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Exploratory analysis of learners' motivation on learning Mathematics in Philippines

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Abstract
Purpose: The primary objective of this study was to investigate how motivation explains learners' performance in mathematics.
Research methodology: This study analyzed learners' age, sex, parents' educational attainment, siblings, occupation, and motivation using Mubeen and Reid's (2014) measurement. It also tested their relationship with mathematics achievement, and determined a regression model for predicting high school mathematics performance.
Results: The study revealed a male-dominated population of Grade 9 learners at Matucay National High School, with satisfactory mathematics performance and four siblings. They align their personal goals with learning, and their motivation is crucial for positive study habits and academic achievement, particularly in mathematics.
Limitations: This study examined learner motivations in mathematics among Grade 9 students at Matucay National High School, focusing on factors such as expectations, learning outcomes, development track, future career success, and test-taking ability.
Contribution: Given that the pandemic has had a significant impact on the municipality, this study will benefit students by offering strategies for staying motivated to learn mathematics to manage and regulate the impact of the outbreak on their academic performance.
Novelty: This study explores learners' motivation in mathematics among Grade 9 students at Matucay National High School in the Philippines. It uses Mubeen and Reid's motivation measurement and analyzes demographic factors, motivational attributes, and their correlations with academic achievement. The study revealed that mothers' educational attainment and motivation significantly predicted their mathematics performance. This study provides insights into improving mathematics education and learner outcomes.
Keywords: *Academic Performance. New Normal, Motivation on Learning Mathematics, Learners' Motivation*
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1. Introduction

In most of 2020, schools in the Philippines moved to learning from home (remote learning) due to COVID-19 restrictions. This was unprecedented, and schools needed to make quick decisions about how to best facilitate it with little time and the required resources and skills. Implementing remote or distance learning will greatly affect learners' interest and motivation in learning during the learning process because they do not have face-to-face interactions and conversations with their teachers. This was highlighted by the studies of Ratnawati and Hasanah (2021) and Sudiasih et al. (2021), in which the implementation of distance learning often reduced learners' interest and motivation in learning because learners did not interact with their friends and teachers. Thus, it is necessary for learners to be

motivated to learn during the learning process (Aryani & Suarjana, 2022). The existence of good learning motivation in the learning process is necessary because it can provide enthusiasm, direction, and persistence of behavior in learning activities (Berlyana & Purwaningsih, 2019; Nugroho & Fitri, 2018). Giving motivation can have a big impact on learners because those who have strong motivation will have a lot of energy and enthusiasm to participate in learning activities. In addition, Chulsum (2017) and Padmapriya (2015) found that learning motivation functions as a driving force for learners to create, ensure continuity, and provide direction for learning activities in which it is hoped that goals can be achieved. Thus, the existence of learner motivation in the learning process is very important to ensure that the learning process runs smoothly and produces learning objectives that can be properly achieved.

However, the reality in the field is that learners' learning motivation is often very low. Various factors can result in low learning motivation for both internal and external learners. One of the factors that can cause low learner motivation is the way the teacher teaches, which is less liked by learners, so that learners feel bored with participating in learning. In addition, the low motivation of learners to learn can also be caused by subjects that are not liked by learners, such as mathematics. Often, learners assume that mathematics is a very difficult science; therefore, it is less desirable for learning. According to the results of the researcher's initial observations, it was found that many learners at Matucay National High School did not have enthusiasm to learn mathematics; many learners seemed to lose motivation in learning. The low motivation to learn mathematics is caused by various factors, one of which is the assumption of most learners that mathematics is a difficult and boring subject, such that many learners do not like mathematics and even make mathematics a scourge that must be avoided. The lack of motivation to learn in these learners hampered the learning process because both teachers and learners had to repeat learning on the same material.

The lack of learner motivation also affects the learning atmosphere, which makes the learning atmosphere less fun or more rigid. In addition, the lack of motivation to learn among these learners can cause a decrease in their learning outcomes. This will automatically impact the achievement of learning objectives that are not optimal (Doyan et al., 2018; Saputra et al., 2018). Thus, it is necessary to conduct a study that discusses the factors that contribute to low learner motivation. Thus, solutions can be found to address these problems.
Based on the above observations, the researcher decided to embark on this study to investigate how motivation could explain learners' performance in mathematics.

1.1 Research Questions

This study investigated how motivation can explain learners' performance in mathematics. Specifically, it sought answers to the following questions.

1. What is the profile of learners in terms of the following?
    a. Age
    b. Sex
    c. Parents' Highest Educational Attainment
    d. Number of Siblings
    e. Parents' Occupation
2. What is the learners' motivation to learn mathematics?
3. What is the learners' performance in mathematics?
4. Is there a relationship between learners' performance in mathematics and the following?
    a. Learners' profile variables
    b. Motivation
5. To what extent do the following variables explain the variations in learners' performance in mathematics?
    a. Profile
    b. Motivation
6. What are the descriptive factors of the learners contained in the motivation instrument?

1.1 Research Hypothesis

The present exploratory analysis of learners' motivation to learn mathematics was conducted with Grade 9 learners of Matucay National High School for the School Year 2021-2022. Thus, this study aimed to test the following hypotheses:

Hypothesis 1. There was no relationship between learners' performance in mathematics and their profile variables and motivation.

Hypothesis 2. The following variables do not adequately explain the variations in learners' performance in mathematics:

a. Profile
b. Motivation

2. Literature review

This study is based on Self-Determination Theory. This section tackles self-determination and how it fosters motivation towards learning. In proposing the importance of needs, the self-determination theory asserts the importance of intrinsic motivation. The self-determination version of intrinsic motivation emphasizes a person's perception of freedom rather than the presence or absence of "real" constraints on action. This means that a person feels free, even if they are operating within certain external constraints. In principle, and as used in this study, a learner can experience self-determination even if the learner must live within externally imposed rules of appropriate classroom behavior. However, to achieve a feeling of self-determination, the learner's basic needs must be met: needs for autonomy, competence, and relatedness. In motivating learners, the bottom line is that teachers have an interest in helping learners meet their basic needs and in not letting school rules or teachers' own leadership styles interfere with or block the satisfaction of learners' basic needs.

Anchoring the topic, the choices that encourage the greatest feelings of self-control are those that are about relatively major issues or that have relatively significant consequences for learners, such as those who choose as partners for a major group project. However, choices also encourage some feeling of self-control, even when they are about relatively minor issues, such as how to organize their desks or what kind of folder to use for storing their papers at school. Furthermore, it is important to offer choices to all learners, including those needing explicit directions, to work successfully, avoid reserving choices for only the best learners, or give up offering choices altogether to learners who fall behind or who need extra help.

As a result, all learners will feel more self-determined and, therefore, more motivated if they have some choice. Teachers can also support learners' autonomy more directly by minimizing external rewards (such as grades), comparing learners' performance, and by orienting and responding to learners' expressed goals and interests.

In certain ways, self-determination theory provides a sensible way to think about learners' intrinsic motivation, and therefore, how to get them to manage their own learning. A particular strength of the theory is that it recognizes the degree of self-determination, which becomes the basis of numerous ideas about this reality.

