Students' Satisfaction and Attitudes Toward Mathematics in Blended Learning in Relation To Performance in Mathematics

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ABSTRACT:

This research delved into the pivotal role of student satisfaction and positive attitudes in fostering academic achievement in Mathematics, particularly within the context of blended learning. The investigation encompassed the attitudes and satisfaction levels of 163 Grade 7 to 10 students, selected via stratified random sampling. Employing a descriptive-correlational research design, the study utilized questionnaires to collect data, which were subsequently analyzed through Mean, Standard Deviation, Pearson Product-Moment Correlation Coefficient, and Stepwise Multiple Regression Analysis. The findings unveiled a prevailing positive attitude among students toward blended learning, indicating satisfaction with the instructor, instructional methods, interaction, and technological aspects during the blended learning experience. Furthermore, the students' performance in Mathematics exhibited a satisfactory level during blended learning. A noteworthy correlation emerged between students' favorable attitudes toward Mathematics and their academic performance. Additionally, a significant relationship was identified between students' satisfaction with the teacher and interaction during blended learning, and their subsequent academic performance in Mathematics. Crucially, the study identified predictors for students' performance in Mathematics during blended learning, highlighting the influential role of their attitudes toward liking Mathematics and their satisfaction with teachers. In light of these findings, the study proposes that Mathematics educators should proactively incorporate activities aimed at enhancing student satisfaction and cultivating positive attitudes toward Mathematics within the blended learning modality. This strategic approach is posited to contribute significantly to optimizing academic outcomes in Mathematics.

KEYWORDS: blended learning, mathematics, performance, satisfaction, teachers' performance

INTRODUCTION

The Covid-19 pandemic and the ensuing societal alienation have had an impact on all facets of society, including education (Dreseen et al., 2020). Educational institutions have had to quickly adjust to the situation to maintain education. Online learning has received an unparalleled push as a result of this (Teras et al., 2020). Due to the closure of schools during the pandemic, the majority of learners are learning online. Learners in elementary years are difficult to keep motivated while they are learning remotely (Bester & Pirc, 2020). Assuring that the children are interested, involved, and confident in their learning is what motivation entails. Parents and teachers play a vital role in offering encouragement and feedback to pupils (Rasmitadila et al., 2020). Despite the federal and state government's best efforts to

encourage e-learning and online education, the Coronavirus pandemic and the resulting lockdown have forced schools around the world to temporarily close, and this virus has created a large gap in the education system (Hoffman & Miller, 2020 & Komada et al., 2021).

The pandemic-related abrupt change in the Philippine school system's delivery has an impact on the educational learning environment. Until the last quarter of school year 2022-2023, schools all across the globe had switched to online instruction. After the vaccine period, several schools transitioned to blended learning. In contrast to face-to-face training alone, blended learning chains face-to-face instruction with online and offline classess (Awal et al., 2021).

The development of blended learning acquired significance as a fresh approach to education on a worldwide scale. Blended learning is a method that has the advantages of online and traditional learning components (Rasheed, Kamsin & Abdullah, 2020). Blended learning requires diligent work, the correct mindset, enough budget, and highly motivated teachers and students for its implementation to be successful (Dangwal, 2018). Learning can take place in various ways, with asynchronous and synchronous learning as well as face-to-face classroom instruction and virtual learning being frequently distinguished (Müller & Mildenberger, 2021).

The use of traditional teaching methods utilization of online and offline learning modalities is blended learning, and it is widely used across higher education. Some scholars have referred to it as the new traditional model or the new normal in course delivery" (Dziuban et al., 2018; Jones, 2017). With synchronous and asynchronous approaches, teaching and learning can augment the flexibility of classroom activities. Teaching and learning are combined as part of the blended learning paradigm. It incorporates e-learning with conventional learning theories and methods to encourage self-control and teamwork (Huang, 2021). The best prediction performance was found in the blended data set that combined traditional and online essential elements (Lu et al., 2018). In Indonesia, blended learning in education creates considerable changes in the learning process at school. Pupils who get instruction through blended learning feel happier and more appealing and less likely to become bored during class. In addition, blended learning enhances student engagement and motivation, idea comprehension, and successful attainment of the learning goals (Fitri & Zahari, 2019).

The Department of Education in the United States of America, a combination of classroom and online-based modalities, offers vast opportunities in learning methods for developing student skills and expertise as learners. Blended learning shows an increase in learners' ability to collaborate, be creative, do independent studies, and tailor their learning experiences to meet their needs (Cleveland-Innes & Wilton, 2018). Blended learning has a demonstrated capability to increase opportunities for student and peers and student and teacher collaboration, increase the flexibility and accessibility of learning beyond classroom, increase interaction among students and teachers, enhance learning through more meaningful learning, and promote the skills and traits of a lasting learner (Allison, 2022). Blended learning has a greater impact on increasing students' learning interests than online or face-to-face instruction (Abdullah, 2018).

MATERIAL, METHODOLOGY, AND LITERATURE REVIEW
Material of the Study

This study adopted a descriptive-correlational approach to investigate the satisfaction and attitudes of 163 Junior High School students (Grade 7 to 10) towards blended learning, selected from a total population of 280 through simple random sampling. The criteria for participation included enrollment in

the Junior High School Department for the academic year 2022-2023, completion of first-quarter requirements, and voluntary consent. The research employed three key instruments: a researcher-made questionnaire assessing students' attitudes toward learning Mathematics, yielding a reliable Cronbach's Alpha coefficient of 0.73; Students' Blended Learning Satisfaction (SBLS) questionnaire, demonstrating a Cronbach's alpha coefficient of 0.92; and a documentary analysis of first-quarter grades using the DepEd grading system. Data analysis was conducted using Minitab Software, employing Mean and Standard Deviation to identify students' attitudes and satisfaction with blended learning, Frequency and Percentage to assess performance in Mathematics, Pearson Product-Moment Correlation Coefficient to explore relationships, and Stepwise Multiple Regression Analysis to identify predictive constructs or variables impacting students' Mathematics performance.

