveness and the challenges they encountered, the teachers were asked the FGD guide questions formulated by the researchers. The FGD session was recorded using a digital audio recorder to provide a permanent record which allowed the researcher for repeated analysis and scrutiny of the data. It lasted at most 30 minutes per group. Follow-up questioning and necessary clarifications were done via phone conversations, or if possible, a second face-to-face interview was established.

The study was conducted at two (2) public schools located in Imus City, Cavite, and Antipolo City, Rizal, where the researchers are currently teaching Mathematics. Purposive sampling was used to select 20 teachers comprising both junior high school and senior high school teachers. They were chosen purposively as they are handling printed modular students during the school year 2021-2022. As the study involves the participation of individual teachers, potential ethical issues were addressed before conducting the research. Permission to complete the study was requested from the respective school principals through formal letters. Also, informed consent forms were given to participants explaining the research procedure, particularly the audio recording of the interview.

For the analysis of the data collected, the audio record, as well as the field notes, were immediately and accurately transcribed into words and stored in a word processing program to be analyzed qualitatively. It was then examined by looking for indications of categories. For each category, the researchers gave codes on them, and after several read-throughs, the codes were developed into a name with corresponding definitions to answer the research problems.

Results and Discussions

The aim of this study is to explore how the teachers exhibit responsiveness to the identified needs of the students in terms of mathematical problem-solving skills under the PMDL modality. After conducting an in-depth analysis of the responses shared by the participants during the FGD, several themes were generated. These themes were formulated, defined, and supported by some of the statements of the participants, as shown in Table 1 and Table 2. The analysis of the responses revealed several themes that all boiled down to how the teachers will be more aware of the students' needs and how they should respond to them.

Teachers' Responsiveness to Students' Needs in Learning Mathematical Problem-Solving under Modular Distance Modality

One of the things that the teachers believed to be an effective way to help them to be aware of the students' mathematical needs is by ensuring that communication with the students, regardless of the platform, will remain uninterrupted. One of the participants said, *"I am becoming aware of it by constantly checking on them through group chats, text messaging, or even by calling them."* (*Nalalaman ko 'to sa pamamagitan ng pangungumusta sa kanila sa group chat namin o kaya thru text messaging o tawag sa telepono*). Another teacher-participant confirmed by stating, *"How do I make sure that I know my students' needs? I get to communicate and ask them what is the problem and*

what hinders them from hitting the targeted objectives. We have online communication thru Facebook and Messenger, some reach out via calls or text messaging, and there is also number of parents and teachers stating their concerns in person every week during the retrieval and distribution." This concept is reflected in the study of Alshaboul, et. al. (2021) as they discussed the idea of Holmberg (1989), which signifies that the success of distance education is characterized by undisturbed communication between the teacher and learners.

Table 1. Generated Themes and Theme Definitions on Teachers' Responsiveness to Students' Needs

Generated Theme	Theme Definition
1. Constant communication with the learners through online/social platforms and other conferences.	This generated theme refers to continuous communication between the teachers and learners in any way possible (through chat, text, parents/guardians).
2. Immediate checking of learners' outputs and giving them timely feedback	One of the tasks of a teacher is to check and provide feedback to the outputs of the learners. Hence, this theme shows how significant feedbacking is when it comes to assessing and identifying students' needs.
3. Involving parents/guardians in the process	Provided that the utilized modality of the school limits the student-teacher interactions, thus, parental involvement indeed plays a very vital role in delivering not only the instructions and feedback but also students' needs.
4. Encouraging students to give personal reflections on the lessons about problem-solving	Through personal reflections, the students will be able to share their thoughts, experiences, and challenges that they encounter as they answer their self-learning modules.
5. Allowing students to ask questions through online platforms	Online platforms like messenger and email allow the students to inform their teachers with regard to the questions they have as they do the activities that are provided for them.
6. Limited student-teacher interactions should not hinder the process of identifying students' learning needs in problem-solving	As identified by some research, students who are enrolled under the PMDL modality experience problems in terms of learning the subjects. Moreover, identifying these needs is never easy due to very limited teacher-students' interactions.
7. Students should be familiar with the problem-solving processes.	Familiarization with the basic processes of solving mathematical problems is one of the things that teachers should ensure if they would really want to promote independent learning. Having this done, the students be able to accomplish their tasks accordingly even if the assistance that teachers give is very limited.
8. Strengthening students' know-	This theme implies that understanding of the basic ma-

