Blended Learning Experiences and Self-concept in Mathematics of Science, Technology, Engineering and Mathematics (STEM) Students

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Abstract – *– Mathematics self-concept, the view of oneself to perform well in mathematics, is one of the significant variables researchers look into in improving mathematics education. During the pandemic, most schools delivered instruction through blended learning modalities, particularly the combination of online and modular distance learning. This was the reason why this study explored the students' blended learning experiences in mathematics that promoted or constrained their mathematics self-concept in the new learning setup. This qualitative study utilized purposive sampling and interviewed ten (10) Science, Technology, Engineering, and Mathematics (STEM) students through focus group discussions. Data gathered were analyzed through thematic analysis. The findings revealed that the students' experiences with the teacher's expertise on the subject matter, student-student interactions, reviewing notes in mathematics, and use of online resources promoted their mathematics self-concept, while their experiences, such as the teacher's poor interaction with students, noisy learning environment, conflict with home responsibilities, and feeling of isolation constrained it. The results of this study imposed a great challenge to mathematics teachers that in this learning modality, they should provide advantageous learning experiences that will help STEM students in learning mathematics and in order to promote their self-concept in the subject.*

Keywords *– blended learning, blended learning experiences, mathematics self-concept, STEM students*

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INTRODUCTION

Mathematics self-concept of students is one of the factors to consider when talking about providing a quality mathematics education. Its importance was acknowledged by educational researchers, but the literature gave little attention to this construct during this pandemic. In general, self-concept revolves around the idea of how well an individual knows oneself [1]. It was defined by [2], the known researchers for self-concept, as a broad term that describes the perception of the self and is sometimes referred to as the assessment of one's own self and belief in one's own abilities. They also paved the way in modeling self-concepts in different domains, which gave birth to mathematics self-concept as an important construct in the field of education.

As [3] defined, mathematics self-concept is a domain-specific self-concept that refers to how an individual views their abilities to perform well in mathematics and their confidence to learn the contents of the subject. They further describe that a person with a mathematics self-concept learns mathematics topics easily, succeeds in the subject, and values oneself according to their mathematics performance.

Mathematics self-concept is significant as it relates to other constructs that are also considered important in the field, such as mathematics performance and mathematics anxiety. In the study of [4], they found a positive relationship between the mathematics self-concept and academic performance of the students in Cebu, Philippines. In relation to the student's academic achievement, self-concept recorded a higher positive correlation than the student's motivation towards the subject [5]. Furthermore, results from the Program for International Student Assessment (PISA) 2012, an international assessment that evaluated the students' abilities in reading, science, and mathematics, showed that students' mathematics anxiety was reduced in those countries where students' mathematics self-concept improved [6].

Another thing that stresses the need to give attention to students' mathematics self-concept is the Philippines' existing problems in mathematics education. One of which is the country's problem in mathematics performance. Mendoza [7] reported that Filipino

students ranked at the bottom in mathematics subject according to the Trends in International Mathematics and Science Study (TIMSS) 2019, an assessment that tracks trends in student achievement in mathematics, science, and reading on a global scale. Furthermore, the majority of the country's senior high school students reached only proficiency level 2 out of 6 in mathematics literacy based on the results of PISA 2018 [8].

As a matter of fact, several studies in the literature determined factors that affect students' mathematics self-concept, while others provided strategies on how to improve students' mathematics self-concept. The study [9] revealed that students' competence in mathematics can be attributed to the teacher, the environment, and some personal factors. However, the study mentioned above was set in a face-to-face learning environment.

During the pandemic, [10] investigated students' mathematics self-concept in the context of online learning. However, online distance learning was only one among the learning modalities implemented by the Department of Education during the global health emergency. Most schools delivered instruction through blended learning modality, particularly the combination of online and modular distance learning. Yet, the exploration of mathematics self-concept in this learning environment was not common to the literature.

