

## Factors Affecting the Mathematics Performance of Mathematics Major Students

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### Abstract

Mathematics is one of the subjects that is taught in all Schools and Universities. It is usually viewed by students as difficult subject. This study aimed to determine the factors that affect the Mathematics performance of Mathematics major students and the extent of each factor. Further, it sought to determine the challenges encountered by the respondents in learning Mathematics. The study has three research questions and it made use of the explanatory-sequential research design. Relevant literatures were reviewed on theories and findings that emerged from different authors. There were 57 respondents involved in the study, 47 from 1<sup>st</sup> year to 3<sup>rd</sup> year Mathematics major student and 10 from 4<sup>th</sup> year students at Notre Dame of Midsayap College. Data collection was done by using questionnaires. The findings showed that factors that affect Mathematics performance are the sources of the challenges in learning Mathematics. It also indicated that learning Mathematics is affected by numerous factors such as needs, interest, and seriousness of the subject matter, teachers' practices and methodologies, teachers' personality, parental support and home environment. The respondents have encountered challenges in learning Mathematics such as unfavorable teaching practices, lack of time management, lack of motivation, poor internet connectivity, and difficulty to get rapid feedback, lack of knowledge and regulation skills, and limited quotas.

**Keywords:** Factors, Mathematics Performance, Challenges, Respondents, Methodologies

### Introduction

Mathematics performance of students has been a key source of concern both globally and locally. Mathematics is a difficult subject students struggle with even in a face to face setting, thus they usually do not perform well. As a result, it is critical to look at the factors that affect students' Mathematics performance.

The National Council of Teachers of Mathematics in the United States conducted a Mathematics test for college freshmen. They discovered that students in the 12<sup>th</sup> grade do not display mathematical proficiency, implying that students transitioning from high school to college Mathematics may be unprepared (Abellanos et al., 2018). Moreover, according to reports from the International Mathematics Union, basic and secondary Mathematics education in most African countries is weak affecting the number of students who pursue Mathematics as a University major (IMU, 2020).

Here in the Philippines, Mathematics is one of the subjects that is taught in all Schools and Universities. According to the 2016-2017 Global Competitiveness Report, Filipino students' Mathematics performance needs to be improved. In this study, the Philippine was placed 79<sup>th</sup> out of 138 nations in terms of Mathematics education quality. In order to solve these issues, it is

critical to investigate the factors that affect students' success in Mathematics and an assessment of problems' current state must begin at school level (Capuno et al., 2019).

In addition, according to Neil (2021), the findings of Programme for International Student Assessment (2018) revealed that fifteen-year-old students in the Philippines scored lower in Mathematics than students in most other nations. They came second to the last of Dominican Republic with 353 points. In another international test, the 2019 report of TIMSS (Trends in International Mathematics and Science Study) revealed that Filipino grade 4 students received the lowest scores in Mathematics among 58 countries participating in the study.

This situation is also evident in the local context as second year students in both public and private schools in Cotabato City did poorly in the 2010 Regional Achievement test, with Mean Percentage Score (MPS) ratings of 45.16% in Mathematics. These alarming performances of Filipino students in Mathematics at the local, national, and international level need immediate decisions and measures from all educational sectors (Imam et al., 2013). It is in this light that this study is conducted to determine the factors that affect Mathematics performance of Mathematics major students.

## Research Questions

This research focused on the factors affecting Mathematics performance of Mathematics major students.

Specifically, this study sought to answer the following questions:

1. What are the factors affecting Mathematics performance of Mathematics major students?
2. To what extent do the factors affect the Mathematics performance of Mathematics major students?
3. What are the challenges encountered by the respondents in learning Mathematics?

## Literature Review

### Student-related Factors

One of the major components of a high fail rate in Mathematics is the student's related factor, which plays a significant part in the teaching-learning process. There is no way to obtain subject matter knowledge without students' enthusiasm in teaching-learning activities. The success of the students is determined by their efforts. The need, interest, practices, and seriousness of the subject matter are all factors to consider. Mathematics anxiety, past knowledge of students, and student effort in learning Mathematics is all aspects that affect students' performance. Student labor is another and important aspect of students related factors that affect in students' low pass in Mathematics. Mathematics is needed practice which has different theory and several formulas. So learning of Mathematics, students should be managing extra time for practice. Generally, Mathematics achievements determine student's labor in present situation; students are not laborious in Mathematics learning. Consequently, Mathematics achievement of students was diseasing. It was effect on student slow pass in Mathematics. Student's labor is responsible for students following views of Mathematics teachers (Raj Acharya, 2017).