The study believes that the performance of learners in mathematics is affected by their profile variables and motivation to learn the subject. Figure 1 shows the independent variables of the study: learners' profile, such as their age, sex, parents' highest educational attainment, number of siblings, and parents' occupation. It also includes learners' interest in and motivation for learning the subject. The dependent variable was learners' performance in mathematics.

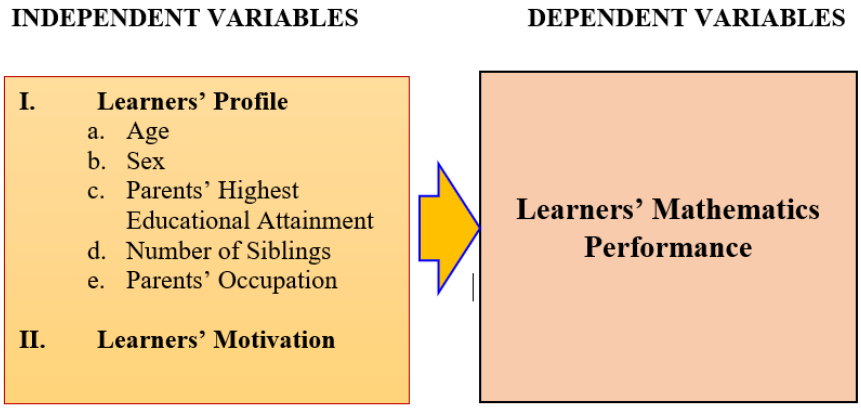

Figure 1. Paradigm of the study showing the relationship between the independent and dependent variables

2.1 Learning Mathematics from Home During Covid-19

Studies from the United States have reported the impact of teaching and learning during the pandemic (Buttimer et al., 2022; Hamilton, Diliberti, & Kaufman, 2020; TODAY & Ipsos, 2020). Buttimer et al. (2022) interviewed 40 teachers across the United States in a range of school sectors during 2020 to describe their professional experiences during the pandemic. This study highlights three main challenges faced by teachers. These were:

1. Teachers struggled to motivate learners.
2. Teachers experienced burnout and loss of their identity as teachers.
3. Inequalities were exacerbated for learners with special needs or those from non-well-resourced districts.

TODAY and Ipsos (2020) reported that many parents (60%) and teachers (86%) expressed concerns about how learners were progressing academically during remote learning. Hamilton et al. (2020) reported teachers were having a harder time doing their job remotely (83%), and they believed that learners were falling behind due to learning from home (76%). In addition, only 12% of teachers reported covering all or nearly all of the curriculum they would have covered had face-to-face learning continued, and the authors raised concerns about learners' readiness for the next grade level.

Australian studies have also found similar difficulties for teachers and learners during COVID-19. The findings from an online survey of more than 3500 teachers across Australia and New Zealand in April 2020 described the potential impact of enforced distance teaching and learning during COVID-19 on teachers, children, and educational outcomes (Flack, Walker, Bickerstaff, Earle, & Margetts, 2020). The responses revealed that teachers were "under extraordinary pressure—dealing with unfamiliar technologies and teaching methods, struggling with additional demands for preparation, worrying about the lack of social contact with learners and colleagues, and fearing for the educational and psychological welfare of learners, particularly those in early primary school." Several themes were identified in relation to meeting learners' needs through online learning. The most common concerns are learner isolation and well-being.

These social needs were ranked higher than the potential learning loss. Teachers were also concerned that the loss of social interaction in the classroom would decrease the effectiveness of their teaching, and 39% of Australian teachers reported being only somewhat confident or not at all confident in their school's ability to meet learners' online learning needs. Related to this, 37% of Australian teachers were concerned that learners lacked access to technology or the Internet, and 36% and 38% were concerned that learners lacked technological support from a parent or guardian and learning support from a parent or guardian, respectively. Considering the concerns for learners' (and teachers') well-being, the study made a range of recommendations, one of which was to lessen learning targets and lower expectations.

As previously mentioned, learners from disadvantaged backgrounds are likely to be at greater risk of falling behind during remote learning. Results from PISA in 2018 (Thomson, De Bortoli, & Buckley, 2013) compared the home learning environments of low and high socioeconomic status (SES) 15-year-olds in Australia. While 88% of the 15-year-olds reported having a quiet place to study at home, this varied from 78% for low-SES learners to 96% for advantaged learners. Similarly, 84% of disadvantaged learners reported having a computer at home for schoolwork, compared to 99% of advantaged learners. These data did not consider whether parents and siblings were working or studying at home, thereby putting extra strain on learners and families to negotiate access to potentially limited devices in the home. Further, parent beliefs and values regarding the use of technology at home, or the 'screen time' of learners, may add to the complexity of access to devices.

A brief supply to the Australian Government by the Australian Chief Scientist (Dr Alan Finkel) outlined three factors that moderate the effectiveness of remote learning (Finkel, 2020). These were: a) access to digital technology and the Internet, b) a home-learning environment and family support, and c) teacher and learner readiness and capabilities. Drane, Vernon, and O'Shea (2020) outlined ten recommendations to support the learning of vulnerable children during the COVID-19 pandemic. Relevant to the current study were recommendations that suggested that learners and parents should not be overloaded with downloading multiple applications and platforms, learners and parents should not be expected to scan and send through learners' work, reaming classes for primary learners should be no longer than 20 minutes, technologies should be chosen based on teachers' and learners' skills, and families should be supported by providing Internet connectivity and access to devices.

2.2 Challenges in Studying Mathematics Using Self-Learning Module During Covid-19 Pandemic

The emergence of the coronavirus disease (COVID-19) pandemic has altered the global educational system. In the Philippines, the Department of Education uses printed self-learning modules (SLMs) to facilitate modular distance learning (MDL). A self-learning module is a short unit of instruction dealing with a single conceptual unit of subject matter with a self-contained and independent unit of instruction, with a primary focus on a few well-defined objectives (Padmapriya, 2015). This is an essential tool in modular distance learning that serves as a catalyst for continuing quality education among Filipino learners during the COVID-19 pandemic. However, a study conducted at Balbalayang National High School and Baguio National High School in the Philippines showed that most learners could neither study independently nor efficiently follow the instructions in the modules, resulting in blank answer sheets (Pe Dangle, 2020). Moreover, most learners have difficulty answering the learning modules and state that mathematics is the most challenging task (Dangle, 2020).

Junior high school learners from Alfonso Ang Militante Integrated School, Gingoog City, Philippines, faced the same problem in answering their self-learning modules, specifically in mathematics. As observed by researchers as mathematics teachers, most learners have difficulty answering their modules, leaving no answers submitted. The researchers interviewed other mathematics teachers about the incident to further verify the existing problems in other schools and substantiate the phenomenon. The teachers found that their learners had submitted math modules with no answers on activities and were effortless in answering the self-learning modules. Learners' challenges in studying mathematics amidst the COVID-19 pandemic yielded six (6) central themes: difficult lessons and activities, distractions in learning, difficulty understanding English instruction, absence of assistance from people, poor quality of module, and lack of time management.

Mathematics is known for its abstract concepts, which contribute to its difficulty. Learners lack the prerequisite knowledge of basic concepts involving variables and exponents, resulting in difficulty in understanding lesson concepts in mathematics. Most learners had difficulty using variables, such as generalized numbers and varying quantities (Gray et al., 2007).