Methodology

Prior to data collection, the researcher sought permission from the Dean of the Graduate School and obtained approval. Subsequently, a letter was sent to the Vice President for Academic Affairs (VPAA) of Misamis, and upon securing the necessary permit, consent letters were distributed to the respondents, accompanied by an explanation of the study's significance. Data gathering occurred exclusively on the school premises, where the researchers administered survey questionnaires to ensure full cooperation and facilitate data retrieval. The collected data underwent tallying, analysis, and interpretation.

Literature Review

The attitudes of the students toward Mathematics are their emotional reactions, whether good or negative, their level of confidence to succeed in studying Mathematics, and their coping mechanisms for dealing with mathematical issues (Ajisuksmo & Saputri, 2017). The degree of love or dislike someone has for mathematics (Iji et al., 2018). The degree of influence linked with mathematics or the emotional state of mind toward the subject, which may be positive or negative, is known as attitude toward mathematics (Aguanta & Tan, 2018). Students frequently develop good or negative attitudes towards Mathematics when learning the subject during high school. Students' high school attitudes often persist for a long time, influencing whether they plan to major in mathematics in college.

Indicators of student satisfaction are frequently used to evaluate the efficacy and quality of online programs (Sampson, 2017). This is based on the justification that students evaluate the caliber of their educational experience when they express how satisfied they are with a course. In addition, a high degree of student satisfaction may be a sign of timely and meaningful communication between students and their teachers and a sign that the teaching strategies effectively reflect from learning objectives and expectations (Moore, 2017). Finally, student satisfaction also affects motivation and attitude, which may significantly impact how effectively students learn in Math (McFarland & Hamilton, 2017).

A study conducted in Sakarya Universities, Turkey, motivation strongly predicted online learning satisfaction. The social interaction, desire to learn, self-development, and educational progress are the four motivation constructs significantly related to satisfaction (Shih et al., 2017). In Qatar, students experienced lower satisfaction because of the need for more interaction with students and teachers and a minimum motivation to do the required classroom tasks (Alkhatib, 2018). One of the reasons is the demands for active and interactive classes is providing hands-on experiences and effective development of skills during class discussions (Potkonjak et al., 2017). Due to the teachers' and students'

need for technological proficiency and problem-solving capabilities, full-scale online delivery of school courses is uncommon (Alkhatib, 2018).

Additional elements in analyzing students' academic achievement in mathematics need to be considered. Aside from the usual trends, such as a students' academic history or documented learning difficulties, the online learning environment has thrown some wrenches into the works (Alonazi & Ahmed, 2018). Some additional factors affecting student performance in Mathematics include the environment, family status in the community, and the availability of new teaching methodologies. The students' home situation is considered one factor to be emphasized, especially those students learning remotely. Many students, even those who have done well in previous academic contexts, may require assistance in the new hybrid and online learning environments. Students flourish when given a chance to work together and interact with others. They develop academically and socially from class discussions and interactions with others. Unfortunately, they are currently denied the chance to do so in person. Discussions can be conducted remotely, but this efficiency depends heavily on the teacher or facilitator (Chazen, 2020).

The mid-Atlantic University studied if very high levels of personal happiness were connected with educational success at the tertiary level (Antaramian, 2017). In terms of academic performance, it was revealed that students with higher satisfaction in socioeconomic status were an advantage over those with low satisfaction. Mathematics needs higher student engagement, self-efficacy, approach-oriented goals, and lesser academic pressure. Also, the most contented students outperformed their less contented counterparts in terms of Grade Point Averages (GPA) (Antamarian, Francis &Taylor, 2017).

One subject that Filipino students struggle with in the Philippines is Mathematics (Capuno et al., 2019). The Mathematics achievement of students in the nation consistently outpaces that of learners from other nations (Punzalan & Buenaflor, 2017). According to the 2019 Trends in International Mathematics and Science Survey, the Philippines was placed last in Mathematics among fifty-eight participating countries. The Programme for International Student Assessment highlighted that the Philippines' ranking in terms of mathematical literacy in 2018 was second-worst out of seventy-nine nations (Bernardo, 2020). Also, the Philippines placed 79th out of 138 countries in the 2016–2017 edition of the World Economic Forum's Global Competitiveness Report for Mathematical Education (Capuno et al., 2019). Thus, it is critical to offer learners a variety of engaging learning opportunities to boost their performance in Mathematics (Bakait et al., 2021).

RESULTS AND DISCUSSION

Attitude of the Students toward Blended Learning

Table 1 shows the students' positive attitude toward blended learning (M = 3.11; SD = 0.43). Among the three categories, the students have a very positive attitude toward valuing Mathematics (M = 3.31; SD= 0.57). However, the category confidence in Mathematics obtained the lowest rating (M = 2.83' SD = 0.43). The findings revealed that the respondents valued mathematics and they preferred a job including mathematics. They believed that learning mathematics would aid them in achieving their goals and advancing in their careers. However, the students perceived a low level of confidence in Mathematics. Thus, students felt that their Mathematics performance could have been higher. Mathematics was difficult for them, and recalling Mathematics topics is difficult for them. They experienced a problem after the discussion with the teacher.

In terms of confidence, the results show that the respondents had neutral sentiments toward their capacity to study Mathematics (M = 2.83; SD = 0.43). Due to the difficulty of the subject, students require assistance. As a result, they lose faith in their ability to learn the material. Therefore, it is essential to increase their self-assurance in their ability to learn the material so that their attitudes toward it change. Students' performance may suffer if their attitudes toward learning the material are ignored at this stage. Teachers should therefore develop methods to increase pupils' confidence in learning the material.

Assessing respondents' perspectives on the importance of Mathematics in their lives reveals their attitudes toward the subject. The table presents the respondents' attitudes toward Mathematics and its value. The overall result (M = 3.31; SD = 0.57) indicates that respondents had favorable attitudes toward the importance of Mathematics. Students stated that the subject is important because they can apply the concepts in their daily activities. However, these positive attitudes must be maintained, and they engage additional activities to instill the value of Mathematics.

Currently, blended learning is a very popular and important style of education based on information technology (Siregar et al., 2019). The COVID-19 epidemic led to a paradigm change in how people learn and was the source of this solicitation. Digital-based learning, completed largely or entirely online, is replacing the paradigm and trend of conventional learning, which involves face-to-face interaction in the classroom (Muktiarni et al., 2019). It is crucial to remember that one of the key factors to consider when teaching Mathematics to students is their attitude toward the subject. Students with positive attitudes toward mathematics are more likely to succeed in the subject than those with negative attitudes (Damrongpanit, 2019).