Self-concept is created by the social environment and past experiences [2]. According to the Skill Development Model proposed by [11], academic self-concept developed mostly as a result of academic success from activities and instructional environment. Since this study points to the causality of blended learning experiences toward the students' mathematics self-concept, the skill development model explains the link between the two.

This study added to the little body of research about the mathematics self-concept of students in the Philippines during the sudden shift in education caused by the pandemic.

RESEARCH QUESTIONS

This study explored the blended learning experiences and self-concept in mathematics of Science, Technology, Engineering, and Mathematics (STEM) students. Specifically, this study answered the research questions "What blended learning experiences in mathematics promote the mathematics self-concept of STEM students?" and "What blended learning experiences in mathematics constrain the mathematics self-concept of STEM students?".

MATERIALS AND METHODS

This study was a qualitative research that used a phenomenological research design to explore the blended learning experiences in mathematics of STEM students that promote/constrain their mathematics self-concept. Phenomenology allowed researchers to focus on how people experience the world and to understand the people's subjective perspectives [12]. Using this type of research approach allowed the researcher to gain a better understanding of the participants' consciousness in specific situations [13]. With this knowledge, phenomenological research design was best to use as this study focused on exploring the experiences, insights, perceptions, and beliefs of the participants when it comes to their blended learning experiences in mathematics and their mathematics self-concept.

Research Participants and Materials

In order to have a clearer picture and to better address the central phenomenon being studied, the researcher employed purposive sampling in selecting the participants of the study. Creswell [14] stated that purposive sampling will allow the researcher to have the authority to select the participants and the research site. Using purposive sampling, ten (10) STEM students comprised the research participants of this study, who were chosen from the University of Southern Mindanao – University Laboratory School. Among all STEM students enrolled in the second semester of the school year 2021-2022, the participants came from Grade 12 STEM students due to the reason that Grade 12 students have undergone all mathematics subjects in the strand. All of them were 18 years old, and an Informed Consent Form was administered to get their voluntary participation. The participants were coded as "Participant 1", "Participant 2", …, "Participant 9", and "Participant 10" for anonymity.

One of the materials used in the study was a semi-structured interview guide question, with 11 open-ended questions, that was used in the focus group discussions. Semi-structured interviews allowed the researcher to ask follow-up questions to deepen the insights of the participants. This material was validated by three experts in the field of qualitative research. Voice recorder and note-taking materials were also used to aid in gathering the participants' views and opinions and for the later transcription of the information gathered.

Data Analysis

This study employed a thematic analysis in analyzing the data gathered and was done manually by the researcher. Alhojailan [15] explained that thematic analysis is a type of qualitative analysis that aims to present themes relating to the topic. This suited the study since thematic analysis values the interpretations of the participants, which are important in providing the best relevant reasons for their actions, ideas, and behaviors.

The researcher and the participants followed the minimum health protocols during the focus group discussions. The 30 to 45-minute duration of the interview was audio recorded and transcribed verbatim by the researcher. A copy of the transcript was sent to the participants for member checking. The researcher underwent coding by highlighting related words or phrases of the participants that answer the research questions. The researcher then grouped those related codes under a single theme. The themes were cross-checked with the interview transcripts, the researcher's notes, and the related studies in the literature.

In order to uphold the trustworthiness of this study, it conformed to the four standards posited by [16] among qualitative researchers. First is the credibility of the study, where the researcher provided the truth of the findings by having the verbatim transcription of the focus group discussions and the themes together with the respective codes verified by the participants and by the research adviser. Second is the transferability of the study, where the researcher found applications of the findings to other settings by comparing the data gathered to the different related studies available in the literature. Third is the dependability of the study, where the researcher established consistency of the findings by providing a detailed process of the data gathering procedure with the necessary evidence, such as the proof of data collection and sample statement of themes from multiple participants. The last of the standards is conformability, where the researcher upheld an unbiased interpretation by formulating themes that were shaped solely by the participants' responses during the focus group discussions.