The limited examples given in the module triggered challenging experiences of the learners in learning difficult lessons because sometimes the examples given do not coincide with the activities in the module to be answered, resulting in participants' difficulty in answering the activities in the module.

Given the examples in the self-learning module, perhaps it is the only guidance that the participants could lean on. However, mathematics self-learning modules provide only a few examples for every topic, and are sometimes different from the activities found in the module. Hence, when the participants tried to answer the activities in the module, they could not answer them because they had limited resources on how to respond to various problems. Modular Distance Learning (MDL) benefits participants but requires essential resources for quality learning (Panganiban & Madrigal, 2021). One of the reasons that learners have difficulty answering their modules is the lack of information in their learning materials (Panganiban & Madrigal, 2021).

With all the difficulties experienced, participants acknowledged their lapses, saying that they opted to submit blank answer sheets. The participants had no choice but to leave the answer sheets in the module blank because of the difficulty level of the activities provided in the module. The findings of this study support the previous result that most learners have difficulty answering the learning modules, and state that mathematics is the most challenging self-learning module (Gueta & Janer, 2021; Pe Dangle, 2020).

The second theme discussed learners' experiences while learning mathematics using self-learning modules. Learners experience various disruptions when learning mathematics. This theme has four categories: household chores, noisy environments, cell phones, and friends. Learning at home is a benefit of modular distance learning. However, the household chores took over the duration of the participants. Most learners could not focus because of various distractions, such as household chores, which negatively affected them (De Claro, 2021).

A conducive learning environment is a critical factor that teachers should consider. However, during the COVID-19 pandemic, learners had to learn at home. Parents have neglected the concept of a conducive learning environment at home as para-teachers in a new normal situation. A generally polluted environment with loud noises and elevated levels indicates a high probability of negatively affecting learners' cognitive abilities (Diaco 2014). The learning environments usually available for learners in their homes are also polluted by noise, thus affecting their ability to learn (Diaco, 2014).

Moreover, cell phones were also a factor in distraction from learning. Participants shared that they were distracted by their cell phones. According to Hossain and Yasmin (2022), online platforms are the best option to save students from collapsing the academic world in a pandemic situation; therefore, their study developed a new teaching and learning model that analyzes the practical situation of respondents. However, the use of technology is rampant in society as it offers vast benefits to its users. However, educators cannot deny that learners are prone to the various applications offered by cell phones, such as Facebook and TikTok, which distract learners when used too much and may harm their learning. Despite its positive effects, it adversely affects learners (Darko-Adjei, 2019). Smartphones shift the focus of users because of their addictive nature, intruding on calls during lecture hours. There is a tendency to check social media platforms that distract learning on the part of distance learning learners, and some of the inhibiting factors found were unreliable internet connectivity. The screen size makes smartphones uncomfortable for learning (Darko-Adjei, 2019).

Finally, friends played a role in the distractions in learning. Friends are blessings in life. They put colors on it. Nevertheless, an individual should set limitations and establish self-regulation. Hanging out with friends is good, but it should succeed with priorities to focus on what is more important at present.

The third theme showed how language affects students' understanding of the self-learning module. The participants expressed that they had difficulty understanding the mathematics self-learning module, especially on how to solve mathematical problems, because it was written in English.

The lack of English vocabulary led to an inability to comprehend English in the mathematics self-learning module, resulting in learners' inability to understand and learn mathematics lessons, concepts, and solving. This substantial precedent is one of the reasons learners had difficulty learning mathematics during the COVID-19 crisis. Moreover, learners learning English through self-learning modules had difficulty as they were deficient in vocabulary (Salamuddin, 2021). They require language fluency and

proficiency to comprehend and express themselves effectively in both oral and written processes to learn self-learning modules.

In addition, this finding supports the similar experience of someone who had difficulty completing the learning modules due to a language barrier (Panganiban & Madrigal, 2021). Furthermore, learners can neither study independently nor efficiently follow the instructions in the modules because of their lack of English vocabulary, resulting in blank answer sheets (Pe Dangle, 2020).

The fourth theme described how the learner received no help from others while learning mathematics using the self-learning module. COVID-19 has forced learners to develop independent learning methods to contain the virus. Independent learning without assistance from people in the environment is laborious. Learners in modular distance learning need help from parents who serve as para-teachers. This expressed dissatisfaction due to the difficulty in communicating with teachers (Pe Dangle, 2020) and identified the absence of a competent guide (Panganiban & Madrigal, 2021).

Furthermore, the participants expressed their sentiments on the additional burden of independent learning amid difficult experiences in learning the lessons and answering the activities given because they needed to do it alone. It is difficult for learners to learn independently without assistance, especially when they do not understand a certain topic. Independent learning is expected from learners as a new normal of education emerges, but it is not anticipated what the outcome will be. As the participants experienced independent learning, their development was challenging. The participants sought assistance from their community, especially parents and teachers, in learning mathematics using self-learning modules. Nonetheless, the stakeholders did not address participants' sentiments. In one study, most learners disagreed with the modular distance-learning approach because they felt abandoned. They learned independently using self-learning modules (SLMS), such as commonly printed and audio materials with delayed feedback, as cited by Salamuddin (2021). Moreover, learners' learning through self-learning modules was assisted and guided by their parents, siblings, relatives, and other significant others who served as the home's acting teacher for effective instruction (Panganiban & Madrigal, 2021).

The fifth theme describes how participants perceived the quality of the printed mathematics self-learning modules provided by the Department of Education (DepEd) in the Philippines. Learning resources are an essential factor in learning as they guide learners, especially in the absence of a teacher in times of crisis. These sentiments prove that the quality of the self-learning modules provided by the Department of Education (DepEd) was not optimal. Learning resources are significant in distance education, especially if learners have no other learning resources, but the Department of Education has failed to fulfill this aspect of modular distance learning among learners. According to Panganiban and Madrigal (2021) and Pe Dangle (2020), there was a lack of funding to produce modules and supplementary materials, and schools could only provide low-quality printed modules, leading to learners' and teachers' disappointment. This was revealed by Gueta and Janer (2021), who suggested that each school must be adequately supported and funded to ensure the proper module replication needed for the learning of the students.

The limited number of examples provided in the module caused learners to have difficulty learning math lessons, thus making most of the learners rely on the given examples in the self-learning modules provided. However, it was not sufficient for learners to fully grasp the lesson concept, especially when considering limited learning resources as a guide. Modular Distance Learning (MDL) benefits participants but requires essential resources for quality learning (Panganiban & Madrigal, 2021). One of the reasons that learners have difficulty answering their modules is the lack of information in their learning materials (Panganiban & Madrigal, 2021).

The sixth theme shows how learners mismanaged their time at home instead of learning in a modular distance-learning setup. Given the various distractions, the learners could not manage their time. Modular distance learning develops learners' discipline through self-regulation and self-perseverance. Nonetheless, not all learners develop these characteristics. By contrast, learners tend to relax too much and end up cramming, which is a clear disadvantage for learners. Most learners have time management

issues and are unable to focus due to various distractions, such as household chores, which result in poor time management (De Claro, 2021). Moreover, dishonesty in answering modules has been vast with the use of AI tools, and the students do not study anymore but rather just get the answers by surfing the net. According to Lichauco et al. (2023), while institutional policies were perceived as high, there was a low positive correlation between policy awareness and the tendency to engage in academic dishonesty in one category of learners. Plagiarism-detecting software may deter some forms of cheating; however, opportunities for other forms of academic misconduct still exist. The prevalence of academic misconduct was higher among second-year students, indicating the normalization of such behavior among peers.