### Teacher-related Factors

Students' failure in Mathematics has been linked by researchers such as Biotenbeck(2011) and Clement (2013) to teachers' teaching practices. Teaching practices, according to Biotenbeck (2011), include what teachers do in the classroom, how they use instructional approaches, and traditional teaching methods. These were such as lecture-style education, teacher-centered methods, and rote memorization in teaching Mathematics.

According to Isack (2015), teaching approaches such as problem solving and the use of visual aids in the Mathematics classroom can boost students' enthusiasm and morale, and students' mathematical performance is influenced by teaching and learning methods as well as their cultural backgrounds. And also teaching methods, teacher qualifications, subject majors and the years of experience are determinants of student's achievement in Mathematics. Several factors have been found by Suan (2014) that appear to be the cause of students' arithmetic underachievement. The first component was the teacher's personality, which included things like teaching styles, subject matter mastery, instructional approaches and procedures, classroom management, communication skills, and personality.

### Parent-related Factors

One of the most essential aspects of a student's success in Mathematics is the influence of their parents. The role of parents in their children's education is critical. Almost all children's education is influenced by their family's socioeconomic condition and parental support. The children's first and second schools are at home and at school. The child's home environment has a direct impact on their education at school. As a result, it influences children's mathematical learning (Raj Acharya, 2017).

### Environmental-related Factors

From the learning perspective, media can have a profound impact on how learners process and ultimately comprehend the content due to its essential role as content deliverer. Ineffective use of media contributes to interest, engagement, and motivation issues and ultimately contributes to a lack of understanding in e-learning environments (Lange and Costley, 2017). According to the findings of the study by Barrot et al., (2021), college students' online learning challenges varied in terms of type and extent; their greatest challenge was related to their learning environment at home. Similarly, students face obstacles when participating in online learning, such as non-smooth signals and feeling disturbed by noise in the home environment (Ariyanti & Santoso, 2020).

### Challenges in Learning Mathematics

Students' self-factors, such as negative perception and poor self-control, appear to be the sources of difficulties in learning Mathematics. Perceiving Mathematics as too difficult and confusing is the two attributions to student's failure in Mathematics, according to a prior study conducted on the local and international education context. On the other side, a

lack of regulation skills will make it more difficult for students to grasp Mathematics literacy and skills. Many students were unable to successfully manage or allocate time to study Mathematics, obtain assistance when unable to complete Mathematics problems, or maintain concentrate on the teacher's instruction (Rameli, 2017).

According to Ho and Hyun (2011), students face difficulties in comprehending Mathematics due to a lack of knowledge of mathematical symbols, formulas, concepts, and representations. As a result of this condition, students become anxious. It is discovered that students' inability to grasp mathematical equations, concepts, symbols, and representations was an impediment to mastering Mathematics, resulting in a negative nervous sensation about engaging in Mathematics activities. The results on the most prevalent obstacles faced by students owing to a lack of Mathematics skills might be explained best by a lack of mastery of basic Mathematics knowledge. Students' obstacles in learning Mathematics included being taught by a decisive and monotonous teacher who liked to reprimand, punish, and employ tedious teaching methods. Students' inability to learn mathematics literacy is also a result of unfavorable teaching procedures and behavior, which cause students to become uncomfortable, restless, and have low self-confidence (Rameli, 2017).

One disadvantage of online learning is that students may be unable to connect with or relate to their classmates, which is not the case in the classroom, where students can ask their colleagues or teachers for rapid clarifications. Isolated students may experience stress and other mental health issues as a result of this. Another disadvantage for students is that they may lose interest in the subject and, as a result, become ineffective learners. Due to synchronization, it can be difficult to get rapid feedback or address other related difficulties from teachers (Delas Peñas, 2020).