RESULTS AND DISCUSSION

Blended Learning Experiences that Promoted the Mathematics Self-Concept of STEM Students

Data analysis revealed four experiences reported in themes that promoted the mathematics self-concept of STEM students (Table 1). These are (1) the teacher's expertise on the subject matter, (2) experiences in student-student interactions, (3) reviewing notes in mathematics, and (4) the use of online resources.

Table 1. Summary of themes on blended learning experiences that promoted the mathematics self-concept of STEM students.

Themes	Sample Quote
Teacher's expertise on the subject matter	… if the teacher shows expertise in teaching, it boosts my confidence to solve mathematics tasks (Participant 7).
Student-student interactions	… seek help from friends who understood [the lesson]. … to friends who were more intelligent in mathematics than me because they can help me better (Participant 4).
Reviewing notes in mathematics	… present lessons can be found in your notes. In that way, I found the subject easy (Participant 8).
Use of online resources	You can still access references as long as you have internet (Participant 10).

Teacher's expertise on the subject matter. STEM students believed that teachers' expertise in teaching mathematics helped them to increase their mathematics self-concept during the blended learning modality. They said that when their teacher taught mathematics lessons, without a doubt, it made them believe in their own selves to succeed in mathematics. One participant affirmed that:

> *"… 'pag magaling yung teacher na nagturo tsaka master niya like di siya naga dalawang isip na nagaturo yang deretso lang po ganyan. Ma boost yung confidence mo na magsagot.* (… if the teacher shows expertise in teaching, like she doesn't doubt what she teaches, it boosts my confidence to solve mathematics tasks)." – Participant 7

Another participant explained that the teacher's expertise in teaching the subject made them confident that they could really learn the content presented. Participant 8 added that. *"dito sa amin [school]…, may mga teacher talaga na … magaling gud talaga magturo so parang pagkatapos ng klase, alam mo talagang may nakuha ka.* (Here [in our school], we have teachers that were excellent in teaching, so after the class, I am confident that I really learned something)."

Student-student interactions. STEM students acknowledged the vital role of their classmates in

learning mathematics during blended learning. They said that when they helped one another in learning difficult mathematics concepts, it made them confident to achieve mathematics success. When asked what they did to succeed in the subject, participants pointed out:

> "*Dati po nong grade 11 po kay classmate X po talaga ako nagapahelp po. Kaming mga mag classmate, nagtulungan po talaga kami before po.* (Back in grade 11, I asked my classmate X for help. In our class, we really helped each other before)." – Participant 6
>
> "*... paturo po siguro sa friends na nakaintindi. ... sa mga friends po na ... mas ano matalino sa math kaysa sa akin ... kasi mas matulungan nila ako.* (… seek help to friends who understood [the lesson]. … to friends who were more intelligent in mathematics than me because they can help me better)." – Participant 4

Some participants also reported that when they faced difficulty in the subject, their classmates sent words of encouragement in their online chat rooms, which sparked their motivation to keep moving forward amidst the challenges they face. When asked about the things that drove them during blended learning, Participant 3 shared that "*... may mga encouragement po sa gc na 'kaya lagi to.'* (There are words of encouragement in our group chat like 'we can do this')."

Reviewing notes in mathematics. STEM students also believed they were confident to learn mathematics because they could recall prior knowledge related to the new concept presented with the help of their notes. The participants shared that one of the strategies they used to ensure success in the subject during the blended learning was by reviewing their previous mathematics notes as they learned mathematics subjects in the STEM strand. When asked what they did to perform well in General Mathematics, one explained that:

> *"... no'ng grade 10 marami kasi akong ano [notes], yo'ng mga notebook ko, ginakeep ko kasi so parang minsan mayroon talaga ..., sa mga notes mo na makita mo gud [yo'ng lesson]. So 'yon parang mas madali nalang siya [General Mathematics] sa akin.* (… back in grade 10, I had lots of notes, I kept my past notebooks because, present lessons can be found in your notes. In that way, I found the subject easy)." – Participant 8

Another participant agreed with the usefulness of reviewing notes in the mathematics subject and noted that their mathematics lessons back in junior high school really helped them in the mathematics lessons during senior high school. Participant 7 said that, "… *kasi lahat ng naturo po sa amin no'ng [junior] high school po makatulong po talaga siya pagka senior high [school] po*. (… because everything that was taught in [junior] high school helped a lot during senior high [school])."