ledge of the basic mathematical concepts as it affects their comprehension of the other topics	thematical concepts is a significant factor that affects how students continuously learn especially when it comes to problem-solving since it is the application of different skills more so it requires collaborative learnings from previous discussions.
9. Providing teacher-made material which provide a thorough problem-solving discussion	By giving other examples through teacher-made materials, the learners are able to fully understand the situations presented in the problem-solving activities.

Communication itself is not only limited to speaking but also entails the ability to express oneself through writing. The majority of the teachers were also able to determine the areas of opportunities for the learners even though they did not have the luxury of an internet connection. The teachers made sure that they would read their students' journals, end-of-quarter reflections, and the most common one, checking their students' outputs as immediately as possible. Through this, the teachers will be able to assess the learners individually and focus on their needs based on the assessments' results and the insights they narrated in their journals. For instance, one teacher said, *"Checking students' outputs and answers immediately is the main way to be aware of these problem-solving needs. There were only few of them who are solving hitting the standards and having the proper procedures and answers. Bigger percentage of students have erroneous tries and there are few who did not answer at all."*

Parents' participation in the implementation of distance education is considered vital for success. In order for the teachers to determine the academic needs of the learners, parents should be cooperative, and they should also help in motivating their children to study the lessons (Bayram, 2021). During the interview, one participant explained, *"I ask the parents every time they go to school to get the modules and have feedback on their output."* Through this, the teachers will be able to send differentiated instructions to the learners when it comes to problem-solving. More so, the parents will inform the teachers what specific part of the lessons their children have difficulties with.

The Department of Education (DepEd), through its memorandum released last July 2020, defined MDL as *"...a learning delivery that is in the form of individualized instruction where learners use self-learning modules in print or digital format, whichever is applicable in the context of the learner, with the guidance of any member of the family or other stakeholder in the community trained to serve as para-teachers or learning facilitators."* (p 6). However, this concept of MDL does not only limit student-teacher interaction through printed or digitized learning materials, especially if the students have queries with regard to the lessons on problem-solving that need to be answered right away. Hereof, the function of social media or any other online platform became a beneficial tool to make this process possible. This was verified when a teacher said, *"This is difficult. Direct messages (through Facebook) are the best method I employ during these times."* Another teacher also mentioned, *"by asking if they have questions in the lesson through chat."* The students used online platforms to seek help from their teachers to help them fully understand how problem-solving should be done correctly.

After conducting the interview with the mathematics teachers, one of the significant generalizations that emerged is that identifying the needs of the students in problem-solving is difficult. Most of the interviewees cited that it is because of the modality that they employ. It hinders them from conducting the usual assessment method, which allows them to monitor their learners' progress

closely. One teacher said, *"Yes. It was very hard for me because I did not have a direct contact with my students since not all of them have internet connections." (Oo naging mahirap ito sa akin dahil wala akong direktang ugnayan sa mga bata at hindi lahat ng mag aaral ay may internet o gadget na nagagamit.)* Since the teachers do not have the opportunity to closely monitor and give real-time feedback to the learners, the dilemma of 'who and how the learners did the activities is one of the areas of concern.