The degree to which students enjoy the teaching-learning procedures used in the lessons impacts their confidence in mathematics (Christensen & Knezek, 2020). Therefore, it is crucial to discover elements that may foster a favorable attitude to boost the possibility that students will choose and stick with mathematics and related career sectors and foster a more widespread interest and curiosity about the natural world (Smith et al.,2022).

As blended learning is new to Junior High School students, they must have a favorable attitude toward its use in mathematics instruction. By offering a variety of activities and boosting support to students who need help catching up with the topic, teachers can help students develop a positive attitude toward the subject. By fostering a good learning environment, highlighting the value of Mathematics, stressing positive feedback, introducing technology, encouraging group work, making Mathematics interesting, and addressing negative attitudes, teachers can improve students' attitudes toward math. In addition, teachers can help students' attitudes toward arithmetic and make it more interesting and rewarding by putting these strategies into practice.

Table 1 Attitude of the Students toward Blended Learning

(n = 163)

Constructs	M	SD	Remarks
Liking Mathematics	3.19	0.28	Positive
Valuing Mathematics	3.31	0.57	Very Positive

Confidence in Mathematics	2.84	0.43	Positive
Overall Attitude	3.11	0.43	Positive

Note: Attitude Scale : 3.25-4.0 (Very Positive); 2.50- 3.24(Positive);1.75-2.49(Negative); 1.0-1.74(Very Negative)

Students' Satisfaction with Blended Learning

Table 2 shows the student's satisfaction with blended learning. According to the findings, students were generally satisfied with blended learning (M= 3.11; SD= 0.43). According to students, the blended learning strategy was excellent in keeping them interested and learning. It might cause blended learning to become more widely used in educational settings.

Students were highly satisfied (M = 3.23; SD = 0.38).with their teachers' attributes in blended learning. The outcome shows teachers support and engage students in a mixed-learning setting. Also, students in blended learning were extremely happy with the behaviors and traits demonstrated by their teachers who might be excellently interacting with and supporting their students online. Thus, positive and successful learning environment must be promoted to ensure high student satisfaction. Teachers need to handle the difficulties of blended learning well.

It is worth noting that blended teaching can be challenging for students and teachers, so it is encouraging to see that students report high levels of satisfaction with their teachers' actions and qualities. Further, to continue building on this success, gathering more specific student feedback may help identify improvement areas and support ongoing teacher development.

Students were highly satisfied with the blended learning in terms of interaction (M = 3.08, SD = 0.40), technology (M = 3.07, SD = 0.35), and instruction (M = 2.94, SD = 0.44). The high level of student satisfaction in blended learning was on the engagement with the students and teachers in blended learning, the use of technology in the teaching-learning process, and the instruction in blended learning. The data show that learners had the lowest rating on their satisfaction with instruction.

The high level of student satisfaction with interaction suggests that the teachers and students in blended learning are working well together and that the teachers are fostering a supportive and engaging learning environment. The high level of student satisfaction regarding the utilization of technology suggests that the teachers in blended learning are effectively integrating technology into their teaching and that students are finding it to be a valuable tool for learning. While students in blended learning were highly satisfied with various aspects of their education, they had a lower rating of satisfaction with the instruction they received. This information is important to consider as instruction is a crucial component of any educational experience and has a significant impact on how the students' success.

It is worth exploring the reasons for this lower satisfaction rating with instruction, as it may provide valuable insights into areas for improvement and opportunities for teacher development. For example, it may be that students are feeling overwhelmed by the volume of course materials or that they need to receive more individualized feedback from teachers. Alternatively, students may need help understanding the material or more support to apply what they are learning effectively.

Regardless of the reasons for the lower satisfaction rating with instruction, it is important to address this issue to ensure that students receive the support and guidance they need to succeed in blended learning. It can be addressed by providing additional resources, personalized feedback, or opportunities for interaction and collaboration with teachers and students. In addition, teachers need to

provide the students with instructional quality aligned to their skills to provide better learning opportunities. It is important to have an improved developed plan for instruction in guiding the students to gain knowledge, values, and skills in the teaching-learning process.

The learners' satisfaction is based on combining online and face-to-face course components to enhance and complement each other and interact. Creating a user-friendly learning environment using the blended learning modality is crucial for enhancing student and instructor engagement and communication (Zeqiri et al., 2021). The engagement and contentment of its users can be used to gauge the success of blended learning. Students' achievement, contentment, involvement, motivation, engagement, perspective, self-reliance, and accountability are just a few benefits and results of blended learning (Li, 2022; Long & Chei, 2021). Compared to pure face-to-face learning, students who used blended learning reported higher satisfaction levels. In one study, blended learning surpassed pure online learning in terms of improving students' focus, confidence, and satisfaction (Long & Chei, 2021).

A crucial part of teaching is increasing students' satisfaction with the processes inside the classroom. Teachers should allow students to connect, ask questions, use the newest technology, and receive the best instruction possible. Mathematics teachers are urged to make an extra effort to encourage students to feel more at ease and welcome in online and in-person classes. Providing pertinent examples, utilizing various teaching techniques, offering timely feedback, promoting self-reflection, and celebrating accomplishment are all steps in enhancing students' enjoyment of the subject. Teachers can use these techniques to give their students an enjoyable learning experience in Mathematics.

Table 2 Students' Satisfaction with Blended Learning
(n = 163)

Constructs	M	SD	Remarks
Teacher	3.23	0.38	Very High
Instruction	2.94	0.44	High
Interaction	3.08	0.40	High
Technology	3.07	0.35	High
Overall Satisfaction	3.11	0.43	High

Note: Satisfaction Scale : 3.25-4.0 (Very High); 2.50- 3.24(High); 1.75-2.49(Low); 1.0-1.74(Very Low)

Students' Performance in Mathematics

Table 3 shows the students' performance in Mathematics. The findings revealed that students generally performed satisfactorily (M= 82.87; SD= 6.23) in the subject. In addition, students were achieving acceptable levels of performance in Mathematics overall. A large group of students demonstrated fairly satisfactory performance (n= 56; % = 34.36), while some of them have shown satisfactory (n= 45 or 27.61%), very satisfactory (n= or 20.25%), and outstanding
(n= 29 or 17.79%) performance as well.