During online classes, internet connectivity, audio clarity, obsolete devices and software, and a short attention span are all prevalent issues (Amadora, 2021). According to Santos (2019), Mathematics is a subject that requires more concentration than any other. A proper study environment and a distraction free area could be the determining factor when solving complex equations or problems in geometry, algebra, or trigonometry.

## Methodology

The study used the explanatory-sequential research design. Creswell & Plano-Clark (2011) defined an explanatory sequential design as "first collecting quantitative data, then collecting qualitative data to assist explain or elaborate on the quantitative results." The rationale for this technique is that quantitative data and outcomes provide a broad image of the study topic; and for further analysis, particularly qualitative data collecting, is required to improve, extend, or explain the broad.

## Participants

This study was conducted at Notre Dame of Midsayap College. The institution is located at Poblacion 5, Midsayap, Cotabato. A total of fifty-seven (57) Mathematics major students were included in the study, forty-seven (47) respondents for the quantitative data collection and ten (10) respondents for the qualitative data collection.

## Instruments of the Study

This study made use of researcher-made questionnaires through Google form. One is the survey questionnaire and an open-ended questionnaire. The survey questionnaire has two major parts. The first part contained the factors affecting Mathematics performance of the respondents by checking Yes or No if it is a factor that affects their Mathematics performance and if their answer is yes the respondents would answer the second part of the questionnaire that determines the extent of each factor by checking the Likert scale as Strongly Agree (5), Agree (4), Neutral (3), Disagree (2) and Strongly Disagree (1). A Likert scale presents the respondent with a statement and asks the respondent to rate the extent to which he or she agrees with it. It is named for American social scientist Rensis Likert, who devised his approach in 1932 (Sullivan & Artino, 2013). The open-ended questionnaire asks about the challenges encountered by the respondents in learning Mathematics.

## Procedure

This research followed a systematic and orderly procedure as follows: Letter was signed by the researchers, subject teacher and thesis adviser. Afterwards, the letter was sent to Dean of College of Education to ask permission for the conduct of the study.

After receiving the approved letter from the College of Education office, the letter for the respondents, the survey questionnaire and open-ended questionnaire in a Google form were distributed to the respondents through their Group Chats with clear instructions above. There was a 100% response retrieval from the respondents.

For qualitative data, letters were also sent to the respondents to get their permission to be part of the study. After their approval, the researchers sent the open-ended questionnaire through Google form validated by their subject professor and their adviser. Afterwards, the data were analyzed and organized according to themes. After the transcriptions, translations and themed, another letter were sent to the respondents for their validation if their answers are clustered into accurate answers.

### Ethical Considerations

Since there are many ethical challenges because of new and unpredictable nature that have repercussions in doing qualitative research (Houghton et al., 2010), the researchers were mindful of research ethics and its values when obtaining the population of the study, gathering data and dissemination of the findings. The researchers prepared a particular consent form to inform the selected students that they are the respondents of the study, the methods, how the respondents are identified and protected.

By abiding the principle of informed consent, the researchers protected the respondents' freedom. This principle required the researchers to make sure that respondents understood the goal of the study in order to gain their trust and allow for open participation. The respondents gave them the assurance that only the researchers who they are. The results of the study are kept in a way that only the researchers can access them with the intention of maintaining the identity and confidentiality.

### Results

This section presents the results of the data gathered. The analysis and interpretation of the data presented to each table were based on the objectives of the study in the form of statistical figures.

### Factors affecting Mathematics Performance in terms of Student-related Factors

The table below presents the Student-related Factors that Affect the Mathematics Performance of the Respondents.

Table 1.1 *Factors that Affect the Mathematics Performance of the Respondents in terms of Student-related Factors.*