Tambychik and Meerah (2010) emphasized in their study that having insufficient mathematics skills may cause difficulties in problem-solving, for it requires the application and integration of various mathematical concepts and skills, especially in decision-making and cognitive processes. This construct supported the generated themes that are focused on students' familiarity with the problem-solving processes as well the significance of strengthening students' knowledge of basic mathematical skills. The mathematics teachers unanimously agreed that these two things are essential for the students when it comes to learning problem-solving-related activities. One teacher explained, *"Actually, what the students need is to be familiarized with the basic math so that they can easily analyze or comprehend the problem solving and also, they must practice and be patient in answering more problem-solving in math." A similar* response elicited when a teacher said, *"They do not solve in step-by-step way of solving math problem solving."* The distance may be an issue; however, if the provided learners' materials are considered self-learning, then the students will still be able to follow the instructions as long as they are familiar with the processes and have the necessary basic mathematical knowledge. A teacher responded during the interview, *"One of which is lack of understanding of basic concepts. Students nowadays lack focus due to the influence of social media and online games. They answer problems impulsively because they are in a hurry for doing other things (social media) or in the case of working students, they need to prioritize their work over the module."* Meanwhile, to give solutions to the problems that exist due to difficulties in comprehending the problem itself, some teachers crafted teacher-made materials containing contextualized sample problems and shared them with their students. This was confirmed when the teacher-participant said, *"If I notice that my students do not understand the examples from the modules, I create contextualized examples and share it to them."* Similarly, *"I give more examples. Sometimes, I make it easier in order for them to fully understand the concepts." (Nagbibigay ako ng ibang examples. Minsan mas pinapadali ko para mas mabilis nilang maintindihan.)* as mentioned by another teacher during the interview. Through this, the students could understand the problems since most of them were presented in such a way that they could relate to them.

Challenges Experienced by Mathematics Teachers in Exhibiting Responsiveness to Student Needs in Learning Mathematical Problem-Solving under Modular Distance Modality

The thematic analysis also highlighted the challenges experienced by the mathematics teachers to respond to the needs of students in solving mathematical problems under modular distance learning. These teachers particularly articulated the difficulties they experienced in responding to students' autonomy in solving word problems. Many of them have raised the challenge of eliciting insights into the thought processes of students under the modality. In order to address students' needs in problem-solving, teachers must assess students' thought processes. However, they felt the need to get more information about how the students were thinking to answer appropriately, which cannot be measured solely by the module. One teacher said, *"It's hard to identify what do students need when it comes to problem solving because, I only based it from their output from the module which cannot assess what they really need especially in problem solving. The activities in the modules are very limited in terms of identifying the students' needs."* Strategies to gain insights into students' thinking processes while solving mathematical problems are applicable in face-to-face inte-

raction between the teacher and the student. While there are some techniques, which may still need to improve to be useful for modular learning, the incapability of the module hinders the way for the teachers to respond to students' needs. According to Nuswowati and Purwanti (2018), modules should comprise exercises that encourage students to analyze and solve problems critically.

Teachers expect to respond to students' current mathematical needs. However, it was a challenge for them to know that most of their students' needs were insufficient knowledge of the basic mathematics concepts necessary for solving word problems. They complained that instead of concentrating on the needs of the students to their current state in mathematics, they have to address and start over again on the basics so that learners can catch up with the modular learning of problem-solving. One teacher during the interview said, *"After I checked their outputs, I have found out that there are still plenty of students who lack of the basic math concepts. If I need to address something on how they do problem solving, it seems like I need to start from scratch." (After I checked their output, marami talaga ang kulang pa sa basic concepts sa math. Kung may need ako i-address sa problem-solving skills nila, para akong magsisimula sa umpisa talaga).* Likewise, another teacher said that *"It's hard to address their problem-solving needs, especially that they lack the basic concepts. Instead of focusing on the present lesson, I need to review them about the concepts that they had supposedly learned beforehand." (Instead na naka-focus na lang sa lesson. Babalikan ko pa 'yung dating concepts na hindi nga nila alam.)*