2.3 Motivation

Learner motivation is essential for success in online learning environments (Artino 2008; Widjaja and Chen 2017). Motivation is "a theoretical construct used to explain the initiation, direction, intensity, persistence, and quality of behavior, especially goal-directed behavior" (Widjaja & Chen, 2017). Self-Determination Theory (SDT) is a meta-theory of human motivation and personal development (Deci and Ryan 2000). It combines several mini-theories to explain a detailed understanding of human motivation and functioning (Legault, 2017). SDT's six mini-theories account for human behavior across life domains, including work, relationships, education, religion, health, sports, and even stereotyping and prejudice (Legault, 2017). SDT is based on the main assumption that people have an inborn need for competence, autonomy, and relatedness to other people and search for activities that satisfy these needs (Studer & Knecht, 2016).

The following are assumptions about SDT: First, motivation in a certain activity is determined by the perceived degree to which the activity offers feelings of competence, autonomy, and relatedness, including the current strength of these needs (subject to individual and state differences). The second assumption is that intrinsic motivation should be differentiated from extrinsic motivation. Intrinsic motivation is better type of motivation for securing personal well-being and advancing personal growth. SDT also postulates that extrinsic motivation can be divided into four subtypes, including activities performed purely satisfying an external demand (external regulation) and activities performed to achieve fully internalized instrumental outcomes, and that is integrated into the repertoires of behaviors satisfying psychological needs (integrated regulation), "introjected regulation," and "identified regulation." Finally, SDT assumes that perception of autonomy, and thus also the "quality" of motivation, increases from situations of "external regulation" through to activities under "integrated regulation" integrated regulation'(Studer & Knecht, 2016).

Motivation is a prerequisite for learning engagement (Saeed & Zyngier, 2012). Research shows that motivated learners have the inner strength to learn and adjust to the demands of the school context (Ferreira et al., 2011), are more likely to be actively engaged, and display improved performance, persistence, and creativity (Schunk, Meece, & Pintrich, 2014). Online learning cannot be a possible substitute if these learners are not motivated enough (Aduayi-Akue et al., 2017) because lack of motivation is a reason for learner attrition in distance education (Murphy & Rodríguez-Manzanares, 2009). Lim and Kim (2003) emphasized that motivating learners in distance education is challenging, especially in circumstances where interactions are low, such as self-directed online instruction. However, if teachers are enthusiastic, sincere, and approachable, learners' motivation for online courses will be established. Teachers must design relevant learning activities, such as online discussions, to realize their goals, aspirations, and interests. (Hartnett, St. George, & Dron, 2011).

Learner motivation has been widely studied across a vast range of traditional educational settings (Hartnett et al., 2011). However, Bekele (2010) noted that research exploring the motivation to learn in online environments is limited in both number and scope. In addition, distance education motivation is mainly studied at the post-secondary level, and few studies have been conducted at the high school level (Murphy & Rodríguez-Manzanares, 2009).

Another thing about getting the full attention of learners to become motivated to learn online is the use of computer games. Based on the findings of Khaneghahi et al. (2022), computer games are mental and

cognitive activities that lead children to reach high levels of thinking and increase their concentration and creative thinking. Almagro, R. E., & Edig, M. M. (2024) have also revealed a clear connection between positive computer attitudes and active social media engagement. Moreover, significant evidence has indicated the effectiveness of motivational strategies in improving math learning outcomes. This shows that the more students are engaged in computers, the easier it is for them to be motivated to learn mathematics online.

2.4 Studies Related to Motivation and Interest

Musso et al. (2012) investigated how different but interrelated variables, such as background, motivation, and social support, could explain learners' attitudes towards math. In their study, they adapted the "Intrinsic Motivation Inventory" to assess the main determinants of self-motivation. He also measured teachers' perceptions, peer support, and learners' attitudes. In their findings, learners held a positive attitude towards mathematics, which explained their grade achievements in mathematics. Further, we conducted a hierarchical analysis using SEM, which showed that motivation-related variables are the main predictors of learner attitude, and that teachers and peer support are highly significant in explaining these attitudes. Their findings are consistent with those of Khayati and Payan (2014), whose work dwelts teachers' opinions on the factors that influence learners' interest in mathematics. In their findings, the separation of the educational classroom of mathematics from the main classroom, peers, size and appearance of the math book, and first-grade teachers at each educational level, among whom the elementary first-grade teachers had more importance and impact, were among the most influential and important factors in this regard. They further added that school environment, family, conducting research related to mathematics, its daily application in life and other courses, and studying the history of mathematics were categorized as important factors that would increase learners' interest in mathematics, and they think that these factors can be categorized into variables. Singh et al. (2002) used structural equation models to also estimate and test the conjectured relationships of 2 motivation factors, 1 attitude factor, and 1 academic engagement factor on achievement in mathematics and science among learners in the United States. Their results supported the positive effects of two motivation factors, attitude and academic time, on mathematics and science achievement. The strongest effects were those of the academic time spent on homework.

Also, Davadas and Lay (2017) also investigated "Factors Affecting Learners' Attitude toward Mathematics: A Structural Equation Modeling Approach" among Malaysian Form 4 learners. Using the partial least squares structural equation modeling approach, they established interrelationships between the factors of parental influence, teacher affective support, classroom attitude, and learners' attitude toward mathematics. In order, their study found that the latter two factors have more influence on learners' attitudes towards mathematics than the former. Their findings align with those of Aryana et al. (2010), who conducted a study involving 220 Turkish learners and found that the enjoyment of the teaching method and help with mathematics from parents had a significant negative effect on mathematics anxiety. Kocakaya and Kocakaya (2014) studied how the number of teachers and expert teachers among elementary learners influences their academic achievement in science and mathematics. They sampled 5,672 elementary learners for their study, and using SEM, it has been observed that the established model has acceptable fit indices, and an increasing number of teachers and expert teachers have positive effects on learners' science and mathematics achievements. Can these positive effects on the 5,672 learners' academic achievement in mathematics and science be attributed to an increase in their interest in mathematics?

Moreover, Heinze et al. (2005) concluded in their work that interest in mathematics can be regarded as a predictor of mathematics achievement. They also added that learners showed hardly any fear of mathematics, independent of their achievement level. Koller et al. (2001) said their data show that interest does not influence achievement in lower secondary schools, but it later becomes an important predictor of course choices. According to Quílez-Robres (2021), there is a moderate positive effect size (0.321) for motivational and social factors (0.210), and a small positive effect size (0.172) for emotional factors. The moderating effects of age (65% for social factors) and geographical area (52% for motivational factors, 17% for emotional factors, and 76% for social factors) were studied. These results highlight the importance of motivational and social factors for academic achievement. In addition, along

with the moderating effect of age, that of geographical area emerges strongly, given the diversity of the contexts studied. Our results highlight the importance of these factors in academic performance, and therefore, the need to design school plans that address the correct development of these variables. Adeyanju (2006) says, "Most studies in education focus on what goes on in the classroom while neglecting other important factors, such as sociopsychological factors. He also added that the way an individual learns is not only affected by classroom work and events, but there are other factors that determine what, why, and how an individual learns." He added that "the combination of proximal and distal factors ought to be considered, but little or no consideration is given to the distal factors like sociopsychological variables such as self-concept, study habit, attitude, dialect, gender, home and family types, peer group, parental socioeconomic status, and others that exert dominant influence on all facets of the life of an individual." What are these submissions?

