Canadian Journal of Family and Youth, 17 (1), 2025, pp. 148-169
ISSN 1718-9748© University of Alberta
http://ejournals,library,ualberta.ca/index/php/cjfy

Advancing Math Competency Among Science, Technology, Engineering and Mathematics (STEM) Students: A Comprehensive Exploration of Learning Styles, Educational Resources, Parental Engagement, and Study Habits

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Abstract

This study adopts a quantitative research approach to explore the collective impact of learning styles, educational resources, parental engagement, and study habits on the mathematical proficiency of STEM students. The sample comprises 53 STEM students selected via random sampling from a secondary school in the Province of Southern Leyte. Data collection primarily involved the administration of structured survey questionnaires. Quantitative data acquired from both surveys and proficiency tests underwent analysis utilizing descriptive and inferential statistical techniques. Ethical principles were strictly upheld throughout the study. The investigation into factors influencing students' mathematical competence revealed notable positive effects associated with note-taking skills, mathematical proficiency, and internet access. Conversely, parental engagement and time management exhibited significant negative effects.

Keywords: STEM, math competency, learning styles, educational resources, parental engagement, study habits

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Introduction

Advancing math competency among Science, Technology, Engineering and Mathematics (STEM) students is crucial for their success in the fields of science, technology, engineering, and mathematics (Banerjee, 2016). It is a key factor in achieving the United Nations Educational, Scientific and Cultural Organization's Sustainable Development Goal 4-Quality Education. STEM education plays a vital role in equipping young people with the skills necessary to adapt to the digital age and create life-changing opportunities for themselves and their families. STEM education incorporates the integration of science, technology, engineering, and mathematics to develop students' critical thinking, problem-solving, and creativity skills through real-world applications and contexts (Widya et al., 2019). This comprehensive approach to STEM education not only enhances students' understanding of academic concepts but also prepares them for the 21st-century workforce, where the ability to think critically, solve complex problems, and collaborate with others is highly valued (Bybee, 2010; Fajrina et al., 2020; Academy & Council, 2014). However, according to the 2022 Program for International Student Assessment (PISA) results, the Philippines finds itself in a challenging position. This poses a critical concern as mathematics proficiency is fundamental to success in STEM fields. These emphasize the need for targeted interventions to support STEM students in overcoming the obstacles they encounter in mathematics education. Addressing these challenges is vital for ensuring that STEM students are well-equipped to excel in their academic pursuits and contribute effectively to the evolving demands of the 21st-century workforce.

Research has shown that students have different learning styles, and understanding and catering to these styles can significantly impact their mathematical ability (Ernawati & Surima, 2020). According to a study by Delima et al. (2019), students' learning styles can affect their mathematical performance. By identifying and addressing individual learning styles, educators can enhance students' understanding and application of mathematical concepts (Banaga & Fabella, 2018; Hasmiwati & Widjajanti, 2020). Additionally, studies revealed that adapting teaching methods to accommodate different learning styles can lead to improved academic performance in mathematics (Sabri et al., 2014). These findings underscore the importance of recognizing and incorporating learning style preferences in mathematics education to enhance students' mathematical ability. Educational resources also play a crucial role in advancing math competency among STEM students (Kul et al., 2018). A study conducted by Rezat et al., (2021) found that the availability of high-quality educational resources, such as textbooks, online tutorials, and interactive learning platforms, significantly contributed to improved mathematical proficiency among students. Access to these resources not only enhances students' understanding of mathematical concepts but also provides them with opportunities for independent practice and self-directed learning (Rashid & Asghar, 2016; Hui & Mahmud, 2023), which are essential for mastery of mathematical skills.