The data indicate a diverse range of performance levels among the group of students in Mathematics. While the majority of students are achieving fairly satisfactory levels of performance in Mathematics, a significant number of students demonstrated higher levels of achievement. However, it would be important to continue monitoring and supporting the progress of all students to ensure that they are meeting their full potential.

The number of students having fair grades in Mathematics in blended learning is alarming. Mathematics is full of abstract concepts. Thus, providing concrete and adequate examples to deepen students' understanding is essential. Simplifying the topics in Mathematics is an important component in delivering instruction. Despite the sudden shift of the education arena into blended learning, it is of utmost priority to emphasize the usage of varied teaching approaches. The teachers need help to monitor easily how the students attentively listen during the implementation of online discussions. Despite the strategies implemented, teachers can only force the learners to open their cameras if the internet connection is stable. In this regard, it is always important to monitor consistently each student's progress, even with face-to-face discussions or online classes.

The teachers are responsible for the student's advancement in the classroom. In teaching and learning, they act as facilitators (Najeeb Ullah et al., 2021). Several aspects need to be taken into account in order to perform well in the classroom. Researchers (Lazarides & Buchholz, 2019; Blazar, 2015; Shenke et al., 2015) have discovered that when teachers can manage and reinforce emotional support, it will positively affect students' mastery goals, lessen math anxiety, and ultimately result in the development of mathematics achievement and performance.

Teachers should constantly encourage students to master the fundamentals of mathematics in a classroom setting. For students to move on to solving increasingly difficult Mathematics issues that could affect their academic scores, they must first grasp the fundamentals of the subject. In addition, teachers must enhance student performance with technology-assisted programs in order to provide high-quality instruction. Thus, creating engaging learning experiences and adapting to new and existing learning technologies that improve the learning environment during blended learning is vital.

The overall fair performance also indicates that some students may struggle to keep up with the rest of the group or may not have reached their full potential. In such cases, it would be important to identify the factors contributing to their lower performance and provide targeted support to help them improve. Hence, Mathematics teachers must reflect on the factors that might affect the students' performance in the subject In addition, they have to consider some factors like prior knowledge, learning styles, motivations and attitudes, environment, and kind of topics or subject matter in the curriculum when planning and delivering instruction to ensure that their students have the best chance of success in Mathematics. By addressing these factors, teachers can help their students overcome challenges and achieve their full potential in the subject.

Table 3 Students' Performance in Mathematics
(n = 163)

Constructs	Frequency	Percentage	M	SD
Outstanding	29	17.79	92.86	2.64
Very Satisfactory	33	20.25	86.52	1.40

Satisfactory	45	27.61	81.91	1.61
Fairly Satisfactory	56	34.36	76.30	1.50
Did not meet the expectations	-	-	-	-
Overall performance	163	100.00	82.87	6.23

Note: Performance Scale : 90-100 (Outstanding); 85-89 (Very Satisfactory); 80-84 (Satisfactory); 75-79 (Fairly Satisfactory); 74 and below (Did not meet the expectations)

Relationship between the Students' Attitude toward Blended Learning and the Students' Performance in Mathematics.

Table 4 shows the relationship between the students' attitude toward blended learning and the students' performance in Mathematics. Findings show that the students' attitude towards Mathematics as to Liking Mathematics (r= 0.273; P= 0.000) ; and Valuing Mathematics (r = 0.107; p= 0.173) have p-values less than 5 percent level of significance. Hence, the null hypothesis is rejected. There was a highly significant relationship between the students' attitudes towards Mathematics regarding liking and valuing the subject. Also there is a significant relationship between the students' attitude regarding valuing the subject and their performance in Mathematics.

The results show that students who are enthusiastic about Mathematics and have a positive outlook are more likely to succeed. Also, students are more likely to succeed in subject if they recognize its value and significance. These results are congruent with educational psychology research, which has repeatedly shown a high correlation between students' attitudes regarding a subject and their academic success. Students are more likely to interact with the subject matter, stick with their efforts, and ultimately do better when they have a positive attitude about the subject and see its importance and relevance.

Therefore, educators need to pay attention to students' attitudes toward Mathematics, foster positive attitudes, and promote the value and relevance of the subject. Some ways may include incorporating real-world examples and applications of Mathematics concepts, providing opportunities for student choice and autonomy in their learning, and offering support and encouragement to students who may be struggling or disengaged. By doing so, educators can help improve students' attitudes toward the subject and ultimately achieve their academic success.

However, the students' attitudes towards Mathematics and their performance in subject (r= 0.089; p= 0.259) have a p-value greater than the five percent significance level. The result led to the decision not to reject the null hypothesis. Hence, there was no significant relationship between the students' attitude in Mathematics in the area of confidence and their performance in the subject. This finding may seem surprising, as confidence is often a key factor in academic performance.

It is important to consider that this result did not necessarily mean confidence is unimportant or irrelevant to Mathematics performance. Rather, it may indicate that other factors, such as prior knowledge, instructional quality, and motivation, may have a stronger impact on performance. It is also possible that the measure used to assess confidence in this study was not sensitive enough to capture the

full range of student's attitudes and beliefs about their Mathematical abilities. Different measures or approaches to assessing confidence may yield different results.

While this finding may suggest that confidence is unrelated to Mathematics performance, it is important to continue exploring the complex interplay of various factors that affect students' success. It includes students' attitudes, beliefs, skills, strategies, and social and cultural contexts. By understanding these factors, educators can better support students' academic success and promote their positive attitudes and beliefs about math.

Via the students' nonacademic variables, a modern teaching style influences direct and indirect learning achievement (Damrongpanit, 2019). Modern teaching techniques and nonacademic elements in students both have an impact on how well children learn Mathematics (Pitsia et al., 2017; Balentyne, 2016). This study's results align with those of Sirmaci (2010), who found a substantial connection between students' attitudes toward mathematics and their Mathematics performance. Furthermore, this finding is supported by Karjanto (2017), who discovered a significant positive correlation between students' math achievement and attitudes. Often, the studies on the relationship between students' attitudes and students' academic performance show a positive relationship (Jolejole-Caube, et al., 2019; Turra et al., 2019; Ngussa & Mbuti, 2017).