In addition, Akinboye (2010) claimed that some factors that influence learners' academic performance are heredity, environment, and time. Some factors he added were also residents of the learner, family, school, and society. These factors resident in the learner include physical health, truancy, emotional problems, personality factors, poor study habits, self-concept, continued failure, lack of basic cognitive skills, and examination strategies or restiveness. Self-concept is concerned with all that an individual thinks he/she is, what he/she thinks he/she can do, and how best he/she can do it. Moreover, Al Husaini et al. (2023) revealed that low-entry grades, family support, accommodation, student gender, previous assessment grade, student internal assessment grade, GPA, and students' e-learning activity were the most significant factors influencing students' academic performance. This finding would be helpful for other researchers interested in academic performance issues, such as modeling and predicting students' academic performance. Based on Hannula (2016), Heinze et al.. al. (2015), it is a sort of self-perception that can be high (positive) or low (negative). In the last two decades, a substantial body of research has examined the correlation between success in academic achievement in general, and mathematics and science in particular. Attitudinal and affective variables such as self-concept, confidence in learning mathematics and science, interest and motivation in mathematics and science, and self-efficacy have emerged as salient predictors of achievement in mathematics and science. These factors also predict mathematics and science avoidance on the part of learners, which affects their long-term achievement and career aspirations in the mathematics and science fields. Like so, Khaneghahi, S., Sefatgol, S., & Siyasar, M. (2022) showed that there is a positive and significant relationship between academic motivation and students' academic enthusiasm. The intensity of this relationship is very strong, and academic motivation has the power to predict academic enthusiasm, which therefore leads to good academic performance

3. Methodology

3.1. Participants

The respondents of the study were K to 12 Filipino learners in an outstanding secondary school in the Division of Cagayan located in Allacapan, Cagayan, the Philippines. Simple random sampling was used to select participants in the study. Data collection began in June 2021 and ended in September 2021.

Table 1 demonstrates that most respondents were in the age range of 14–15 (87.5%). In addition, there were more female respondents (55 %). In terms of the number of siblings, most respondents had 4-5 siblings, 49.2%). Furthermore, in terms of their parents' educational attainment, respondents' fathers were at the high school level (43.33%) and respondents' mothers were at the college level (34.17%). In terms of parents' occupations, most of their fathers' occupations were farming (70.83%) and their mothers' occupations were housekeepers (67.5%).

Table 1. Demographic characteristics of the respondents

Levels	Frequency	Percent	Levels	Frequency	Percent
Age			***Educational Attainment of Mother***		
14-15	105	87.5	College Graduate	23	19.17
16-17	14	11.7	College Level	41	34.17
18-19	1	0.8	High School Graduate	16	13.33

Sex		
Male	66	55
Female	54	45
Number of Siblings		
0-1	7	5.8
2-3	42	35
4-5	59	49.2
6-7	12	10
Educational Attainment of Father		
College Graduate	3	2.5
College Level	34	28.33
High School Graduate	31	25.83
High School Level	52	43.33
High School Level	28	23.33
Parents' Occupation (Father)		
Trading and Trade related	6	5
Overseas employment	3	2.5
Education (teacher)	1	0.83
Sales worker	0	0
Farming	85	70.83
Carpentry/laborer	25	20.83
Housekeeper	0	0
Parents' Occupation (Mother)		
Trading and Trade related	0	0
Overseas employment	31	25.83
Education (teacher)	4	3.33
Sales worker	4	3.33
Farming	0	0
Carpentry/laborer	0	0
Housekeeper	81	67.5

Source: Processed data by Campanilla (2022)

3.2. Research instrument

The main data-gathering instrument used in this study was a survey questionnaire. The researcher created a checklist to determine the profiles of the learners. Learners' motivation to learn mathematics was determined using the Motivation Scale for Learning Mathematics (IMSLM) by Mubeen and Reid (2014). The IMSLM was modified by the researcher to suit learners. The reliability and validity of the modified Motivation Scale instrument were tested using Cronbach's alpha, and a score greater than 0.70 was considered satisfactory for the overall reliability of the instrument.

3.3. Data Analysis

A descriptive research method employing survey and correlational research techniques was used to explore learners' motivation to learn mathematics. A descriptive design was used to determine the profile of the learners, such as their age, sex, parents' highest educational attainment, number of siblings, and parents' occupations. It was also used to determine the learners' performance in mathematics and their motivation to learn mathematics. A correlational research design was used to determine the relationship between learners' performance in mathematics, their profile variables, and motivation.

A multivariate analysis of variance was used to analyze the data, which involved the observation and analysis of more than one statistical variable at a time. Simple frequency counts and percentage distributions were used for data on the learners' profiles. When all the data were gathered, they were tabulated and treated statistically. To assess the motivation of the learners, individual and category weighted mean computations were applied using a 5-point Likert scale. The Pearson product-moment correlation was used to determine the relationship between the different variables in the study. Multiple regression analysis was used to determine the variables that explain variations in learners' performance in mathematics, and to determine the factors contained in the motivation instrument. Factor analysis, particularly principal component analysis, was used to determine the patterns of inter-measurement correlations and determine the number of reasons needed to account for the correlation. Statistical software was used to analyze the data gathered in the study, and it was interpreted at a significance level of 0.05. Factor analysis was tested at a significance level of 0.05.

4. Results and discussion

4.1. Learners' Motivation to Learning Mathematics

Learners' motivation to learn mathematics is presented in Table 2. As shown, the learners strongly agreed that their personal goals and objectives are associated with their mathematics learning (4.29), as the mathematical concepts they learn can assist them in finding an excellent career (4.27). They also strongly agreed that they tried to perform well in mathematics evaluation as compared to other learners (4.25), and they prepared well for mathematics tests, assignments, and projects (4.25). This finding shows that learners appreciate how interesting, important, and useful the task is in their mathematics subject; thus, high tasks lead to more involvement in learning.

Furthermore, they also agreed that it always concerns them that other learners perform better in mathematics (3.8), which makes them anxious about how they will perform better in mathematics (4.04). Thus, they seek to understand if they find it difficult to learn mathematics (4.08), if they learn mathematics with great interest and put in adequate effort (4.06), and if they employ different approaches that ensure they learn mathematics well (3.95). In addition, the learners further agreed that it is essential and valuable for them to obtain high scores in mathematics (4.1). This finding is supported by the learners' responses during the interviews that they often like to learn things that interest them on their own, and they often ask questions because they want to learn things. Moreover, they prefer to work on problems to know how to solve them, and sometimes they like difficult problems because they enjoy trying to solve them. Aryana (2010) concluded that learners who feel more confident about themselves are not apprehensive, and they have higher academic achievement in contrast to those who do not have confidence in themselves. Similarly, Naderi et al. (2009) noted that research has consistently shown a positive correlation between how people value themselves and their academic attainment. According to them, learners who feel confident generally achieve more, while those who lack confidence in themselves achieve less.