Parental engagement has been identified as a contributing factor to mathematics success among students (Evans & Field, 2020; Samad & Mangindara, 2020; Huang et al., 2021). Studies revealed that parental involvement in students' mathematics education, including support with homework, encouragement, and participation in math-related activities, positively influenced students' attitudes and performance in mathematics (Kung & Lee, 2016; Liu & Leighton, 2021). Parental engagement serves as a crucial support system for students, reinforcing the importance of

mathematics and fostering a positive learning environment. In addition, study habits also play a significant role in shaping students' mathematical ability (Capuno et al., 2019; Murni & Helma, 2021). Studies highlighted the impact of effective study habits, such as regular practice, time management, and seeking help when needed, in improving students' performance in mathematics (Pratiwi & Farozin, 2020; Capuno et al., 2019; Murni & Helma, 2021; Black et al., 2023). Encouraging the development of strong study habits is essential for fostering a disciplined approach to learning and empowering students to excel in mathematics. Overall, a comprehensive approach that considers and integrates learning styles, provides access to high-quality educational resources, fosters parental engagement, and promotes effective study habits is crucial for advancing math competency among STEM students.

The existing literature provides valuable insights into the factors that contribute to math competency among STEM students. However, there is a noticeable gap in the research that lies in the holistic exploration of all these factors in one setting. While individual studies have delved into the impact of learning styles, educational resources, parental engagement, and study habits on mathematical ability separately, there is a lack of comprehensive research that examines the synergistic effects of these factors. Therefore, there is a pressing need for research that integrates these diverse aspects and explores their combined influence on the mathematical proficiency of STEM students. This comprehensive approach will not only enhance our understanding of the multifaceted nature of math competency but also inform the development of more holistic strategies to support students in their mathematical learning journey. Additionally, educators and policymakers can develop more effective and targeted interventions to support students in overcoming mathematical difficulties.

Methodology

This study employed a quantitative research design to comprehensively investigate the variables of learning styles, access to educational resources, parental engagement, and study habits, and to determine their collective influence on the mathematics competency of STEM students. The participants consisted of 53 STEM students drawn from one secondary school in the Province of Southern Leyte, selected using a random sampling method.

Data collection primarily involved administering structured survey questionnaires adapted from the Virginia Gordon’s University Survey: A Guidebook and Readings for New Students and The Center for Learning and Student Success to the participants. The survey included items designed to assess participants' learning styles, perceived access to educational resources, level of parental engagement in their education, study habits, and self-reported mathematics competency. Additionally, participants underwent standardized mathematics proficiency tests to objectively measure their mathematical competency. Quantitative data collected through surveys and proficiency tests were analyzed using descriptive and inferential statistical techniques. Descriptive statistics such as frequency distributions, percentages and mean were computed to summarize participants' responses to survey items. Inferential statistics, including correlation analyses and regression analyses, were conducted to examine the relationships between the variables and identify significant predictors of mathematics competency among STEM students.

Ethical considerations were adhered to throughout the study. Participants were provided with informed consent forms detailing the study's objectives, procedures, and potential risks and benefits, and their consent was obtained prior to participation. Measures were implemented to ensure the confidentiality and anonymity of participants' data, including the use of coded identifiers and secure data storage practices. Ethical approval was sought from the relevant institutional review board before commencing data collection.

Results and Discussion

Learning Styles

In the investigation of students' learning styles, it becomes evident that a significant majority align with the visual learning modality, constituting 45.3% of the sampled population. Subsequently, auditory learners emerge as the second most prevalent group, representing 39.6% of participants. Notably, tactile learners comprise a comparatively smaller proportion, encompassing only 15.1% of the student cohort. This distribution underscores the diverse array of learning preferences observed within the student demographic, highlighting the prevalence of visual and auditory modalities over tactile learning approaches.

Table 1: Frequency Distribution of Students' Learning Styles

Learning Styles	Frequency	Percentage
Visual	24	45.3%
Auditory	21	39.6%
Tactile	8	15.1%