Table 2. Generated Themes and Theme Definitions on Challenges Experienced by Mathematics Teachers in Exhibiting Responsiveness

Generated Theme	Theme Definition
1. The limitation of the module to elicit students' thinking processes on problem-solving	This refers to the inability of the module to capture students' problem-solving thought processes
2. Students' lack of basic mathematical concepts	Teachers cannot respond to the current needs of the students because they found out that there are mathematical needs that were not addressed previously.
3. Students' lack of initiative to ask questions	Many students do not ask questions about the topic, particularly in solving math problems.
4. Authenticity of the answers of the students in the problem-solving activities	Given that the students are answering at a distance, it is difficult to identify the authenticity of their answers.
5. Giving feedback on students' performance in problem-solving	Teachers experienced giving feedback to be challenging because of time constraints.
6. Students' lack of interest and willingness to solve word problems	One of the challenges experienced by the teachers is that there are students who avoid problem-solving. They are not interested to solve mathematical problems
7. Difficulty adjusting for individualized activities involving problem-solving	When teachers have identified students' needs, the flexibility of the activities to respond to these needs are harder under modular learning

Another problem encountered by the teachers in modular classes which involve problem-solving is that students themselves are not responsive. They do not ask questions about the topic, particularly in solving math problems. Many of the interviewed teachers said that the students are now lacking the initiative to ask questions and communicate with the teachers regarding the lesson. The group chat on Facebook-Messenger, which is supposed to be their open communication system, is quiet even when the teachers encourage them to ask something about the lesson. One teacher explained, *"We always have an open communication. Even in group chats. If they personally submit their outputs, I always ask them if they have questions with the activities. They always say "none" but if I check their works, there are parts in the activity sheets that are left unanswered."* (*Palagi naman kaming may open communication. Sa group chat, meron din. Kapag sila mismo ang nagpapasa, nagtatanong ako kung meron ba silang tanong. Wala daw, pero walang sagot sa LAS.)* Teachers are worried that students may be unable to answer some word problems, which is why they are waiting for the students to ask questions. They even compared their experience last year. It was confirmed by the statements of a teacher saying, *"Last year, most of the students were very active in our Group Chat (GC). They always asked questions. This year, its different. Maybe they already know the system. They ask questions very seldom, sometimes, they give no questions at all." (Last year, ang mga bata active talaga sa GC- nagtatanong talaga sila. Ngayon, alam na siguro ang sistema. Wala nang nagtatanong, wala nang nagchachat doon.)* From the previous, the students are active in the chat application. When they find it hard to answer word problems, they would ask their teachers right away, and the teacher responds to them. In that way, the teachers could identify the needs they had to address when the students solve math problems.

In distance learning modality, teachers are distrustful of the authenticity of the answers of the students in the problem-solving activities. Academic dishonesty became rampant, especially during the pandemic. It was reported that answers to self-learning modules (SLMs) are being posted on Facebook groups termed '*Online Kopyahan'*, which appear to entice learners based on their large following. One teacher said, *"Cheating is available online or with the help of "tropa" (Peer). They know the answers but cannot justify his/her answers."* The Department of Education condemned this act and took action regarding the matter. Nevertheless, teachers became already doubtful even about the needs of the students regarding solving mathematical problems. They do not know if the ideas they are dealing with are the needs they must respond to.

An essential aspect of improving students' performance is giving immediate feedback. Feedback can take many forms- comments, redirection, encouragement, essential information, but it is only helpful if it is received—if it assists students in achieving goals, mainly to solve problems. During face-to-face classes, there could be challenges in giving timely feedback, even so in the new normal that modular distance learning has limited interaction between the teachers and students. Learners submit their modules, and are checked by the teacher. One teacher-participant said, "*It's hard to handle and check the papers one by one and finished all before the next retrieval to return it right away to give intervention. So, the intervention became late and not timely because they are already in the next topic unlike in face-to-face classes that immediately you can give intervention."* Because of the number of papers being checked, it will take some time to finish. When the students received the checked paper, two or more weeks had already passed. Constant, encouraging feedback is essential for ensuring that students understand where they are in the learning process, what they need, and where they are headed, not just for transparency but also so that they can take ownership of it.