Use of online resources. The usefulness of online resources was deemed by STEM students to be another way to promote their mathematics self-concept. The accessibility of online learning materials was acknowledged by STEM students to build their confidence to succeed in learning mathematics under the blended learning modality. When asked what helped them build their confidence to perform well in mathematics, one participant explained that:

> "… *kung hindi mo talaga ma gets, kaya mo man din mag search sa iba. Unlike noon na wala ka talagang mahanapan. Mahirapan ka pa maghanap ng reference but right now, search ko lang sa internet kahit saan ka man lang po, kahit dito ka lang, kahit saan ka magpunta may reference ka pa rin talaga na mahanap as long as may internet ka.* (… if you really can't understand [the lesson], you can search [materials] somewhere else. Today was different from before where materials were limited. Today, I can use the internet wherever I am. You can still access references as long as you have internet)." – Participant 10

Participants agreed to the benefit of accessing online resources. They shared that they accessed tutorial videos from YouTube when they faced difficulty in learning mathematics during the blended learning. Participant 7 said that, "*... pag once di ko po maintindihan, deretso po ako YouTube. Maghanap ng parang tutorial or step by step yo'ng ganyan po.* (When I cannot understand the lesson, I will go to YouTube and watch tutorials)." Another participant also added that web pages available on the internet really helped. Participant 10 shared that, "*Ako po mostly is a module and mga articles sa Google po. Marami po kasi usually mga parang tinuturo nila yo'ng process.* (I mostly look at my module and articles available on Google. There were online articles that explained the process)."

This study explored the blended learning experiences that promoted the STEM students' mathematics self-concept. It was found that these were (1) the teacher's expertise on the subject matter, (2) experiences in student-student interactions, (3) the usefulness of reviewing notes, and (4) the use of online resources.

The participants revealed that their teacher had influenced how they viewed their performance in mathematics. According to [17], teachers' role in the classroom was vital in developing the students' mathematics self-concept. This can be done through the use of performance feedback and praise, supportive teaching provisions, and involving students in tasks that promote their higher-order thinking skills. Moreover, students' pride and self-confidence in learning can also be ignited through the use of positive reinforcement [18].

The students also perceived the importance of learning and being motivated by peers in developing their mathematics self-concept. It was evident in the study of [19] that students under the reciprocal peer tutoring intervention showed a significant increase in their mathematics self-concept. They found that self-concept in mathematics improved in those students who were able to explain mathematics information to their peers and for those students who felt more capable and valuable in mathematics as they helped each other.

The results also revealed the role of reviewing notes in promoting the students' mathematics self-concept. Although the literature did not specifically note the link between these two, it can be associated with the prior knowledge activated because of reviewing one's notes, which allowed them to be familiarized with the new content presented. Prior knowledge does not just benefit individual learning but also shows its importance in learning complex tasks when done collaboratively [20].

Lastly, the results showed that accessing online resources was perceived by the students to develop their mathematics self-concept. The initiative of the students to access additional learning resources on the internet depicts their autonomy in learning, and students who engaged in tasks that ignited their independence in learning were revealed to have positive mathematics self-concept [10].

Blended Learning Experiences that Constrained the Mathematics Self-Concept of STEM Students

On the other side, data analysis revealed four experiences reported in themes that constrained the mathematics self-concept of STEM students (Table 2). These are (1) the teacher's poor interaction with students, (2) a noisy learning environment, (3) conflict with home responsibilities, and (4) feelings of isolation.