| Variables                                                              | Yes |        | No |       |
|------------------------------------------------------------------------|-----|--------|----|-------|
|                                                                        | F   | %      | f  | %     |
| 1. Mathematics anxiety (fear and lack of confidence in subject matter) | 44  | 93.62  | 3  | 6.38  |
| 2. Prior knowledge                                                     | 41  | 87.23  | 6  | 12.77 |
| 3. Student effort                                                      | 47  | 100.00 | 0  | 0.00  |
| 4. Attitude towards Mathematics                                        | 45  | 95.74  | 2  | 4.26  |
| 5. Time Spent on Mathematics                                           | 46  | 97.87  | 1  | 2.13  |
| 6. Perceived importance of Mathematics                                 | 47  | 100.00 | 0  | 0.00  |
| 7. Study habits                                                        | 46  | 97.87  | 1  | 2.13  |
| 8. Time Management                                                     | 45  | 95.74  | 2  | 4.26  |
| 9. Enthusiasm in Mathematics                                           | 44  | 93.62  | 3  | 6.38  |
| 10. Intelligence or IQ                                                 | 46  | 97.87  | 1  | 2.13  |
| 11. Cognitive entry skills                                             | 44  | 93.62  | 3  | 6.38  |
| 12. Self- concept                                                      | 46  | 97.87  | 1  | 2.13  |
| 13. Library utilization                                                | 45  | 95.74  | 2  | 4.26  |
| 14. Gender factors and stereotyping (Math is for males)                | 22  | 46.81  | 25 | 53.19 |
| 15. Need, interest, practices and seriousness of the subject matter.   | 47  | 100.00 | 0  | 0.00  |
| N= 47                                                                  |     |        |    |       |

### Factors affecting Mathematics Performance in terms of Teacher-related Factors

The table below presents the Teacher-related Factors that Affect the Mathematics Performance of the Respondents.

Table 1.2 *Factors that Affect the Mathematics Performance of the Respondents in terms of Teacher-related Factors.*

| Variables                                                                                                                                                                                                                                       | Yes |        | No |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--------|----|------|
|                                                                                                                                                                                                                                                 | f   | %      | F  | %    |
| 1. Teacher's teaching practices and methodologies (Teaching approaches and methods like lecture methods, discussion, demonstration, problem-solving, project, inquiry approach, cooperative learning and the use of audio-visual technologies). | 47  | 100.00 | 0  | 0.00 |
| 2. Teacher qualifications                                                                                                                                                                                                                       | 45  | 95.74  | 2  | 4.26 |
| 3. Teacher's Year of experience                                                                                                                                                                                                                 | 44  | 93.62  | 3  | 6.38 |
| 4. Teacher Attitude                                                                                                                                                                                                                             | 46  | 97.87  | 1  | 2.13 |
| 5. Teacher and student relationship                                                                                                                                                                                                             | 47  | 100.00 | 0  | 0.00 |
| 6. Teacher's personality or attributes (Teaching styles, subject matter mastery, classroom management, communication skills, Sense of humor, consistent help, active learning, teacher's personality value and empathy)                         | 47  | 100.00 | 0  | 0.00 |
| N= 47                                                                                                                                                                                                                                           |     |        |    |      |

### Factors affecting Mathematics Performance in terms of Parent-related Factors

The table below presents the Parent-related Factors that Affect the Mathematics Performance of the Respondents.

Table 1.3 *Factors that Affect the Mathematics Performance of the Respondents in terms of Parent-related Factors*

| Variables                                              | Yes |       | No |       |
|--------------------------------------------------------|-----|-------|----|-------|
|                                                        | F   | %     | f  | %     |
| 1. Parental support                                    | 46  | 97.87 | 1  | 2.13  |
| 2. Family's socio-economic condition                   | 46  | 97.87 | 1  | 2.13  |
| 3. Inherited DNA differences (Parents' Genetic Factor) | 29  | 61.70 | 18 | 38.30 |
| N = 47                                                 |     |       |    |       |

### Factors affecting Mathematics Performance in terms of Environmental-related Factors

The table below presents the Environmental-related Factors that Affect the Mathematics Performance of the Respondents.

Table 1.4 *Factors that Affect the Mathematics Performance of the Respondents in terms of Environmental-related Factors.*

| Variables                                                                                    | Yes |        | No |      |
|----------------------------------------------------------------------------------------------|-----|--------|----|------|
|                                                                                              | f   | %      | F  | %    |
| 1. Home Environment                                                                          | 46  | 97.87  | 1  | 2.13 |
| 2. Teaching and learning environment (classroom)                                             | 46  | 97.87  | 1  | 2.13 |
| 3. Teaching and learning materials like textbooks.                                           | 46  | 97.87  | 1  | 2.13 |
| 4. Media used in online Mathematics learning (WhatsApp, Zoom, email, Google classroom etc.). | 47  | 100.00 | 0  | 0.00 |
| 5. School cultural factors                                                                   | 44  | 93.62  | 3  | 6.38 |
| N = 47                                                                                       |     |        |    |      |

### Extent of Student-related Factors

The table below presents the Extent of the Student-related Factors that Affect the Mathematics Performance of the Respondents.