In addition, not all learners are committed to doing their modules; most of them merely complete their modules for the sake of formality and compliance. Knowing that students are taking

modules for granted is really a problem for teachers to identify and address their needs to solve math problems. Students are not willing to answer the questions involving problem-solving. They submit output without the answers to the word problems. One teacher said, *"Students chose to answer multiple choice type of test/activity than the [word] problem solving. They skip doing the latter*." *(Pag mga multiple choices, sinasagutan nila. Pag problem solving na, nag-i-skip mga bata. Ayaw nilang sagutan.)* Similarly, a response from the interviewee explained, *"Some of the students don't have outputs or are not submitting their outputs, and if ever they submitted, they don't have answers especially when there are word problems to be solved."* They skipped when they encountered these questions. They lack motivation and interest in solving. Finally, teachers experienced difficulty adjusting to individualized activities involving problem-solving. One teacher said, *"Honestly, I find it difficult especially when I am giving Individual Learner's Monitoring Plan (ILMP) that includes their status in Problem-Solving. They have different least-mastered skills that needed to be addressed. It requires more time and effort to create an intervention strategy that is individualized for each of them." (Sa totoo lang Sir, nahihirapan ako lalo na pag magbibigay na ng ILMP, lalo na sa problem solving na mga MELCs kasi minsan yung intervention ko sa isang student, iba dapat doon sa isa. Mageexert talaga ng effort para maddress ko yung kailangan ng mga students ko individually.)* Teachers raised concerns about having individualized activities based on students' needs which will consume most of their time. In modular distance learning, teachers are encouraged to move toward greater levels of responsiveness. Teachers may be challenged to be aware of and attend to their students' needs, and many may ask for extensive assistance to grasp this practice.

Considering these experiences and challenges identified after the rigorous analysis of the gathered data, an action plan to support the mathematics teachers' responsiveness to students' needs in solving mathematical problems is hereby proposed. As cited by Ask *et al*. (2019), an action plan is a systematic and comprehensive set of instructions that are suggested to address the identified problems or to make an improvement in a particular area. It was also emphasized in the same study that planning is essential, especially in student learning as well as in everyday activities. Hence, the crafted action plan *(see Appendix A)* by this present research is composed of five components that are guided by the framework of Enhanced School Improvement Planning (SIP), which is composed of three (3) major steps (DepEd Order No. 44, s. 2015). These steps are the following: *Assess*, *Plan*, and *Act*. In relation to the present research conceptual framework, the components for the proposed action plan are (a) *Indicators for Teachers' Responsiveness*, which were identified by thoroughly analyzing the experiences of the teachers (Assess); (b) *Recommended Strategies,* and (c) *Suggested Approach*, components that include the suggestions from the researchers and some education experts who evaluated the action plan for its strategic implementation (Plan); (d) *Timeline/Persons Responsible*, in which mathematics teachers and other teaching-related personnel were specifically identified to implement the plan within the timeframe set by the school (Act); finally, (e) *Challenges to be addressed* was included to ensure that the identified challenges on how teachers become aware of and responsive to the problem-solving needs of learners are addressed as soon as possible (Continuous Improvement).

Conclusions

The evidence from this study intimates that the manner by which mathematics teachers respond to and address the diverse needs of students learning mathematical problem-solving through modular distance learning is inclined to their level of awareness. It may also be accounted that the said teachers persevere in taking a proactive approach to optimize learning and cater to students' needs despite the arduous conditions catalyzed by the new learning modality. The research results

constitute an initial step toward supporting teachers' responsiveness. Present findings suggest implementing the developed action plan and monitoring its effectiveness in addressing students' needs in learning mathematics problem-solving through modular distance learning. In prospect, further work may be performed to develop and validate the findings. More broadly, the generated themes may be a viable stimulus for investigation using triangulation of data gleaned from students. To elucidate, the extent of teachers' responsiveness can be highlighted by utilizing quantitative analysis. As this research has given rise to an important issue, the methodology may be replicated at different levels, in different learning modalities, and in various school contexts.