Teacher's poor interaction with students. Poor student and teacher interaction was pointed out by STEM students to constrain their mathematics self-concept. They revealed that they encountered unpleasant experiences with their teachers. They were called inappropriate names. When asked about a particular experience in the blended learning that reduced their confidence to succeed in the subject, a participant revealed that:

> "*May teacher po kasi kami na minsan na magsabi po na 'bobo' ganyan. Kasi …, di po namin nasagot kaagad yung question niya po … through online class lang po siya. Nasabi niya po yan.* (We have a teacher that called us 'stupid'. We did not immediately answer her question in an online class. She spoke of that word)." – Participant 7

This particular experience allowed fears to form in their minds, and because of this, they could not voice out their work because they were afraid to be judged by their teacher. Their fear of their teacher and of the same experience to happen again reduced their confidence to perform well in the subject. Participant 10 shared that, "*ma discouraged ka nalang din po na magsagot. Kasi kahit alam mo yung sagot na ganun, tapos …, baka barahin niya ako kung mali ako. Matakot ka nalang din po ganun.* (It made me discouraged from participating in class. Even though I know the answer, I am afraid that she will judge me if I got it wrong)."

Table 2. Summary of themes on blended learning experiences that constrained the mathematics self-concept of STEM students.

Themes	Sample Quote
Teacher's poor interaction with students	We have a teacher who called us stupid (Participant 7).
Noisy learning environment	… When it was very noisy. You can't focus (Participant 7).
Conflict with home responsibilities	… while in class, chores are given to me (Participant 6).
Feeling of isolation	... I totally lost my motivation to do math. I had so many distractions, I felt isolated, and it was really hard to cope (Participant 8).

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Noisy learning environment. STEM students also reported that the unnecessary noises that they received from their surroundings distracted their learning during the blended learning modality. The noise around them affected their focus on learning mathematics at home. When asked which experience reduced their self-concept in learning the subject, one student shared that:

> "*Yun po yung maingay po talaga masyado. Hindi po maka focus. Kahit ilang beses na sabihihin mo po sa kanila na magtahimik muna kasi naga klase ka or naga study ka ganyan, mahirap po talaga. Lalo na yung mga kapitbahay na sige pa music.* (When it was very noisy. You can't focus. It was really difficult because you have to ask [the people around you] to minimize their noises multiple times when you join a class or when you study. Especially those neighbors with loud music)." – Participant 7

Another participant agreed with that and pointed out that noises that cannot be controlled really challenged their confidence to succeed in the subject. Participant 9 shared that, "*Slaughter house yo'ng kapitbahay namin kaya wala po talaga akong choice. Like alas tres na ako ng umaga mag study may naga hingal na baboy.* (Our house was located beside a slaughterhouse so I didn't have a choice. Even if I study at 3:00 a.m., I can still hear panting pigs)."

Conflict with home responsibilities. STEM students also pointed out their home responsibilities, such as assigned household chores, to lower their confidence to succeed in mathematics. They explained that they cannot focus in class because they were given chores during class hours. One participant reported that:

> "*… hindi maka focus mag-aral po ganiyan kasi habang naga klase po minsan gina utusan ka ng ganito ganiyan po.* (… I can't focus on learning because sometimes while in class, chores are being given to me)." – Participant 6

The same experience was reported by another participant due to the reason that the self-learning modules in mathematics cannot be prioritized due to household responsibilities. Participant 4 shared that, "… *hindi ko siya [modules] masyadong ma prioritize din kasi …, maraming nagagawa sa bahay*. (I can't really prioritize my modules because there is so much to do at home)."