Students who enjoy Mathematics tend to perform better and achieve higher grades than those who do not because those students who enjoy the subject are more motivated to learn and are willing to put in more effort to comprehend the ideas. On the other hand, students who do not enjoy Mathematics are more likely to struggle with the subject and may not perform well. They may lack the motivation to learn, have a negative outlook toward the subject, and may not be willing to put in the extra effort needed to succeed. Therefore, it is essential for Mathematics teachers to promote a positive attitude toward the subject and to create an engaging and enjoyable learning environment. By fostering a love for Mathematics and addressing negative attitudes toward it, teachers can help students overcome their challenges, perform better, and ultimately succeed in the subject.

Table 4 Relationship between the Students' Attitude toward Blended Learning and the Students' Performance in Mathematics

Variables	r value	p value	Decision
Liking Math and Performance	0.273	0.000	Reject Ho
Valuing Math and Performance	0.107	0.173	Reject Ho
Confidence in Mathematics	0.089	0.259	Do not reject Ho

Note: Probability Value Scale: **$p<0.01$ (Highly Significant); *$p<0.05$ (Significant); $p>0.05$ (Not significant)

Relationship between the Students' Satisfaction with Blended Learning and the Students' Performance in Mathematics

The Pearson Product-Moment Correlation Coefficient was used in determining the relationship between the students' satisfaction with blended learning and students' performance in Mathematics (Table 5). The data revealed that among the four variables, only the students' satisfaction with the teacher ($r = 0.238$, $p = 0.002$); and the satisfaction in the interaction in Math ($r = 0.254$, $p = 0.001$) have

p values less than 0.05 level of significance. The finding led to the rejection of the null hypotheses. There was a highly significant relationship between the level of students' satisfaction with the teacher and interaction in Mathematics and their performance in the subject.

Students are more likely to be engaged, motivated, and focused on studying when they have positive connections with their teacher and classmates. It may result in better academic Mathematics performance. On the other hand, students may be less motivated, less engaged, and more prone to disengage from their learning when they have tense or unfavorable relationships with their teacher or face negative interactions in the classroom. Worse academic performance and even complete disengagement from school are possible outcomes.

Teachers must place a high priority on developing strong relationships with their students and fostering a helpful learning environment. Various techniques, including demonstrating concern and interest in the students' lives, fostering chances for student autonomy and choice, offering criticism and encouragement, and laying out specific standards for behavior and performance can be done. By doing this, teachers can encourage students' general well-being and sense of community in the classroom while also fostering their academic achievement in Mathematics.

However, the variables on students' satisfaction with the instruction in Mathematics (r = 0.075, p= 0.344); and satisfaction with the technology used by the teachers' performance (r = 0.092, p = 0.245) have p-values greater than five percent level of significance. Hence, the null hypothesis was rejected. There was no significant relationship between the students' satisfaction with instructions, the technology used in instruction, and their performance in Mathematics. This finding might seem surprising, as technology is often a powerful tool for enhancing teaching and learning.

Nevertheless, it is important to remember that this result does not necessarily mean that technology is unimportant or irrelevant to Mathematics performance. Rather, it may indicate that other factors, such as the instructional quality, teacher-student relationships, and student motivation, may have a stronger impact on performance. It is also possible that the technology used in instruction in this study was ineffective in enhancing student learning or that the measure used to assess satisfaction with technology was not sensitive enough to capture the full range of students' experiences. Different types of technology and different measures or approaches to assessing satisfaction with technology may yield different results.

While this finding may suggest that technology in instruction is not a key predictor of Mathematics performance, it is important to continue exploring the complex interplay of various factors contributing to student success including the use of technology and the quality of instruction, teacher-student relationships, and student motivation. By understanding these factors, educators can better support student's academic success in Mathematics and promote their positive attitudes and beliefs about technology as a tool for learning. Modern technology offers different tools for teaching Mathematics (Tanas et al., 2020). The teachers utilized several mathematics software such as GeoGebra, Minitab, and technology-aided activities and instructions. With this regard, the student's perception that there is no significant relationship between technology and their Mathematics performance during blended learning calls for a challenge to the Mathematics teachers and an approach to heightening technology integration during blended learning. The study's findings contrast those of a study that found that employing technology in the classroom improved pupils' academic performance (Wah, 2015). Similarly, Takaci, Stankov, and Milanovic (2015) deduced from student interviews that employing technology in

mathematics learning made it simple for the students to grasp the material and allowed them to communicate, cooperate, and reinforce their comprehension owing to immediate feedback.

Blended learning provides students the opportunity to have flexible interaction in the learning space, time, and place. It supports personalized learning by each student in the process of learning Mathematics. In addition, blended learning allows students to have unlimited access to learning materials via Microsoft Teams and optimizes learning by giving them the freedom to explore information at different levels of learning absorption. A full strategic learning approach in transforming from one system for all models to a student-centered system. Blended learning serves as a solution to the weaknesses of face-to-face and online learning systems because it is a combination of online, offline, and face-to-face learning (Faraniza, 2021).

The learning outcomes of students reflect the caliber of instruction and the educational system. The indicators to achieving an understanding of the topic are based on the curriculum's learning objectives attainment and can acquire and perform at the required level. Since Mathematics is an introductory course in developing logic and reasoning skills, it enables many international countries to create and formulate a standardized knowledge measure for assessing the quality of educational management in each nation based on national student assessment results (Kalaycioglu, 2015; Karakolidis et al., 2016; Lee, 2016).

The role of teachers and their interactions with students in Mathematics class plays a big part in the performance in the subject. By providing effective instruction, feedback, motivation, classroom management, and differentiated instruction, teachers can help their students attain and achieve their full potential in Mathematics. Teachers always need to maintain giving quality instruction and innovative strategies. Having quality interactions within blended learning is important in monitoring and assessing the level of development that each student is apt to identify areas that need additional assistance and improvement. In addition, teachers need to heighten the integration of related technology in teaching Mathematics. In order to ensure students' pleasure with their learning, teachers must create a welcoming and nurturing environment. Administrators must appreciate the value of student contentment and invest properly in physical spaces, educational materials, and intangible social networks that support students' well-being and a feeling of community.