Table 2. Learners' Motivation to Learning Mathematics

Statements	Weighted Mean	Descriptive Value
"WHEN I AM IN MATHEMATICS CLASS…"		
1. I take a pleasure in mathematics learning.	3.78	Agree
2. My personal goals and objectives associate with my mathematics learning.	4.29	Strongly Agree
3. It always concerns me that other Learners perform better in Mathematics.	3.88	Agree
4. It makes me anxious about how I will perform better in Mathematics.	4.04	Agree
5. I seek to understand if I find difficulty in learning Mathematics.	4.08	Agree
6. When the time comes to take mathematics test, I will become anxious.	3.81	Agree
7. It is essential and valuable for me to get high scores on Mathematics.	4.1	Agree
8. I learn Mathematics with great interest and put in adequate effort.	4.06	Agree
9. I employ different approaches that ensure I learn Mathematics well.	3.95	Agree

10. The mathematical concepts I learn can assist me to find an excellent career.	4.27	Strongly Agree
11. I think about the mathematics learning that how it will help me in my profession.	3.83	Agree
12. I expect to achieve better in the mathematics subject	3.63	Agree
13. It makes me worried to think about a weak performance in mathematics test.	4.03	Agree
14. I try to perform well in mathematics evaluation as compared to the other Learners.	4.25	Strongly Agree
15. I take it seriously about my mathematics performance that how it will influence my overall grade.	3.83	Agree
16. Receiving high grades in mathematics is not as significant to me as the mathematical concepts I learn.	4.12	Agree
17. How mathematics will be obliging or useful to me is considerable.	3.83	Agree
18. I do not like to even think about math evaluation.	3.93	Agree
19. How I will employ the math which I study in daily lives and in future is significant to me.	4.14	Agree
20. I am personally responsible if I do not get the mathematical concepts well and am weak in understanding.	4.09	Agree
21. I am sure to perform better in Mathematics projects, problem sets, or developments.	3.8	Agree
22. I find mathematics interesting in studying.	4.18	Agree
23. The mathematical concepts have realistic worth for me.	4.08	Agree
24. I am confident in my abilities to perform well in mathematics exam.	3.71	Agree
25. All the mathematics learning is associated or pertinent to my existence.	3.98	Agree
26. I prepare well in doing mathematics tests, assignments and projects.	4.25	Strongly Agree
27. When I learn Mathematics, I like that it challenges me.	4.14	Agree
28. I am sure on my capabilities and competencies in mathematics subject.	3.82	Agree

29. I am positive that I can achieve high grade in math subject.	3.82	Agree
30. I learn Mathematics with great interest and put in adequate effort.	4.16	Agree
Weighted mean	3.996	Agree

Legend:

1.00-1.79	Strongly Disagree
1.80-2.59	Disagree
2.60-3.39	Neutral
3.40-4.19	Agree
4.20-5.00	Strongly Agree

Table 3 shows learners' levels of motivation. As can be seen, the majority (67 or 55.83 percent) of the learners were motivated, 24 or 20 percent of them were neutral, 21 or 17.50 percent of the learners were demotivated, five or 4.17% were highly motivated, and only three or 2.50 percent of the total population of learner-respondents were highly demotivated. This finding means that learners at Matucay National High School are motivated to learn mathematics because their personal goals and objectives are associated with mathematics learning, as indicated by their responses in the previous table. This finding implies that if learners perceive that what they are learning in their mathematics subject is reflective of their expectations and goals in the subject, they tend to be motivated.

Table 3. Motivation Level of the Learners in Learning Mathematics

Level of Motivation	Frequency (n=120)	Percentage
Highly Motivated	5	4.17
Motivated	67	55.83
Neutral	24	20.00
Demotivated	21	17.50
Highly Demotivated	3	2.50

Scale:

4.20-5.00	Highly Motivated
3.20-4.19	Motivated
2.60-3.19	Neutral
1.80-2.59	Demotivated
1.00-1.79	Highly Demotivated

4.2 Learners' Performance in Mathematics

The distribution of learners in terms of mathematics performance is presented in Table 4. As can be seen from the table, many of the learners (61 or 50.8 percent) had grades ranging from 84 to 87, while

34 or 28.2 percent had grades ranging from 80 to 83, and 23 or 19.2% had grades ranging from 88 to 91. The mean grade of the learners was 84.93 with a standard deviation of 2.70, which means that the learners performed satisfactorily in mathematics. This finding implies that learners have average performance in mathematics. This is a clear indication that low mathematics achievement is a perennial problem in the Philippine educational system. Moreover, this finding is supported by the PISA results that the Philippines ranked 67th of 140 countries in terms of the quality of math and science education in the 2015–2016 Global Competitiveness Report of the World Economic Forum and 79th of 138 in the 2016–2017 data.

Table 4. Distribution of Learners in Terms of Academic Performance in Mathematics

Category	Frequency (n=120)	Percentage
88-91	23	19.2
84-87	61	50.8
80-83	34	28.2
76-79	2	1.7
Weighted mean	84.93	
S.D.	2.70	

Source: Processed data by Campanilla (2022)

4.3. Correlations between the Learners' Performance in Mathematics and Selected Variables

The study hypothesized that there would be no significant relationship between learners' mathematics performance, learners' profile variables, and learners' motivation to learn mathematics. Thus, based on the results of the correlation test, the computed coefficients of mothers' educational attainment and learners' motivation to learn mathematics had associated probabilities of less than.05. In this regard, the null hypothesis is rejected.

The correlation analysis also revealed that mothers' educational attainment was significantly related to their mathematics performance, as shown by the computed r-value of 0.2004 with a probability of 0.0282. This finding indicates that the higher the mother's education, the greater the probability that she can help her children in their studies. This is because the mother is usually the one who tutors the children at home, and mathematics is a complicated discipline that requires patience, wide knowledge, and understanding. Furthermore, this finding is consistent with the findings of Siyang (2023), who found that mothers with higher educational attainment can promote the comprehensive quality of their children and help support the sustainable development of society. Moreover, learners whose parents had less than a high school education obtained lower grades in mathematics than those whose parents had a higher level of education.

Lastly, learners' motivation to learn mathematics was found to be significantly related to their mathematics performance, as indicated by the r-value of 0.3193 and a probability of 0.0143. This finding indicates that learners' motivation to learn mathematics was directly related to their academic performance in mathematics; thus, the presence of motivation would result in an improvement in their math performance.