Visual learners in mathematics often prefer concepts presented visually, such as through diagrams, graphs, or charts (Halwani, 2017; Garderen, 2006). Visual patterns are particularly beneficial for this type of learner (Aso, 2001). Visual aids like graphs and geometric figures significantly enhance the learning experience for visual learners in mathematics (A, 2003; Widodo et al., 2018). Conversely, auditory learners thrive when information is presented verbally, benefitting from explanations, discussions, and lectures. In mathematics, auditory learners may benefit from hearing mathematical concepts explained aloud, such as through classroom discussions or instructional audio recordings (Istiqomah et al., 2020). Engaging in discussions and verbalizing mathematical concepts can reinforce understanding for auditory learners (Karlimah & Risfiani, 2017). Group discussions or study sessions where concepts are explained verbally are also beneficial for this learning style (Zaenuri et al., 2021; Karlimah & Risfiani, 2017). Furthermore, incorporating audio elements into educational resources, such as using audio recordings to explain mathematical problems or concepts, can enhance learning outcomes for auditory learners (Risnawati et al., 2018; Karlimah & Risfiani, 2017). Thus, recognizing the pre-

ferences and strengths of visual and auditory learners in mathematics can guide educators in designing more effective teaching strategies and resources tailored to individual learning styles, ultimately enhancing the mathematical learning experience and outcomes for all students.

Learning Resources

The study scrutinized the students' learning resources, encompassing their weekly allowance, internet accessibility, and possession of educational devices. Regarding weekly allowance, a substantial majority of students (58.5%) reported receiving an allowance ranging from 51 to 150 pesos weekly, while a minimal fraction (3.8%) reported a weekly allowance of 50 pesos or less. Students with lower weekly allowances may encounter challenges in affording essential educational materials, such as textbooks or supplementary resources, potentially hindering their academic progress (Hayhoe et al., 2015). On the other hand, students with higher allowances may have greater access to educational resources, enabling them to enhance their learning experiences.

Table: Frequency Distribution of Students' Learning Resources

Learning Resources	Frequency	Percentage
Weekly Allowance		
50 and below	2	3.8%
51 – 150	31	58.5%
151 – 250	8	15.1%
251 and above	12	22.6%
Internet Access		
Data	2	3.8%
WiFi	21	39.6%
WiFi and Data	30	56.6%
No Access		
Educational Devices		
Android/ IOS	38	71.6%
Laptop	11	20.8%
TV	2	3.8%
Desktop Personal Computer	2	3.8%

A substantial proportion of students (56.6%) reported having access to both WiFi and data, while a slightly smaller group (39.6%) indicated access only to WiFi. Conversely, a very small portion of students (3.8%) stated that they had access solely to data. These findings underscore the prevalence of multiple connectivity options among students, with the majority having access to both WiFi and data networks. This dual access potentially allows for greater flexibility in accessing

online educational resources, as students can choose the most suitable network depending on their location or specific needs. However, the small percentage of students reliant solely on data connectivity highlights potential disparities in access to reliable internet infrastructure. Addressing these discrepancies is crucial to ensuring equitable access to digital learning resources for all students, regardless of their connectivity options. With the increasing reliance on technology in education, the use of data and Wi-Fi has become crucial to students' learning experiences. Access to reliable internet connections allows students to conduct research, collaborate on projects, and access online resources to enhance their understanding of various subjects (Atteh et al., 2020). Furthermore, data and Wi-Fi enable students to engage in virtual learning environments and online courses, expanding their educational opportunities beyond traditional classroom settings (Redondi et al., 2016; Farley et al., 2015; Bhat, 2023).

Among the available educational devices, such as Android or iOS phones and tablets, laptops, TVs, and desktop personal computers, the majority of students utilized Android or iOS phones and tablets (71.0%). Following this, laptops were the second most commonly used device, with 20.8% of students opting for this option. A very small percentage of students (3.8% each) reported using either a TV or a desktop personal computer. These findings highlight the prevalence of mobile devices, particularly smartphones and tablets, as primary tools for accessing educational resources among students. These devices provide an unparalleled level of convenience and flexibility, allowing students to access educational materials anytime and anywhere (Remón at al, 2017; Nikolopoulou, 2020). Whether it is downloading e-books, watching educational videos, or accessing online learning platforms, mobile technology has transformed the way students engage with their studies particularly in difficult subject like mathematics (Fabian, Topping, & Barron, 2018; Tingir at al., 2017). As a result, educators and educational institutions are increasingly incorporating mobile-friendly resources into their curriculum to accommodate the diverse learning needs of students.