Table 5 Relationship between the Students' Satisfaction with Blended Learning and the Students' Performance in Mathematics

Variables	r value	p value	Decision	Remarks
Teacher and Performance	0.238	0.002	Reject Ho	Highly Significant
Instruction and Performance	0.075	0.344	Do not reject Ho	Not Significant
Interaction in Mathematics and Performance	0.254	0.001	Reject Ho	Highly Significant
Technology and Performance	0.092	0.245	Do not reject Ho	Not Significant

Note: Probability Value Scale: **p<0.01 (Highly Significant); *p<0.05 (Significant); p>0.05 (Not significant)

Predictors of Students' Academic Performance

Table 6 presents the predictors of students' academic performance. The statistical result suggests that students liking Mathematics attitude (β = 4.90, p=0.01) and satisfaction with teachers (β = 2.87, p=0.03) were significant predictors of students' academic performance. Students who liked Mathematics and were satisfied with their teachers are likely to perform well. These results highlight the importance of promoting positive attitudes toward Mathematics and building strong relationships between teachers and students in promoting academic performance. By doing so, educators could help students succeed academically and develop a lifelong appreciation for and interest in Mathematics.

Students with positive attitudes toward Mathematics are more likely to be motivated to learn and put more effort into their studies. It can result in higher levels of engagement and achievement in math. On the other hand, students who have negative attitudes toward math may struggle to engage with the subject and may be less likely to perform well. Therefore, teachers should work to address negative attitudes towards Mathematics, both in online and offline settings, by providing engaging and interactive learning experiences that cater to students' interests and learning styles and addressing misconceptions or negative beliefs that may be hindering their progress. Teachers can also work to build a supportive and encouraging learning environment that fosters a growth mindset and encourages risk-taking.

Students who feel supported and motivated in their academics are likely to have positive relationships with their teachers. Also, attentive and approachable teachers offer clear explanations and feedback that can boost students' confidence and involvement in their studies, resulting in greater Mathematics proficiency. Teachers therefore have to foster a welcoming and approachable learning environment where students feel free to ask questions and get assistance. In order to keep students on track and resolve any misunderstandings or misconceptions that may emerge, teachers may exert an effort to give clear explanations and comments, both online and offline.

The result of the regression equation (Academic Performance =7.96 + 4.90 Liking Math + 2.87 Teacher) suggests that the students' liking of Mathematics increased by a unit, and the student's academic performance was predicted to increase by 4.90. Additionally, for every increase in students' satisfaction with their teachers, their academic performance also increases by 2.87. Therefore, the variation in the student's attitude towards and satisfaction towards blended learning was explained by the students' liking of Mathematics and satisfaction with teachers for 10.15 percent (r^2 = 10.15). The finding suggests that only 10.15 percent of the student's academic performance in Mathematics can be linked by their attitude in terms of liking Math and their satisfaction with their math teachers in blended learning. The remaining 89.85 percent can be accounted for other factors not included in the study; hence, further studies may be conducted to explore these factors.

Aside from having face-to-face classes, blended learning allows students to engage in virtual and offline classes and giving students time for independent study. In this regard, teachers must encourage learners to improve their study habits. One of the factors that may have a significant impact on students' performance is their study habits. If this needs to be addressed by the appropriate parties, the impact on student performance may worsen (Ebele & Olofu, 2017). Students must have good study habits to excel in life because their study habits aid in obtaining relevant and applicable knowledge. As a result, students who lack these skills will perform poorly in school. Effective learning demands innovative

teaching and instructional approaches that encourage students to participate in the learning process, establish a positive attitude toward the subject and academically reach their full potential (Gibbs & McKay, 2021). Promoting students' Mathematics attitudes is also an essential factor in students' mathematical success (Kaskens et al., 2020). Blended learning integration in the K-12 educational system comes with challenges, specifically in technical, organizational, and instructional (Kaur, 2013). Technical challenges within the blended learning environment consist of successful implementation and use of technology. Lack of funding is a continuous barrier to successful technology integration (Sheninger, 2016). Outdated and aging infrastructure limits the technological resources available and the ability of teachers and administrators to effectively implement technological systems. The effectiveness of technology integration impacts the ability of students and teachers to use technology successfully, especially in rural areas that lack access. Instructional challenges involve strategically implementing technology within the classroom (Kaur, 2013).

Blended learning is a mix of face-to-face and online learning, and it can offer a more flexible and personalized learning experience. However, teachers must provide engaging and interactive online activities and timely feedback to ensure students remain motivated and on track in their studies. Teachers who can provide personalized learning experiences that cater to students' individual needs and learning styles can help to increase motivation and engagement in math, leading to better performance. Additionally, teachers can create a supportive and encouraging classroom environment that allows students to feel comfortable taking risks and asking online and offline questions. Also, they need to address negative attitudes, provide personalized learning experiences, ensure satisfaction with teachers, and ensure consistency between online and offline learning experiences. By paying attention to these factors, teachers can help their students achieve their full potential in math.

Table 6 Stepwise Multiple Regression Coefficients Predicting Students' Academic Performance

Predictors	Coef (β)	SE Coef	t- value	p-value
(Constant)	57.96	5.90	9.82	0.00
Liking Mathematics	4.90	1.74	2.82**	0.01
Satisfaction to Teachers	2.87	1.30	2.20*	0.03
Adjusted r^2	10.15 %			
F value	9.04			
p-value	0.00			
Academic Performance =7.96 + 4.90 Liking Math + 2.87 Teacher				

Note : ** *means p<0.01 (Highly Significant)at 0.01 level*

CONCLUSION

The study's findings have led to several important conclusions. Firstly, students exhibit a favorable outlook towards learning Mathematics within the blended learning environment. Secondly, students report positive experiences with their Mathematics teachers and various elements of blended learning, including instruction, interaction, and technology. Thirdly, the blended learning approach is deemed effective in fostering learning and contributing to students' success in Mathematics. Fourthly, students' attitudes, particularly their liking for Mathematics, are correlated with their academic performance, suggesting that a positive attitude towards the subject may impact their overall

achievement. Fifthly, the quality of teacher-student interaction and students' satisfaction with their teachers appear to positively influence academic performance. Finally, the study underscores the significance of students' attitudes towards Mathematics and their satisfaction with teachers as pivotal factors in understanding academic performance within the context of blended learning.