Table 5. Correlations Between the Learners' Performance in Mathematics and Selected Variables

Variables	r-value	Prob.	Statistical Inference
Learners' profile variables			
Age	0.0268	0.7711	Not Significant
Sex	-0.0065	0.9435	Not Significant
Mother's educational attainment	0.2004	0.0282	Significant

Father's educational attainment	0.1604	0.0802	Not Significant
Mother's occupation	0.0243	0.7924	Not Significant
Father's occupation	-0.0332	0.7188	Not Significant
Number of siblings	-0.1089	0.2363	Not Significant
Learners' motivation to learning Mathematics	0.3193	0.0143	Significant

Source: Processed data by Campanilla (2022)

This further shows that learners who show high achievement motivation will have much to change to reach their goal in mathematics classes. In the undertaking of Otoo et al. (2018), the results showed that learners' confidence directly affects their interest in the learning of mathematics, and there is a direct relationship between confidence and motivation. Therefore, a learner's knowledge of the usefulness of mathematics indirectly increases their interest in mathematics. Learners pick up the perception that mathematics is abstract, and therefore, the learning of mathematics would yield no benefit. With their attitude towards mathematics modelled and their interest in mathematics impacted by this automatic-generated perception, they may never again appreciate the beauty of mathematics. Moreover, Heinze et al. (2005) concluded in their work that interest in mathematics can be regarded as a predictor of mathematics achievement. They also added that learners showed hardly any fear of mathematics, independent of their achievement level.

4.3. Regression Parameters on the Achievement of Learners in Mathematics

Table 6 presents the predictors of the learners' mathematics achievement. It was found that a mother's educational attainment and a learner's motivation to learn mathematics were predictors, as can be explained by 18.4 and 22.3 percent, respectively, of the differences in learners' achievement in mathematics. As shown by the regression coefficient of 0.684, for every unit increase in a mother's educational attainment, mathematics achievement increased by 0.684 units. As explained in the previous tables, a mother's educational attainment is directly related to the learners' achievement in mathematics. This study found that the level of education of the mother influences their knowledge, beliefs, values, and goals about childrearing. For example, higher levels of education may enhance mothers' ability to become involved in their children's education and enable them to acquire and model social skills and problem-solving strategies that are conducive to children's school success. Thus, learners whose mothers have higher levels of education may have an enhanced regard for learning, more positive beliefs, a stronger work orientation, and use more effective learning strategies than children of mothers with lower levels of education.

Citing Qamar et al. (2017), the results showed a weak but positive and statistically significant relationship between paternal authoritative style and the academic self-efficacy of the students. The study showed a weak, positive, and no statistically significant relationship between maternal authoritative style, paternal and maternal authoritarian style, and paternal and maternal permissive style and students' academic self-efficacy. Parental self-efficacy beliefs significantly predicted children's academic abilities.

Learners' motivation to learn mathematics can also explain 22.3 percent of the difference in their mathematics achievements. As explained in the previous tables, learners' motivation was significantly correlated with their mathematics achievement. This finding means that as learners' motivation increases, their mathematics performance also improves. This finding is also supported by the findings of Muenks et al. (2017) and Steinmayr et al. (2018), who found that learners' motivation plays a critical role in children's academic achievement. They highlighted that learners' ability self-concept turned out to be the most important motivational predictor of their grades above and beyond differences in their intelligence and prior grades, even when all predictors were assessed domain-specifically. Of the two learners with similar intelligence scores, the same prior achievement, and similar task values, goals, and achievement motives in a domain, learners with a higher domain-specific ability self-concept will receive better school grades in the respective domain. Therefore, there is strong evidence that believing in one's own competencies is advantageous for academic achievement. This finding shows once again

that implementing validated interventions aimed at enhancing learners' domain-specific ability beliefs in school is a promising approach.

The regression coefficient was achievement in mathematics = 69.896 + 0.684 (mother's educational attainment) + 1.337 (learner's motivation to learn mathematics). Based on this equation, to obtain a 75 percent grade in mathematics, the equation should be *Achievement in Mathematics = 69.896 + 0.684 (high school level) + 1.337 (neutral motivation level: 2.62)*.

Table 6. Regression Parameters of Learners in Mathematics

Predictors	R- square Change	Regression Coefficients	Standard Error	t- value	Probability
Constant		69.896	3.692	18.767	.000
Mothers' Educational Attainment	.184	.684	.678	1.009	.319
Learner's motivation to learning Mathematics	.223	1.337	1.552	.861	.394

Source: Processed data by Campanilla (2022)

4.3. Descriptive Factors of Learners Contained in the Motivation Instrument

Learners' motivation to learn mathematics is generally categorized into five factors or attributes:
The first factor is labelled learner expectations because these statements heavily impact the academic prospects and outlook of learners in their mathematics class. These statements, such as my personal goals and objectives, are associated with my mathematics learning; I expect to achieve better in the mathematics subject; how mathematics will be obliging or useful to me is considerable; how I will employ the math that I study in my daily life and in the future is significant to me; the mathematical concepts have realistic worth for me; and I feel successful in understanding mathematical concepts. These statements indicate that learners' motivation to learn mathematics is driven by their expectations that learning mathematics will be useful in making connections within other contexts and disciplines, and that math skills are very important to their future and job success.

The second factor is labelled learning outcomes because these statements heavily rely on the knowledge, skills, and application of the knowledge and skills the learner has acquired and is able to demonstrate because of learning in their mathematics class. These statements include: I take pleasure in mathematics learning, which always concerns me that other learners perform better in mathematics; it is essential and valuable for me to get high scores on Mathematics; I learn Mathematics with great interest and put in adequate effort; I try to perform well in Mathematics evaluation as compared to the other learners; I take it seriously about my mathematics performance that how it will influence my overall grade; I am sure to perform better in mathematics projects, problem sets, or developments; I find Mathematics interesting in studying; I am confident in my abilities to perform well in mathematics exam; all the mathematics learning is associated or pertinent to my existence; when I learn Mathematics, I like that it challenges me and I am sure of my capabilities and competencies in mathematics subject.

The third factor is labelled "development track in mathematics because these statements are focused on the different strategies and mechanisms the learners employ to track their progress in the mathematics classroom. These statements include the following: It makes me anxious about how I will perform better in mathematics; I seek to understand if I find difficulty in learning mathematics; I employ different approaches that ensure I learn mathematics well; I am personally responsible if I do not get the mathematics concepts well and am weak in understanding; and I prepare well for doing mathematics tests, assignments, and projects.

The statements in Factors 2 and 3 indicate that learners are motivated by their learning achievements. Moreover, learners are interested in learning and mastering content or a given skill in mathematics. This finding implies that learners are both grade- and learning-oriented. They are grade-oriented learners because they are interested in appearing competent or better than others, regardless of the achieved

level. Moreover, they are learning-oriented learners because they intentionally take on difficult tasks beyond their present capability because they consider mistakes and failures as learning opportunities.

The fourth factor is labelled as success in a future career because these statements heavily impact learners' regard for the impact of mathematics learning in their future careers in the world of work. These statements include: The mathematical concepts I learn can assist me in finding an excellent career; I think about the mathematics I learn and how it will help me in my profession; and I am positive that I can achieve a high grade in math. This finding implies that learners at Matucay National High School are motivated to learn mathematics because it can lead to a rewarding and lucrative career. This shows that learners are driven to learn mathematics as it entails their growth and earning potential and the skills needed to be successful.