Acknowledgement

The researchers would like to express their sincerest gratitude and heartfelt appreciation to the Mathematics Teachers and Education Experts from two Public Schools in Imus City, Cavite, and Antipolo City Rizal, who served as the participants of this research.

References

Ask, A., Valand, I., & Aarek, I. (2019). Implementation of Action Plans -- Did the Plans End up in a Drawer? *Journal of the International Society for Teacher Education*, *23*(1), 27–38. https://files.eric.ed.gov/fulltext/EJ1237577.pdf

Ball, D. L. (1993). With an eye on the mathematical horizon: Dilemmas of teaching elementary school mathematics. *Elementary School Journal*, *93*, 373–397.

Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special. *Journal of Teacher Education, 59*(5), 389-407.

Bayram, H. (2021). Challenges Secondary School Teachers Face during the Distance Education Process. *International Journal Of Eurasian Education And Culture*, *6*(12), 613–658. https://Doi.Org/10.35826/Ijoecc.306

Przybyla-Kuchek, J., Hardison, H., & Bishop, J.P. (2x015). A framework for teacher responsiveness. In T.G. Bartell, K.N. Bieda, R.T. Putnam, K. Bradfield, & H. Dominguez, (Eds.), *Proceedings of the 37th Annual Meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (p. 1176). East Lansing: MI: Michigan State University.

Budnyk, O., Protas, O., Voloshchuck, H., Berezovska, L., Yablon, L., & Rusakova, O. (2021). Current Challenges in the Conditions of Distance Education: Inquiry Based Learning. *Revista Inclusiones*, *8* (Numero Especial), 210–222. https://revistainclusiones.org/index.php/inclu/article/view/228

Carpenter, T. P., Fennema, E., Peterson, P. L., Chiang, C. P., & Loef, M. (1989). Using knowledge of children's mathematics thinking in classroom teaching: An experimental study. *American Educational Research Journal, 26*(4), 499–531.

Coffey, J. E., Hammer, D., Levin, D. M., & Grant, T. (2011). The missing disciplinary sub- stance of formative assessment. *Journal of Research in Science Teaching, 48*(10), 1109-1136.

Department of Education. (2015). *Guidelines on the Enhanced School Improvement Planning* [Memo]. https://www.deped.gov.ph/wp-content/uploads/2015/09/DO_s2015_44_0.pdf

Duero, M. (2020, July 25). *July 21, 2020 DM-CI-2020-00162 – Suggested Strategies in Implementing Distance Learning Delivery Modalities (DLDM) for School Year 2020–2021 | DepEd Region VIII*. Department of Education Region VIII - Eastern Visayas. https://region8.deped.gov.ph/2020/07/25/july-21-2020-dm-ci-2020-00162-suggested-

strategies-in-implementing-distance-learning-delivery-modalities-dldm-for-school-year-2020-2021/

Empson, S. B. (2003). Low-performing students and teaching fractions for understanding: An interactional analysis. *Journal for Research in Math- ematics Education, 34*(4), 305–343.

Esguerra, M. A. & Combo, J. A. (2021, November 23 – 25). Learning mathematics from a distance: A basis for continuous improvement on printed modular distance learning (PMDL) modality [Paper presentation]. *2021 Virtual Conference of Basic Education Researchers*, Cainta, Rizal

Esroy, E. (2016). Problem Solving and its Teaching in Mathematics. *The Online Journal of New Horizons in Education*, *6*(2), 79–87. https://tojned.net/journals/tojned/articles/v06i02/v06i02-11.pdf

Fennema, E., Carpenter, T. P., Franke, M. L., Levi, L., Jacobs, V. R., & Empson, S. B. (1996). A longitudinal study of learning to use children's thinking in mathematics instruction. *Journal for research in mathematics education*, 403-434.