Parental Engagement

Students were tasked with rating statements regarding parental engagement to assess the level of support from their parents. On average, they strongly agreed that their parents support and emotionally encourage them in their academic pursuits, engage in discussions about their educational goals and aspirations, and inspire them to pursue educational opportunities and excel academically. Additionally, they agreed, but not strongly, that their parents engage in school activities like parent-teacher meetings and events, offer emotional support during tough academic times like exams or projects, and provide resources such as books, materials, or tutoring for learning outside of school. However, students expressed a neutral stance on whether their parents help them with their homework and academic assignments when they encounter difficulties and regularly communicate with their teachers to stay informed about their academic progress.

Table 3: Descriptive Analysis of Students' Perceptions Regarding Parental Engagement

Parent Engagement	Weighted Mean	Description
1. My parents provide me with encouragement and emotional support regarding my academic endeavors.	4.62	Strongly Agree
2. My parents actively participate in my school activities, such as parent-teacher meetings and school events.	3.72	Agree
3. My parents engage in conversations with me about my educational goals and aspirations.	4.26	Strongly Agree
4. I feel supported and encouraged by my parents to pursue educational opportunities and excel academically.	4.53	Strongly Agree
5. My parents help me with my homework and academic assignments when I encounter difficulties.	2.98	Neutral
6. My parents regularly communicate with my teachers to stay informed about my academic progress.	3.08	Neutral
7. My parents provide emotional support and encouragement during challenging academic situations, such as exams or projects.	4.11	Agree
8. My parents provide resources, such as books, educational materials, or tutoring, to support my learning outside of school.	3.43	Agree
Over – all	**3.84**	**Agree**

Note: 1.00 - 1.80 Strongly Disagree; 1.81 – 2.60 Disagree; 2.31 – 3.40 Neutral; 3.41 – 4.20 Agree; 4.21 – 5.00 Strongly Agree

Parental support plays a crucial role in a student's learning journey, especially in difficult subjects like mathematics. When parents are actively involved in their child's education, it can significantly improve the student's academic performance (Padilla et al., 2023; Yieng et al., 2020; Hanif et al., 2019). In the case of mathematics, parental support can take various forms, such as helping the student with homework, providing encouragement, and fostering a positive attitude towards the subject (Buff et al., 2016; Ing, 2013; Yieng et al., 2020). Research has shown that students whose parents are involved in their education tend to have better attitudes towards learning and are more motivated to succeed (Shukla et al., 2015). When parents take an interest in their child's mathematical education, they can help alleviate the anxiety and fear that often accompanies the subject (DiStefano et al., 2023). By creating a supportive environment at home, parents can help their children develop a growth mindset and the resilience needed to tackle challenging mathematical concepts.

Study Habits

The study delved into the students' study habits, focusing on their time management, test preparation, note-taking, and math skills. Regarding time management, students consistently

attend their classes. Additionally, they typically, though not always, allocate time for exercise and socializing with friends, complete assignments on time, and ensure they get at least six hours of sleep each night. However, the practice of creating a master schedule for each quarter, updating it weekly or daily, adhering to it, and dedicating at least two hours of study for every hour spent in class is done on an occasional basis.

Table 4: Descriptive Analysis of Students' Study Habits: Time Management

TIME MANAGEMENT	Weighted Mean	Description
1. Do you make a master schedule of each quarter?	1.94	Sometimes
2. Do you update it weekly or daily?	2.00	Sometimes
3. Do you stick to it?	1.81	Sometimes
4. Do you allow time for exercise and socializing with friends?	3.02	Generally
5. Do you get at least six hours of sleep each night?	2.89	Generally
6. Do you study at least two hours for every hour in class?	2.08	Sometimes
7. Do you get your assignments done on time?	3.04	Generally
8. Do you regularly attend your classes?	3.85	Always
Over – all	**2.58**	**Generally**