The fifth factor is labelled as test-taking ability because these statements consider the different test-taking situations learners face in their mathematics class. Specifically, these statements include: When the time comes to take a mathematics test, I will become anxious; it makes me worried about a weak performance in a mathematics test, and I do not like to even think about math evaluation. These statements indicate that the learners experienced math test anxiety. Math test anxiety most often appears initially as a retention and recalling constraint on a particular problem—often one that the learner "knew" how to do moments before the test. Worrying over the original problem can lead to more generalized worry and negative self-talk, which can sabotage the learner's overall test performance.

Table 7. Factors of Learners' Motivation in Learning Mathematics

	Components				
	1	2	3	4	5
M1	0.071	**0.621**	0.231	0.211	0.122
M2	**0.649**	0.213	0.410	0.231	-0.059
M3	0.131	**0.612**	0.912	0.312	0.149
M4	0.301	0.211	**0.518**	0.092	0.017
M5	0.361	0.214	**0.531**	0.217	0.009
M6	0.319	0.311	0.099	0.471	**0.612**
M7	0.400	**0.609**	0.210	0.278	-0.044
M8	0.391	**0.505**	0.182	0.390	-0.110
M9	0.299	0.121	**0.591**	0.281	0.012
M10	0.213	0.213	0.211	**0.586**	-0.107
M11	0.289	0.211	0.311	**0.571**	-0.068
M12	**0.811**	0.091	0.301	-0.091	-0.278
M13	0.230	0.281	0.209	0.195	**0.556**
M14	0.241	**0.591**	0.219	0.109	0.279
M15	0.311	**0.511**	0.311	0.305	-0.009
M16	0.323	0.321	**0.520**	0.125	0.123
M17	**0.597**	0.131	0.311	0.023	0.055
M18	0.315	0.384	0.219	-0.076	**0.510**
M19	**0.613**	0.209	0.324	0.215	0.221
M20	0.318	0.091	**0.552**	-0.186	0.060
M21	0.299	**0.621**	0.411	-0.333	0.077
M22	0.311	**0.597**	0.320	-0.250	0.167
M23	**0.611**	0.211	0.391	-0.111	0.322
M24	0.083	**0.610**	0.311	0.318	-0.054
M25	0.099	**0.518**	0.302	-0.047	-0.143
M26	0.121	0.241	**0.592**	-0.150	0.183
M27	0.081	**0.611**	0.094	0.353	-0.212
M28	0.092	**0.590**	0.241	0.214	0.362
M29	0.189	0.312	0.211	**0.572**	0.003

M30	**0.598**	0.314	0.321	0.010	0.044

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization

Components

1. Learner Expectations
2. Learning outcomes
3. Development track in Mathematics
4. Success in future career
5. Test-taking ability

5. Conclusion

This chapter presents a summary of the major findings of the study, conclusions, and recommendations for its possible implementation.

5.1 Summary

The primary objective of this study was to investigate how motivation can explain learners' performance in mathematics. This study on the exploratory analysis of learners' motivation to learn mathematics was limited to Grade 9 learners of Matucay National High School, Allacapan, Cagayan, for the school year 2021-2022. Basically, it determined the profile of the learners based on their age, sex, parents' highest educational attainment, number of siblings, parents' occupation, and the motivation of the learners, which was limited to the results of the survey using the measurement of motivation by Mubeen and Reid (2014). The study also tested their relationship to the achievement of learners in mathematics and determined a regression model for predicting learners' performance in high school mathematics.

A multivariate analysis of variance was used to analyze the data, which involved the observation and analysis of more than one statistical variable at a time. Simple frequency counts and percentage distributions were used for data on the learners' profiles. When all the data were gathered, they were tabulated and treated statistically. To assess the motivation of the learners, individual and category-weighted mean computations were applied using a 5-point Likert scale.

The Pearson product-moment correlation was used to determine the relationship between the different variables in the study. Multiple regression analysis was used to determine the variables that explain variations in learners' performance in mathematics, and to determine the factors contained in the motivation instrument. Factor analysis, particularly principal component analysis, was used to determine the patterns of inter-measurement correlations and determine the number of reasons needed to account for the correlation.

Statistical software was used to analyze the data gathered in the study, and it was interpreted at a significance level of 0.05. Factor analysis was tested at a significance level of 0.05. The study found that Grade 9 learners of Matucay National High School were male dominated; they were at the right age for a Grade 9 learner, had satisfactory performance in mathematics, and had four siblings. Moreover, most of their fathers and mothers completed basic education, whereas most of the learners' mothers were plain housewives and most of the learners' fathers were farmers. Most learners have cellphones and access to the Internet. They sometimes used their gadgets, and most of them used their Internet access on social networking websites.

On the other hand, the study also found that learners strongly agreed that their personal goals and objectives are associated with their mathematics learning, since the mathematical concepts they learn can assist them in finding an excellent career. They also strongly agreed that they tried to perform well in mathematics evaluation as compared to the other learners, and they prepared well for mathematics tests, assignments, and projects. Furthermore, they also agreed that it always concerns them that other learners perform better in mathematics, which makes them anxious about how they will perform better. As apparent from the findings of the study, the mathematics performance of learners is significantly related to their mother's educational attainment and the learner's motivation to learn mathematics.

The regression model that was developed to predict learners' performance in mathematics has an equation of: Mathematics Performance = 69.896 + 0.684 (Mothers' Educational Attainment) + 1.337 (Learners' Motivation to learn Mathematics).

Finally, the motivation of learners to learn mathematics is generally categorized into five factors or attributes, where the first factor is labeled as learner expectations, the second factor is labeled as learning outcomes, the third factor is the development track in mathematics, the fourth factor is labeled as success in a future career, and the fifth factor is labeled as test-taking ability.

5.2 Conclusion

The preparation of mothers, especially their educational attainment, is significant for every child's academic performance, especially in mathematics. Learners' motivation and positive regard towards a subject greatly help to teach them to acquire positive or favorable study habits on a particular subject, especially in a not-so-loved subject such as mathematics.

Wrapping these conclusions up, a well-provided learner extrinsically and basically by his or her mother and acquired a favorable level of personal motivation in learning a certain subject then it will be no question that he or she would perform high.

The regression model developed to predict learners' performance in mathematics has the following equation: Mathematics Performance = 69.896 + 0.684 (mothers' educational attainment) + 1.337 (learners' motivation to learn mathematics).

5.3 Recommendations

Based on these conclusions, the following recommendations are made:

1. The Department of Education (DepEd) should conduct seminars, workshops, and training on embracing electronic gadgets and online classes as part of the demand of the K–12 curriculum for the twenty-first century or modern teachers to improve the performance of learners, especially now that there are changes in the learning platform due to the COVID-19 pandemic.
2. School heads should re-examine and develop strategic plans to enhance the performance of high school mathematics learners. They should also formulate programs that address the needs of learners, especially to elevate learners' motivation.
3. Teachers may utilize different strategies in teaching mathematics, such as a realistic mathematics education approach and hands-on learning, to increase learners' motivation to learn mathematics.
4. Parents, especially mothers, regardless of educational attainment, should spend quality time with their children to strengthen their interest in studying, especially mathematics.
5. Positive displays of attitude and motivation by learners should always be considered by teachers; thus, teachers should be creative in the learning activities implemented.
6. A similar study should be conducted in other disciplines to determine a regression model to predict learners' learning.

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