Gehrtz, J. (2019). *Enacted responsiveness and responsiveness as disposition: Leveraaging and valuing student thinking* (Order Number 13896216) [Doctoral dissertation: Colorado State University]. ProQuest Dissertations and Theses Global.

Hammer, D. (1997). Discovery learning and discovery teaching. *Cognition and Instruction*, *15*, 485–529.

Hammer, D., & Van Zee, E. (2006). *Seeing the science in children's thinking: Case studies of student inquiry in physical science*. Portsmouth, NH: Heinemann.

Hammer, D., Goldberg, F., & Fargason,S. (2012). Responsive teaching and the beginnings of energy in a third grade classroom. *Review of science, mathematics and ICT education, 6*(1), 51-72.

Jacobs, V. R., Lamb, L. L., & Philipp, R. A. (2010). Professional noticing of children's mathematical thinking. *Journal for Research in Mathematics Education, 41*(2), 169–202.

Lampert, M. (1990). When the problem is not the question and the solution is not the answer: Mathematical knowing and teaching. *American Educational Research Journal*, *27*(1), 29–63.

Levin, D. M. (2008). *What secondary science teachers pay attention to in the classroom: Situating teaching in institutional and social systems* (Unpublished doctoral dissertation). University of Maryland, College Park, MD.

Levin, D. M., Hammer, D., & Coffey, J. E. (2009). Novice teachers' attention to student thinking. *Journal of Teacher Education*, *60*, 142–154.

Osman, S., Che Yang, C. N. A., Abu, M. S., Ismail, N., Jambari, H., & Kumar, J. A. (2018). Enhancing Students' Mathematical Problem-Solving Skills through Bar Model Visualisation Technique. *International Electronic Journal of Mathematics Education*, *13*(3). https://doi.org/10.12973/iejme/3919

Pe Dangle, Y., & Sumaoang, J. (2020). The Implementation of Modular Distance Learning in the Philippine Secondary Public Schools. *International Conference on Advanced Research in Teaching and Education*, 100–108. https://doi.org/10.33422/3rd.icate.2020.11.132

Pierson, J. L. (2008). The relationship between patterns of classroom discourse and mathematics learning (Unpublished doctoral dissertation). University of Texas at Austin.

Robertson, A. D., Atkins, L. J., Levin, D. M., & Richards, J. (2016). What is responsive teaching? In A. D. Roberson, R. E. Scherr, & D. Hammer (Eds.), *Responsive teaching in science and mathematics,* 1–35. Routledge.

Robertson, A. D., Scherr, R. E., Hammer, D. (Eds.). (2016). *Responsive Teaching in Science and Mathematics*. New York, NY: Routledge.

Ruiz-Primo, M. A., & Furtak, E. M. (2007). Exploring teachers' informal formative assessment prac- tices and students' understanding in the context of scientific inquiry. *Journal of Research in Science Teaching*, *44*(1), 57–84.

Smith, P. (2018). Learning to know, be, do, and live together with, in the cross-cultural experiences of immigrant teacher educators. Teaching and Teacher Education, 69, 263–274. https://doi.org/10.1016/j.tate.2017.10.018

Statista. (2021, September 10). *Preferred distance learning modality during COVID-19 pandemic Philippines 2021*. https://www.statista.com/statistics/1262554/philippines-preferred-distance-learning-modality-during-covid-19/

Tambychik, T., & Meerah, T. S. M. (2010). Students' Difficulties in Mathematics Problem-Solving: What do they Say? *Procedia - Social and Behavioral Sciences*, *8*, 142–151. https://doi.org/10.1016/j.sbspro.2010.12.020