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REFERENCES

1. Aguanta, E. R., & Tan, D. A. (2018). Effects of dyad cooperative learning strategy on students' academic performance and attitude towards Mathematics. *International Journal of English and Education*, *7*(3), 303-313. Retrieved on October 5, 2022 from https://bit.ly/3ZmmMnn.

2. Ahmed Ismail, A. O., & Mahmood, A. K. (2018). *The influence of interaction on students academic performance: Case of saudi public university*. Piscataway: The Institute of Electrical and Electronics Engineers, Inc. (IEEE). Retrieved on November 3, 2022 from https://bit.ly/40MEjX93.

3. Ajisuksmo, C. and Saputri, G. (2017). The Influence of Attitudes towards Mathematics, and Metacognitive Awareness on Mathematics Achievements. *Creative Education*, **8**, 486-497. doi: 10.4236/ce.2017.83037. Retrieved on October 14, 2022 fromhttps://www.scirp.org/html/146303423_75168.htm?pagespeed=noscript

4. Allison, N. M. (2022). *Administrator and teacher perceptions of effective blended learning in a K-12 setting* (Order No. 29325809). Available from ProQuest Central. (2713439278). Retrieved on November 6, 2022 from http://bitly.ws/CgVcElfa, F., Sabri, M., Novita, L., & Aswandi, A. (2022). The Student's Errors Investigation In Using Punctuation, Capitalization And Spelling In Writing Business Letter. *INOVISH JOURNAL*, *7*(1), 56-64. Retrieved on January 12, 2023 from https://bit.ly/3GTgZiS.

5. Alonazi, A. A. (2018). Psychological, academic and demographic variables affecting students' academic achievement among first year college students in saudiarabia (Order No. 10808605). Available from ProQuest Central. (2038452441). Retrieved on October 15, 2022 from https://www.proquest.com/dissertations-theses/psychological-academic-demographic-variables/docview/2038452441/se-2?accountid=149218

6. Antaramian, S. (2017). The importance of very high life satisfaction for students' academic success. *Cogent Education, 4*(1) . Retrieved on September 20, 2022 from https://www.tandfonline.com/doi/full/10.1080/2331186X.2017.1307622

7. Awal Kurnia, P. N., Andika, H. S., Zakaria, R., Wahyuningsih, S. K., &Daulay, L. A. (2021). Face to face learning vs blended learning vs online learning (student perception of learning). Journal of Physics: Conference Series, 1783(1). Retrieved on December 15, 2022 from doi:https://doi.org/10.1088/1742- 6596/1783/1/012112

8. Balentyne, P. J. (2016). The effects of self-paced blended learning of Mathematics (Order No. 10007139). Available from ProQuest Central. (1762744419). Retrieved from https://www.proquest.com/dissertations-theses/effects-self-paced-blended- learning-Mathematics/docview/1762744419/se-2

9. Bernardo, J. (2020). PH ranks last among 58 countries in grade 4 math, science: Study. ABS-CBN News. Retrieved on May 23, 2022 from https://news.abscbn.com/amp/news/12/09/20/ph-ranks-last-among-58- countries-in-grade-4-math-science-study

10. Capuno, R., Necesario, R., Etcuban, J. O., Espina, R., Padillo, G., &Manguilimotan, R. (2019). Attitudes, Study Habits, and Academic Performance of Junior High School Students in Mathematics. *International Electronic Journal of Mathematics Education*, *14*(3), 547-561. Retrieved on December 5, 2022 from https://eric.ed.gov/?id=EJ1227082.

11. Cleveland-Innes, M., & Wilton, D. (2018). Guide to blended learning. Retrieved on November 15, 2022 from https://bit.ly/40Gv9v4.

12. Chen, X., Breslow, L., & DeBoer, J. (2018). Analyzing productive learning behaviors for students using immediate corrective feedback in a blended learning environment. Computers & Education, 117, 59-74. Retrieved on January 5, 2023 fromhttps://doi.org/10.1016/j.compedu.2017.09.013

13. Christensen, R., & Knezek, G. (2020). Indicators of middle school students' Mathematics enjoyment and confidence. School Science and Mathematics, 120(8), 491-503. Retrived on November 15 2022 from doi:https://doi.org/10.1111/ssm.12439

14. Dangwal, K. L. (2018). Blended learning: An innovative approach. *Universal Journal of Educational Research*, *5*(1), 129-136. Retrieved on November 15, 2022 fromhttps://eric.ed.gov/?id=EJ1124666

15. Damrongpanit, S. (2019). From modern teaching to Mathematics achievement: The mediating role of Mathematics attitude, achievement motivation, and self-efficacy. European Journal of Educational Research, 8(3), 713-727. Retrieved on November 16, 2022 from https://bit.ly/3zfpErA.

16. Dziuban, C., Graham, C. R., Moskal, P. D., Norberg, A., & Sicilia, N. (2018). Blended learning: the new normal and emerging technologies. *International journal of educational technology in Higher education*, *15*(1), 1-16.Retrieved on November 16, 2022 from https://link.springer.com/article/10.1186/s41239-017-0087-5

17. Fitri, S., &Zahari, C. L. (2019, March). The implementation of blended learning to improve understanding of Mathematics. In *Journal of physics: Conference series* (Vol. 1188, No. 1, p. 012109). IOP Publishing. Retrieved from https://iopscience.iop.org/article/10.1088/1742-6596/1188/1/012109/meta

18. Gillet, N., Morin, A. J., & Reeve, J. (2017). Stability, change, and implications of students' motivation profiles: A latent transition analysis. Contemporary Educational Psychology, 51, 222–239. https://doi.org/10.1016/j.cedpsych.2017.08.006

19. Huang, C. H. (2021). Using PLS-SEM model to explore the influencing factors of learning satisfaction in blended learning. *Education Sciences*, *11*(5), 249. Retrieved September 20, 2022 from https://doi.org/10.3390/educsci11050249

20. Iji, C. O., Abah, J. A., &Anyor, J. W. (2018). Educational cloud services and the Mathematics confidence, affective engagement, and behavioral engagement of Mathematics education students in public universities in Benue State, Nigeria. *International Journal of Teaching and Learning in Higher Education*, *30*(1), 47-60. Retrieved November 3, 2022 fromhttps://hal.archives-ouvertes.fr/hal-01440794/document

21. Jolejole-Caube, C., Dumlao, A. B., &Abocejo, F. T. (2019). Anxiety towards Mathematics and Mathematics performance of grade 7 learners. European Journal of Education Studies.