The feeling of isolation. Another thing that hindered the mathematics self-concept of the students was the lack of motivation caused by feelings of isolation during the blended learning. Students revealed that learning at home reduced their motivation to learn and succeed in the subject. They missed the experience of having friends around before the pandemic, as they can learn and study together. One participant confessed that:

> "*Ako aside doon sa ingay, wala din talaga akong motivation no'ng modular palang. Like nawala talaga yung gana ko mag math. … Kadami ko kasing distraction din …, diba na isolate ka lang parang mahirap po talaga …, mag cope …, no'ng junior high kami, mas enjoy mag math kung marami kayo. Kasi madala ka talaga ng mga kaibigan mo …, kahit ayaw mo mag study, you need to study.* (Aside from the noise, I was really not motivated during the modular distance learning. I totally lost my motivation to do math. I have so many distractions, I felt isolated and it was really hard to cope up. Math was more fun during junior high school because you can enjoy math together with friends. You can be influenced by your friends to study even if you don't like doing so)." – Participant 8

This study also explored the blended learning experiences that constrained the STEM students' mathematics self-concept. The results revealed that these were (1) teacher's poor interaction with students, (2) a noisy learning environment, (3) conflict with home responsibilities, and (4) feelings of isolation.

Among other sources of mathematics self-concept, teachers must promote the students' mathematics self-concept and should not be the one causing it to reduce

[10]. Teachers have the responsibility to sustain the positive outlooks of the students towards their mathematics abilities by providing support with the students' questions and clarifications. The way their teacher called other students with inappropriate names formed an idea to the learner that they should not make mistakes in front of their teacher to avoid such things to happen with them. It was explained in the social learning theory developed by Albert Bandura, specifically in the phenomenon called "modeling," that students can learn from others' successes or failures [21]. This particular experience may motivate students to always look for the correct answer, but this lessens their participation in the class due to fear of committing mistakes. In line with this, students' mathematics self-concept will be at stake.

The results revealed that changes in the educational setting brought about by the pandemic constrained the mathematics self-concept of the students. The results of this study conform to the study of [10], which revealed that students with distractive learning spaces obtained low levels of mathematics self-concepts. It was explained that being in a noisy learning environment and being in a conflict with home responsibilities challenged not just the learners' personal learning space as well as their learning experience at home.

Furthermore, the students' feeling of isolation, which resulted from the lack of peer interactions during the blended learning modality, was also noted in the study [5] that threatened the students' academic self-concept. This lack of social presence with the teachers and with their classmates frustrates the students in this kind of learning environment as social interactions are limited.

CONCLUSION AND RECOMMENDATION

Based on the findings of this study, mathematics teachers can make a great difference in promoting the STEM students' mathematics self-concept by providing rich mathematics blended learning experiences. Teachers should equip themselves with the mastery of the content in mathematics and in the delivery of instruction in order to address the difficulty in learning the subject. They should also design instructional activities in blended learning where peer interactions are fostered and where everybody is winning for a better learning experience. They must introduce the use of digital tools in the mathematics classroom, how to effectively utilize them, and expose students to different learning resources available on the internet. They should nurture a healthy relationship with their students and make time to look into students' concerns in learning the subject.

This study further acknowledged the vital role played by parents at home. Parents should be the support system of the students in any learning environment, especially in this new educational setting. This also suggests that teachers should have a strong communication with the parents or guardians in order to diagnose potential problems in students' learning and address them as soon as possible.

The design of the study may limit the results' generalizability, but with this exploration, it gave a picture of which students' experiences in this learning modality will promote or will constrain their mathematics self-concept.

REFERENCES

[1] Sultra, W. S. R. Y., Usodo, B., & Pramudya, I. (2018). Self-concept of junior high school student in learning mathematics. *The International Conference on Mathematical Analysis, Its Applications and Learning 2018, 1,* 44-49.

[2] Shavelson, R. J., Hubner, J. J., & Stanton, G. C. (1976). Self-concept: Validation of construct interpretations. *Review of Educational Research, 46,* 407-441. doi: 10.3102/00346543046003407

[3] Erdogan, F., & Sengul, S. (2014). A Study on the Elementary School Students' Mathematics Self-Concept. *Procedia-Social and Behavioral Sciences, 152,* pp. 596-601. doi: 10.1016/j.sbspro.2014.09.249