Appendix A:
Action Plan to Support Teachers' Responsiveness for the Needs of the Students in Learning Mathematical Problem-Solving under Modular Distance Learning

The following proposals were noted in relation to the findings of the study:

Indicator for Teachers' Responsiveness	Recommended Strategies	Suggested Approach	Timeline / Persons Responsible	Challenge to be addressed
1. Limited student-teacher interactions should not hinder the process of identifying students' learning needs in problem-solving **2. Students should be familiar with the problem-solving processes** **3. Streng-**	Assess all students under modular classes to identify those who are in need of support in solving mathematical problems	● Mathematics head teacher and master teachers must decide to choose a systematically standardized screening process that is efficient to assess a large number of students in a short period of time. ● Choose screening measures depending on the topic covered,	Assessment should take place at the start and before the second quarter of the school year. The decision for the assessing/screening process must be done by the head and the master teachers but the actual assessment must be done by the respective math teachers in each modular class.	❖ **Students' lack of basic mathematical concepts**

thening students' knowledge of the basic mathematical concepts as it affects their comprehension of the other topics **4. Involving parents/guardians in the process**		with a focused competency on problem-solving for each grade level.		
5. Encouraging students to give personal reflections on the lessons about problem-solving	Incorporate journal/reflection writing into the assessment tasks given to learners and other metacognitive prompts that will make learners assess their own problem-solving activities	● Include reflection making or journal writing as a supplementary activity on every learners' assessment tasks for problem-solving. ● Apart from focusing only on the numerical results of the assessment tasks, the teachers can also use the written reflections to gauge the part of the lesson where	Mathematics teachers assigned to create the LAS for lessons involving problem-solving should accomplish them before the start of every school year.	❖ **Authenticity of the answers of the students in the problem-solving activities** ❖ **Students' lack of interest and willingness to solve word problems**

		the students have difficulties answering on, hence, the teachers will be able to respond to it accordingly.		
6. Providing teacher-made materials which provide a thorough problem-solving discussion	Continuously provide contextualized Learner's Activity Sheets (LAS) as supplementary materials emphasizing extensively in-depth discussion of problem-solving	● Mathematics teachers should examine the LAS they give to the students to ensure that they cover problem-solving in depth. It should be incorporated with a variety of clear models of simple to difficult word problems. ● The aim is competency and mastery, therefore in-depth covering with an extensive review of the previous and prerequisite basic arithmetic facts is re-	Contextualized Learner's Activity Sheets (LAS) will be prepared before the start of every school year. LAS will be crafted by the subject teachers and will undergo a series of validation by the master teachers, head teachers, school heads and other subject experts.	❖ **The limitation of the module to elicit students' thinking processes on problem-solving**

		quired.		
7. Constant communication with the learners through online/social platforms and other conferences. **8. Immediate checking of learners' outputs and giving them timely feedback** **9. Allowing students to ask questions through online platforms**	Provide feedback on the outputs and performances of the learners instantaneously Assess the progress of students particularly those identified to be in need of support in solving mathematical problems	● Teachers should provide detailed feedback that explains what pupils performed well and where they might improve in solving mathematical problems. They should provide students the opportunity to correct their mistakes. ● If a student is having trouble completing a word problem the teacher should ask questions to help the student solve the problem correctly. This may be done through the communication platform available for modular classes.	Immediate feedback must be done by the respective mathematics teachers right after having the MELC involving problem-solving. This must be done immediately after having the MELC involving problem-solving. The assessment is to be done by math teachers and the decision for instructional modification must be headed by the master teachers and head teacher.	❖ **Students' lack of initiative to ask questions** ❖ **Giving feedback on students' performance in problem-solving** ❖ **Difficulty adjusting for individualized activities involving problem-solving**

		• Monitor the progress of students regularly and use data from progress monitoring to decide when instructional modifications for modular distance learning are required.		