Note: 1.00 – 1.74 Rarely; 1.75 – 2.49 Sometimes; 2.50 – 3.24 Generally; 3.25 – 4.00 Always

Time management is vital for students, especially in learning mathematics. It helps them study regularly, grasp concepts effectively, and practice problems consistently (Xu, 2020; Hensley et al., 2018). By managing time well, students can progress smoothly through topics, prepare thoroughly for assessments, and balance academic and non-academic activities (Tian et al., 2019; Hamzah et al., 2014; Dias, 2021; Khan et al., 2020; Alyami et al., 2021). Developing good time management habits sets a strong foundation for long-term success, both academically and in life beyond the classroom (Razali et al., 2018; Xu et al., 2020).

Students generally exhibit awareness of the type of tests they will encounter, such as multiple-choice, and possess strategies for preparation. They are adept at completing tests within the allotted time and reviewing or analyzing their performance if they encounter difficulties. Additionally, they occasionally engage in daily studying for each class, commence review for major exams at least three days beforehand, participate in study groups, and anticipate the types of questions that will appear on tests. However, they rarely attend extra help sessions or office hours provided by instructors or teachers.

Table 5: Descriptive Analysis of Students' Study Habits: Test Taking/Preparation Skills

TEST TAKING/PREPARATION SKILLS	Weighted Mean	Description
1. Do you study for each class every day?	2.17	Sometimes
2. Do you start reviewing for major exams at least three days in advance?	2.42	Sometimes
3. Do you belong to a study group?	1.76	Sometimes
4. Do you attend extra help sessions or office hours provided by the instructor or teacher?	1.42	Rarely
5. Do you know what kind of test you will take example is a multiple choice and how to prepare for different type of test?	2.79	Generally
6. Can you predict what types of question will be on the test?	2.23	Sometimes
7. Are you able to finish your test in the allowed period?	3.23	Generally
8. If you do not do well on test, do you review It or analyze it to see where you had problems?	2.85	Generally
Over – all	**2.36**	**Sometimes**

Note: 1.00 – 1.74 Rarely; 1.75 – 2.49 Sometimes; 2.50 – 3.24 Generally; 3.25 – 4.00 Always

In studying mathematics, students rely on their test-taking preparation skills. These skills involve understanding how to approach different types of questions, managing time effectively during exams, and staying calm under pressure (Ma & Cheng, 2018; Dodeen et al., 2014). In mathematics, where problem-solving is key, effective goal-setting and planning, rehearsal, help-seeking, recall and identify key information, keep trying, checking, and correction strategies is vital to facilitate learning (Tee et al., 2018). By honing these skills, students can perform better on math assessments, boost their confidence, and reinforce their understanding of mathematical concepts, ultimately leading to improved academic outcomes (Tee et al., 2018).

Students indicated that they generally maintain an efficient note-taking system, discerning important information and cues to prioritize. In addition, they habitually take notes while reading class materials and rephrase class notes or text notes in their own words. However, they review their notes after each class, preferably immediately after class, but this is done on an occasional basis.

Table 6: Descriptive Analysis of Students' Study Habits: Note Taking Skills

NOTE TAKING SKILLS	Weighted Mean	Description
1. Are you able to take notes in class, keep up with the instructor, and understand the concepts at the same time?	2.36	Sometimes
2. do you have an efficient system of note taking?	2.91	Generally
3. Do you review your notes after each class, preferably in the right after class?	2.19	Sometimes
4. Do you know what the important stuff is to write down and what are the cues that this is important stuff?	3.19	Generally

5. In addition to highlighting, do you make notes as you read class materials?	2.81	Generally
6. Can you put class notes or notes from text into your own wordS?	2.83	Generally
Over – all	**2.72**	**Generally**

Note: 1.00 – 1.74 Rarely; 1.75 – 2.49 Sometimes; 2.50 – 3.24 Generally; 3.25 – 4.00 Always

Note-taking skills involve actively listening to lectures, identifying key concepts, and organizing information in a structured manner (Rupp, 2022). In mathematics, where complex formulas and problem-solving strategies are taught, effective note-taking helps students capture important details, understand concepts more deeply, and review material efficiently(Kobayashi, 2012; Ragnhild & Rensaa, 2014). Additionally, well-organized notes serve as valuable study aids for exams and assignments (Bernard & Piolat, 2005; Rupp, 2022; Witherby & Tauber, 2019). However, note-taking can be challenging for students as it requires them to multitask and make quick decisions about what information to record. It is essential for students to develop effective note-taking strategies and find what works best for them individually (Grabe, 2005).