Table 2.1 *Extent of Student-related Factors that Affect the Mathematics Performance of the Respondents.*

| Variables                                                              | Mean | SD   | Description |
|------------------------------------------------------------------------|------|------|-------------|
| 1. Mathematics anxiety (fear and lack of confidence in subject matter) | 4.04 | 1.10 | Agree       |
| 2. Prior knowledge                                                     | 3.94 | 1.28 | Agree       |
| 3. Student effort                                                      | 4.36 | 0.67 | Agree       |
| 4. Attitude towards Mathematics                                        | 4.19 | 0.97 | Agree       |
| 5. Time Spent on Mathematics                                           | 4.26 | 0.85 | Agree       |
| 6. Perceived importance of Mathematics                                 | 4.34 | 0.76 | Agree       |
| 7. Study habits                                                        | 4.04 | 0.88 | Agree       |
| 8. Time Management                                                     | 4.21 | 1.00 | Agree       |
| 9. Enthusiasm in Mathematics                                           | 3.94 | 1.03 | Agree       |
| 10. Intelligence or IQ                                                 | 4.23 | 0.84 | Agree       |
| 11. Cognitive entry skills                                             | 4.04 | 1.06 | Agree       |
| 12. Self- concept                                                      | 4.23 | 0.84 | Agree       |
| 13. Library utilization                                                | 3.79 | 1.00 | Agree       |
| 14. Gender factors and stereotyping (Math is for males)                | 2.39 | 1.54 | Disagree    |
| 15. Need, interest, practices and seriousness of the subject matter.   | 4.43 | 0.71 | Agree       |
| Overall Mean/SD                                                        | 4.03 | 0.97 | Agree       |

### Extent of Teacher-related Factors

The table below presents the Extent of the Teacher-related Factors that Affect the Mathematics Performance of the Respondents.

Table 2.2 *Extent of Teacher-related Factors that Affects the Mathematics Performance of the Respondents*

| Variables                                                                                                                                                                                                                                       | Mean | SD   | Description    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|----------------|
| 1. Teacher's teaching practices and methodologies (Teaching approaches and methods like lecture methods, discussion, demonstration, problem-solving, project, inquiry approach, cooperative learning and the use of audio-visual technologies). | 4.60 | 0.58 | Strongly Agree |
| 2. Teacher qualifications                                                                                                                                                                                                                       | 4.34 | 0.96 | Agree          |
| 3. Teacher's Year of experience                                                                                                                                                                                                                 | 4.13 | 1.10 | Agree          |
| 4. Teacher Attitude                                                                                                                                                                                                                             | 4.47 | 0.80 | Agree          |
| 5. Teacher and student relationship                                                                                                                                                                                                             | 4.49 | 0.62 | Agree          |
| 6. Teacher's personality or attributes (Teaching styles, subject matter mastery, classroom management, communication skills, Sense of humor, consistent help, active learning, teacher's personality value and empathy)                         | 4.60 | 0.61 | Strongly Agree |
| Overall Mean/SD                                                                                                                                                                                                                                 | 4.44 | 0.78 | Agree          |

### Extent of Parent-related Factors

The table below presents the Extent of the Parent-related Factors that Affect the Mathematics Performance of the Respondents.

Table 2.3 *Extent of Parent-related Factors that Affect the Mathematics Performance of the Respondents.*

| <i>Variables</i>                                       | <i>Mean</i> | <i>SD</i> | <i>Description</i> |
|--------------------------------------------------------|-------------|-----------|--------------------|
| 1. Parental support                                    | 4.47        | 0.86      | Agree              |
| 2. Family's socio-economic condition                   | 4.30        | 0.88      | Agree              |
| 3. Inherited DNA differences (Parents' Genetic Factor) | 2.72        | 1.47      | Neutral            |
| Overall Mean/SD                                        | 3.83        | 1.07      | Agree              |

### Extent of Environmental-related Factors

The table below presents the Extent of the Environmental-related Factors that Affect the Mathematics Performance of the Respondents.