[4] Peteros, E., Gamboa, A., Etcuban, J. O., Dinauanao, A., Sitoy, R., & Arcadio, R. (2019). Factors Affecting Mathematics Performance of Junior High School Students. *International Electronic Journal of Mathematics Education, 15 (1),* Article em0556. doi: 10.31578/jebs.v7i1.252

[5] Kumi–Yeboah, A., Dogbey, J., & Yuan, G. (2018). Exploring Factors that Promote Online Learning Experiences and Academic Self-Concept of Minority High School Students. *Journal of Research on Technology in Education, 50 (1),* pp. 1-17. doi: 10.1080/15391523.2017.1365669

[6] Organization for Economic Co-operation and Development (OECD). (2013). *PISA 2012 results: Ready to learn: Students' engagement, drive and self-beliefs (Volume III): Preliminary version,* OECD, pp. 79-104.

[7] Mendoza, J.E., PH Last in Math, Science among 58 Countries. URL:

https://www.manilatimes.net/2020/12/10/news/top-stories/ph-last-in-math-science-among-58-countries/807487, date retrieved: February 23, 2022

[8] Calsyn, R., & Kenny, D. (1977). Self-concept of ability and perceived evaluations by others: Cause or effect of academic achievement? *Journal of Educational Psychology, 69,* 136-145.

[9] Mamolo, L. A., & Sugano, S. G. C. (2020). Self-Perceived and Actual Competencies of Senior High School Students in General Mathematics. *Cogent Education, 7 (1),* Article 1779505. doi: 10.1080/2331186X.2020.1779505

[10] Bringula, R., Reguyal, J. J., Tan, D. D., & Ulfa, S. (2021). Mathematics Self-Concept and Challenges of Learners in an Online Learning Environment During COVID-19 Pandemic. *Smart Learning Environments, 8 (1),* pp. 1-23. doi: 10.1186/s40561-021-00168-5

[11] Department of Education. (2019). PISA 2018 National Report of the Philippines. https://www.deped.gov.ph/wp-content/uploads/2019/12/PISA-2018-Philippine-National-Report.pdf

[12] Sutton, J., & Austin, Z. (2015). Qualitative Research: Data Collection, Analysis, and Management. *The Canadian Journal of Hospital Pharmacy, 68 (3),* pp. 226-231.

[13] Umanailo, M. C. B. (2019). Overview of phenomenological research. doi: 10.31222/osf.io/4t2fv

[14] Creswell, J. W. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*, 4th Edition, Pearson, pp. 226-258.

[15] Alhojailan, M. I. (2012). Thematic analysis: A Critical Review of its Process and Evaluation. *West East Journal of Social Sciences, 1 (1),* pp. 39-47.

[16] Lincoln, Y., & Guba, E. G. (1985). *Naturalistic Inquiry*, Sage.

[17] Perera, H. N., & John, J. E. (2020). Teachers' Self-Efficacy Beliefs for Teaching Math: Relations with Teacher and Student Outcomes. *Contemporary Educational Psychology, 61,* Article 101842. doi: 10.1016/j.cedpsych.2020.101842

[18] Mantasiah R, M. R., Sinring, A., & Aryani, F. (2021). Assessing Verbal Positive Reinforcement of Teachers During School from Home in the COVID-19 Pandemic Era. *International Journal of Instruction, 14 (2),* pp. 1037-1050. doi: 10.29333/iji.2021.14259a

[19] Moliner, L., & Alegre, F. (2020). Effects of Peer Tutoring on Middle School Students' Mathematics Self-Concepts. *PloS ONE, 15 (4),* Article e0231410. doi: 10.1371/journal.pone.0231410

[20] Zambrano, J., Kirschner, F., Sweller, J., & Kirschner, P. A. (2019). Effects of Prior Knowledge on Collaborative and Individual Learning. *Learning and Instruction, 63,* pp. 101214. doi: 10.1016/j.learninstruc.2019.05.011

[21] Slavin, R. E. (2018). *Educational Psychology: Theory and Practice,* 12th Edition, Pearson, pp. 96-119.