22. Karakolidis, A., Pitsia, V., &Emvalotis, A. (2016). Examining students' achievement in Mathematics: A multilevel analysis of the Programme for International Student Assessment (PISA) 2012 data for Greece. International Journal of Educational Research, 79, 106-115.

23. Karjanto, N. (2017). Attitude toward Mathematics among the students at Nazarbayev University Foundation Year Programme. International Journal of Mathematical Education in Science and Technology, 48(6), 849-863. RetrievedOctober 4, 2022 from https://doi.org/10.1080/0020739X.2017.1285060

24. Kaur, M. (2013). Blended learning – Its challenges and future. Procedia – Social and Behavioral Sciences, 93, 612 – 617. RetrievedOctober 4, 2022 fromhttps://doi.org/10.1016/j.sbspro.2013.09.248

25. Jones, M. N. (Ed.). (2017). *Big data in cognitive science*. New York, NY, USA:: Routledge. RetrievedSeptember 30 , 2022from https://www.mdpi.com/1660-4601/17/5/1589/htm#B37-ijerph-17-01589

26. Lee, J. (2016). Attitude toward school does not predict academic achievement. Learning and Individual Differences, 52, 1-9.

27. Li, L. (2022). Students' academic achievement and satisfaction in a blended learning community of college english in china: A quasi-experimental study. *Sage Open, 12*(3)RetrievedSeptember 19, 2022 from doi:https://doi.org/10.1177/21582440221119485

28. Long, M., &Chei, S. L. (2021). Evaluating the effectiveness of blended learning using the ARCS model. Journal of Computer Assisted Learning, 37(5), 1397-1408. Retrieved on September 20, 2022 fromdoi:https://doi.org/10.1111/jcal.12579

29. Lu, O. H. T., Huang, A. Y. Q., Huang, J. C. H., Lin, A. J. Q., Ogata, H., & Yang, S. J. H. (2018). Applying Learning Analytics for the Early Prediction of Students' Academic Performance in Blended Learning. *Journal of Educational Technology & Society*, *21*(2), 220–232. Retrieved Retrieved on October 20, 2022 from http://www.jstor.org/stable/26388400

30. Müller, C., &Mildenberger, T. (2021). Facilitating flexible learning by replacing classroom time with an online learning environment: A systematic review of blended learning in higher education. *Educational Research Review*, *34*, 100394.

31. Muktiarni, M., Widiaty, I., Abdullah, A. G., Ana, A., &Yulia, C. (2019). Digitalisationtrend in education during industry 4.0. Journal of Physics: Conference Series, 1402(7). . Retrieved September 9, 2022 fromdoi:https://doi.org/10.1088/1742-6596/1402/7/077070

32. Pitsia, V., Biggart, A., &Karakolidis, A. (2017). The role of students' self-beliefs, motivation and attitudes in predicting Mathematics achievement: A multilevel analysis of the Programme for International Student Assessment data. Learning and Individual Differences, 55, 163-173.

33. Punzalan, E. M. D., &Buenaflor, R. F. Modeling the relationship between the basic computational and problem-solving skills of Fourth-Year high school students in the Division of Zambales, Philippines.

34. Rasheed, R. A., Kamsin, A., & Abdullah, N. A. (2020). Challenges in the online component of blended learning: A systematic review. *Computers & Education*, *144*, 103701.Retrieved on September 9, 2022 from https://www.sciencedirect.com/science/article/abs/pii/S0360131519302544

35. Siregar, N., Siregar, T. M., &Siregar, B. H. (2019). Blended learning in students' view. Journal of Physics: Conference Series, 1188(1). Retrieved on September 9, 2022 from doi:https://doi.org/10.1088/1742-6596/1188/1/012099

36. Shih, H. F., Chen, S. H. E., Chen, S. C., & Wey, S. C. (2017). The relationship among tertiary level EFL students' personality, online learning motivation and online learning satisfaction. *Procedia-Social and Behavioral Sciences*, *103*, 1152-1160.

37. Smith, T. J., Walker, D. A., Wen-Yi, H., Ying-Yan, L., Hong, Z., & McKenna, C. M. (2022). Teacher characteristics as predictors of Mathematics attitude and perceptions of engaged teaching among 120RW1S34RfeSDcfkexd09rT3th1RW1S34RfeSDcfkexd09rT3 grade advanced Mathematics students in the U.S. Education Inquiry, 13(3), 338-353. Retrieved on September 9, 2022 from doi:https://doi.org/10.1080/20004508.2021.1883910

38. Takaci, D. , Stankov, G., & Milanovic, I. (2015). Efficiency of learning environment using geogebra when calculus contents are learned in collaborative groups. Computers and Education, 82, 421–431.

39. Tanas, L., Winkowska-Nowak, K., &Pobiega, K. (2020). The importance of teachers' need for cognition in their use of technology in mathematics instruction. *Frontiers in psychology*, *11*, 259.

40. Turra, H., Carrasco, V., González, C., Sandoval, V., &Yáñez, S. (2019). Flipped classroom experiences and their impact on engineering students' attitudes towards university-level Mathematics. Higher Education Pedagogies, 4(1), 136-155.

41. Wah, K. L. (2015). The effects of instruction using the arcs model and geogebra on Upper secondary students' motivation and achievement in learning combined transformation. Asia Pacific Journal of Educators and Education, 30, 141– 158.

42. Zeqiri, J., Kareva, V., &Alija, S. (2021). Blended learning and student satisfaction: The moderating effect of student performance. Business Systems Research, 12(2), 79- 94. Retrieved on October 4, 2022 from doi:https://doi.org/10.2478/bsrj-2021-0020