Table 2.4 *Extent of Environmental-related Factors that Affects the Mathematics Performance of the Respondents.*

| <i>Variables</i>                                                                            | <i>Mean</i> | <i>SD</i> | <i>Description</i> |
|---------------------------------------------------------------------------------------------|-------------|-----------|--------------------|
| 1. Home Environment                                                                         | 4.49        | 0.80      | Agree              |
| 2. Teaching and learning environment (classroom)                                            | 4.15        | 0.91      | Agree              |
| 3. Teaching and learning materials like textbooks                                           | 4.17        | 0.87      | Agree              |
| 4. Media used in online Mathematics learning (WhatsApp, Zoom, email, Google classroom etc.) | 4.47        | 0.62      | Agree              |
| 5. School Cultural factors.                                                                 | 4.13        | 1.04      | Agree              |
| Overall Mean/SD                                                                             | 4.28        | 0.85      | Agree              |

### Challenges in Learning Mathematics

The table below presents the seven common challenges that the respondents encountered in learning Mathematics.

Table 3. *Seven challenges that the Mathematics major encountered in learning Mathematics.*

| <i>Common Themes</i>                     | <i>Interpretation</i>                                                                               |
|------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Unfavorable teacher's teaching procedure | Inappropriate or unfavorable teaching methods and lack of discussion                                |
| Lack of Time Management                  | Unable to successfully manage or allocate time to study Mathematics                                 |
| Lack of Motivation                       | Difficulty to motivate self to pay attention, no goals, desire or willingness to work and laziness. |
| Poor Internet Connectivity               | Non-smooth signals in their learning environment.                                                   |
| Difficulty to get rapid feedback         | Lack of interaction or communication between teacher and student.                                   |
| Lack of Knowledge and regulation Skills  | Difficulties in comprehending Mathematics and difficulty to grasp Mathematics literacy and skills.  |
| Limited quotas                           | Limited amount of things used in learning Mathematics.                                              |

### Joint Implications of Quantitative and Qualitative Data

The table below presents the Joint Implications of Quantitative and Qualitative Data. It shows that student, teacher, parent, and environment-related factors are the sources of challenges faced by the respondents in learning Mathematics. Table 4 (see appendix) *Joint Implications of the Quantitative Data and Qualitative Data.*

Table 4. (see appendix)

### Discussion

#### Student-related factors

Based on the findings, *student effort, perceived importance on Mathematics and needs, practices and seriousness of the subject matter* garnered the highest percentage which got a hundred percent YES response. These imply that all respondents consider these as factors that affect their Mathematics performance. Among these, the *needs, practices and seriousness of the subject matter* garnered the highest extent of factor. These findings are supported by the study of Raj Acharya (2017), that *need, interest, practices and seriousness of the subject matter* are all factors to consider and it includes the past knowledge and effort of the student. Student effort in learning Mathematics is an important aspect that affects students' performance. In addition, lack of student's labor is an important aspect of student-related factors that affect students' low passing score in Mathematics. Learning mathematics requires needed practice which has different theories and several formulas. Thus, students should be spending extra time for practice. Generally, Mathematics achievements determine students' labor in present situation; students are not laborious in Mathematics learning. According to Gafoor & Kurukkan (2020) Mathematics being difficult is lack of knowledge of students and according to Tsabalala and Ncube (2013), perceived importance on Mathematics was an influential determinants of students' performance in Mathematics.

With that, the challenges that affect their time for practice are *time management, lack of motivation, and lack of knowledge and regulation skills*. According to Rameli (2017) many students were unable to successfully manage or allocate time to study Mathematics, obtain assistance when unable to complete Mathematics problems, or maintain concentration on the teacher's instructions. These findings affirm to a recent study, where sixty percent of students who had recently switched to an online

learning system found the experience to be uninteresting and found it difficult to motivate them to pay attention in class. In a separate poll, seventy-seven percent of eight hundred college students said they prefer in-person learning in class than online learning (Gutte, 2021). Another disadvantage for students is that they may lose interest in the subject and as a result, become ineffective learners. And according to the study of Ho and Hyun (2011) the most prevalent obstacles faced by students owing to lack of Mathematics skills might be explained best by a lack of basic Mathematics knowledge.