Regarding math skills, students consistently complete their homework assignments and attempt problems before seeking solutions. Generally, they actively participate in class and ask questions when encountering difficulties with a concept. However, the practice of having a solid command of prerequisite skills for their math class, missing at most two math classes per semester, explaining problem-solving techniques to peers, and allocating sufficient time after tests to review for calculation errors or mistakes like misplaced signs occurs only occasionally.

Table 7: Descriptive Analysis of Students' Study Habits: Math Skills

MATH SKILLS	**Weighted Mean**	**Description**
1. Do you have a good command of the prerequisite skills for the math class in which you are enrolled?	2.28	Sometimes
2. Do you always do your homework assignments and work the problems before looking at the solutions?	2.53	Generally
3. Do you participate in class and ask questions when you don't understand a concept?	2.83	Generally
4. Do you at most miss only two math classes per semester?	1.81	Sometimes
5. Can you explain to another student how to solve all the problems on a math test?	2.08	Sometimes
6. Do you have enough time after taking your test to review for calculations errors end stupid mistakes like misplaced + or – signs?	2.32	Sometimes
Over – all	**2.31**	**Sometimes**

Note: 1.00 – 1.74 Rarely; 1.75 – 2.49 Sometimes; 2.50 – 3.24 Generally; 3.25 – 4.00 Always

Examining the students' math competency level, the data indicates that a significant proportion of students achieved high grades, with 35.9% earning scores in the range of 91 to 95. Following closely, 26.4% of students obtained grades between 81 and 85. Conversely, the lowest percentage (15.1%) of students received grades between 86 and 90, indicating a smaller representation in this category.

Table 8: Frequency Distribution of Students' Math Competency Level

Math Competency Level	Frequency	Percentage
75 – 80	12	22.6%
81 – 85	14	26.4%
86 – 90	8	15.1%
91 – 95	19	35.9%

Math skills are pivotal for secondary students as they underpin their ability to comprehend and apply mathematical concepts effectively. Proficiency in math facilitates problem-solving, logical reasoning, and quantitative analysis, which are essential not only in math classes but also in various aspects of daily life (Yuristia & Musdi, 2020; Hasan et al., 2018). With strong math skills, students can navigate financial decisions, interpret data, and solve practical problems (Maslihah et al., 2020). Moreover, math skills play a significant role in preparing students for future academic and career pursuits, particularly in fields such as science, technology, engineering, and mathematics (STEM) (James, 2013; Christensen, 2011). Therefore, fostering math skills among secondary students is crucial for equipping them with the foundational knowledge and competencies needed for success in an increasingly quantitative world.

Table 9: Multiple Regression Analysis of Factors Influencing Students' Mathematics Competency Level

Variable	Standardized Coefficients	t	p-value
Learning Style	-0.052	-0.624	0.536
Weekly Allowance	-0.039	-0.386	0.702
Internet Access	0.291	2.740	0.009
Educational Gadgets	-0.088	-0.920	0.363
Parental Engagement	-0.370	-2.784	0.008
Study Habit: Time Management Skill	-0.241	-2.069	0.045
Study Habit: Test Preparation Skill	-0.033	-0.234	0.816
Study Habit: Note Taking Skill	0.555	3.920	0.000
Study Habit: Mathematics Skill	0.648	5.276	0.000