### Teacher-related factors

*Teacher's teaching practices and methodologies, teacher and student relationship and teacher's personality or attributes* garnered the highest percentage which got a hundred percent YES response. These imply that all respondents consider these as factors that affect their Mathematics performance. But, the *teacher's teaching practices or methodologies* and *teacher's personality or attributes* garnered the highest extent of factor. These findings support the findings of Biotenbeck (2011) and Clement (2013) that students' failure in Mathematics has been linked to teachers' teaching practices. Teaching practices, according to Biotenbeck (2011), include what teachers do in the classroom, how they use instructional approaches, and traditional teaching methods such as lecture-style education, teacher-centered methods, and rote memorization in teaching Mathematics.

The findings affirm the study of Slater (2013) that instructors' personalities have a direct impact on students' thinking, inspiration, attitudes, and academic accomplishment. Moreover, according to Gao and Liu (2013), active teacher personality apprentices improve school outcomes and maximize student academic progress. Also, Dar (2015) found that tutors' behavior is important in helping students improve their grades. Professionally competent teachers are frequently among the list of popular teachers because they have a positive view, a dynamic and fun-making personality. Their students look forward to going to class and learn new things. In addition, several factors have been found by Suan (2014) that appear to be the cause of students' arithmetic underachievement. The first component was the teacher's personality, which included things like teaching styles, subject matter mastery, instructional approaches and procedures, classroom management, communication skills, and personality.

Moreover, based on the findings of Isack (2015)

teaching approaches such as problem solving and the use of visual aids in the Mathematics classroom can boost students' enthusiasm and morale, and students' mathematical performance is influenced by teaching and learning methods. Furthermore, the most relevant findings were from theme analysis of students during focus group discussions, which resulted in a list of teacher attributes most appreciated by students in schools. A sense of humor, consistent help, active listening, and the teacher's personality value and empathy were among these traits. In other words, children valued teachers who actively listened and supported them, as well as providing an enjoyable, supportive, yet demanding learning atmosphere for the entire class.

With that, the challenges that the respondents encountered in learning Mathematics are the *unfavorable teacher's teaching procedure* and the *difficulty to get rapid feedback* that affect their Mathematics performance. These findings affirm to the study of Rameli (2017) that having an unfavorable teaching procedure is one of the challenges in learning Mathematics which cause students to become uncomfortable, restless and have low self-confidence. One advantage of face-to-face class to Mathematics is students can easily ask question but according to Delas Peñas (2020) due to synchronization, it can be difficult to get rapid feedback or address other related difficulties from teachers.

### Parent-related factors

Based on the results, *parental support* and *family's socio-economic condition* garnered the highest percentage which got a hundred percent YES response. These imply that all respondents consider these as factors that affect their Mathematics performance. The *parental support* garnered the highest extent of factor to students' Mathematics performance. Parental support includes the emotional and financial support of the parents. These findings support the study of (Raj Acharya, 2017) that one of the most essential aspects of a student's success in Mathematics is the influence of their parents. Almost all children's education is influenced by their family's socioeconomic condition and parental support. Students who did receive support and inspiration from their parents have better result and parent's lack of awareness and interest in the subject matters has an impact on their children's ability to study Mathematics.

The challenge encountered by the respondents is *limited quota* which means being out of paper or other materials. According to Santos (2019) it is impossible

to study Math properly by just reading and listening. To study Mathematics, you have to roll up your sleeves and actually solve problems. The more you practice answering Math problems, the better. There is no escaping this reality, to do well in a Mathematics exam you need to have solved a lot of Mathematical problems beforehand.