Note. Constant=72.798, F(9,43)=13.226***, p<.001, R^2 = 0.735

After checking for multicollinearity, the results indicate that there are no issues, thus allowing for the regression analysis to be conducted. The results indicate the absence of any issues with multicollinearity among the independent variables. The overall model was significant ($F(9,43) = 13.226$, $p < .001$), explaining 73.5% of the variance in students' mathematics competency level. This suggests that the combination of predictor variables studied significantly contributes to predicting students' mathematics competency. Moreover, the standardized coefficients, indicating the relative strength and direction of each predictor variable's relationship with mathematics competency, were examined. Among the variables studied, note-taking skill ($\beta = 0.555$, $p < .001$) and mathematics skill ($\beta = 0.648$, $p < .001$) demonstrated the strongest positive associations with mathematics competency. This implies that students with stronger note-taking and mathematics skills tend to have higher levels of mathematics competency. Additionally, internet access ($\beta = 0.291$, $p < .01$) showed a positive effect on mathematics competency. This suggests that students who have access to both WiFi and data tend to have higher mathematical competency levels. Having access to online resources can provide students with opportunities to engage with additional learning materials, access educational websites, use online tutorials, and participate in interactive learning platforms, all of which can contribute to improving their mathematical skills and understanding(Dewi, 2020; Hafidzatulistya & Jana, 2021; Bhaird et al., 2020).

On the other hand, parental engagement ($\beta = -0.370$, $p < .01$) and time management skill ($\beta = -0.241$, $p < .05$) had significant negative effects on students' mathematical competencies. The results indicate that as parental engagement and students' time management skills increase, their mathematical competencies tend to decrease. These suggest that placing a stronger emphasis on parental involvement and time management might potentially impede students' opportunities to engage with and enhance their mathematical skills. These findings contrast with those of many studies, as they indicate that when parents are actively engaged in their child's education, it can significantly improve the student's academic performance (Padilla et al., 2023; Yieng et al., 2020; Hanif et al., 2019). Additionally, studies conducted by Razali et al. (2018) and Xu et al. (2020) suggest that good time management habits lay a strong foundation for long-term success, both academically and beyond the classroom. These contradictions could be attributed to various factors, such as an excessive emphasis on parental involvement, students may become overly reliant on their parents for academic support, which could hinder their independence and problem-solving abilities in mathematics (Wilder, 2013; Pomerantz et al., 2007). Similarly, an intense focus on time management might lead to students become overly stressed or feel pressured to adhere strictly to schedules, potentially hindering their ability to focus and learn effectively. Additionally, excessive scheduling may leave limited room for exploration and spontaneous learning opportunities in mathematics. Therefore, while parental engagement and time management are crucial aspects of students' academic success, this result suggests a need for balance and moderation to ensure that they do not inadvertently hinder students' mathematical development.

Conclusion

The examination of factors impacting students' mathematical competence revealed that note-taking skill, mathematical proficiency, and internet access yielded notable positive effects. In

contrast, parental engagement and time management were associated with significant negative effects. These findings highlight the critical importance of cultivating note-taking and mathematical skills, along with ensuring adequate access to online resources, to enrich students' mathematical competencies. Moreover, effectively addressing challenges pertaining to parental involvement and time management emerges as pivotal for maximizing students' attainment in mathematical learning. This emphasizes the significance of developing strategies and interventions aimed at fostering constructive parental engagement and promoting effective time management skills among students. Nonetheless, it is imperative to maintain a sense of equilibrium and moderation to prevent unintentional hindrance to students' mathematical development.

One limitation of this study is its focus solely on STEM students, potentially limiting the generalizability of the findings to a broader student population. Consequently, future research could consider expanding the scope of the study to include students from diverse academic backgrounds to provide a more comprehensive understanding of the factors influencing mathematical competency across different disciplines. Additionally, exploring longitudinal studies could provide insights into the long-term effects of the identified factors on students' mathematical development over time. Moreover, qualitative research methods, such as interviews or focus groups, could complement quantitative analyses by providing deeper insights into the experiences and perspectives of students regarding the factors influencing their mathematical competency. Thus, addressing these limitations and pursuing future directions would contribute to a more thorough understanding of the dynamics underlying students' mathematical competencies and inform the development of targeted interventions to support their academic success.

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