### Environmental-related factors

According to the findings, *media used in online Mathematics learning* garnered the highest percentage of factor to Mathematics performance of the respondents with a hundred YES responses. This implies that all respondents consider this as a factor that affects their Mathematics performance. Among all environmental-related factors, *home environment* garnered the highest extent of factor. This finding is supported by the study of Lange and Costley (2017) that from the learning perspective, media can have a profound impact on how learners process and ultimately comprehend the content due to its essential role as content deliverer. Ineffective use of media contributes to interest, engagement, and motivation issues and ultimately contributes to a lack of understanding in e-learning environments. In addition, according to Ariyanti and Santoso (2020) that media used in online learning, namely WhatsApp, Google Classroom, Zoom, E-learning Schools and email are suggestion from students for online Mathematics. In addition, according to Raj Acharya (2017) major aspect of pupils' high failure rate in Mathematics is environmental influences. Which refers to the home environment. The family atmosphere is reflected in the home environment. This environmental element influence students learning activities. According to the findings of the study by Barrot et al., (2021), college students' online learning challenges varied in terms of type and extent; their greatest challenge was related to their learning environment at home. Similarly, students face obstacles when participating in online learning, such as non-smooth signals and feeling disturbed by noise in the home environment (Ariyanti & Santoso, 2020).

The challenge encountered by the respondents is *poor internet connectivity* in their learning environment. According to Amadora (2021) during online learning, internet connectivity is one of the prevalent issues. Similarly, students face obstacles when participating online such as non-smooth signals. Moreover, Mathematics is a subject that requires more concentration than any other. A proper study environment and a distraction free area could be the determining factor when solving complex equations or

problems in geometry, algebra, or trigonometry (Santos, 2019).

### Conclusion

Based on the findings of the study, the following conclusions are drawn:

Mathematics performance of the Mathematics major students is affected by numerous factors including student, teacher, parent and environmental factors that are varied in terms of type and extent.

Students, teacher, parent and environmental-related factors appear to be the sources of challenges in learning Mathematics. In the teaching and learning of Mathematics, the Mathematics major students encountered challenges in a face-to-face teaching framework and in online learning that affect their performance in Mathematics.

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Table 4  
*Joint Implications of the Quantitative Data and Qualitative Data.*

| Variables                     | Quantitative Data                                                                                                                                                                                                                                                            | Qualitative Data                                                                                         | Joint Implications                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Student-related factors       | Item 3 or Student effort, item 6 or perceived importance of Mathematics and item 15 or need, interest, practices and seriousness of the subject matter garnered the highest percentage which respondents answered a 100% Yes while item 15 got the highest extent of factor. | Common themes: Lack of time management, lack of motivation, and lack of knowledge and regulation skills. | This indicates that item 3 or student effort, item 6 or perceived importance of Mathematics and item 15 or need, interest, practices and seriousness of the subject matter that include the past knowledge and effort of the students are factors that are connected and supported by the common themes: lack of time management, lack of motivation, and lack of knowledge and regulation skills. |
| Teacher-related factors       | Item 1 or teacher's teaching practices and methodologies, item 5 or teacher and student relationship and item 6 or teacher's personality or attributes garnered the highest percentage with a 100% Yes response while item 1 and 6 got the highest extent of factor.         | Common themes: Unfavorable teacher's teaching procedure and difficulty to get rapid feedback.            | This indicates that item 1 or teacher's teaching practices, item 5 or teacher and student relationship and item 6 or teacher's personality or attributes are factors that are connected and supported by the common themes: Unfavorable teacher's teaching procedure and difficulty to get rapid feedback.                                                                                         |
| Parent-related factors        | Item 1 or parental support and item 2 or family's socio-economic condition are factors that garnered the highest percentage with a 100% Yes response while item 1 or parental support got the highest extent of factor.                                                      | Common theme: Limited quota                                                                              | This indicates that item 1 or parental support and item 2 or family's socio-economic conditions are factors that are connected and supported by the common theme: Limited quota.                                                                                                                                                                                                                   |
| Environmental-related factors | Item 4 or media used in online Mathematics learning garnered the highest percentage with a 100% yes response while item 1 or home environment got the highest extent of factor.                                                                                              | Common theme: Poor internet connectivity                                                                 | This indicates that item 4 or media used in online learning and item 1 or home environment are factors that are connected and supported by the common theme: Poor internet connectivity                                                                                                                                                                                                            |