College Students’ Engagement in Mathematics in the Modern World: The Influential Role of Perceived Teaching Performance of Instructors and Critical Thinking Skills in a Blended Learning Environment

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Abstract

The study aimed to investigate the combined influence of perceived teaching performance and critical thinking skills on engagement in mathematics among college students in Mathematics in the Modern World. The quantitative non-experimental research approach was employed utilizing a predictive-correlation approach. The research conducted was responded to by 101 college students who were officially enrolled in Mathematics in the Modern World general education course in one of the private Catholic higher educational institutions in Davao City. The research used the adapted, modified, pilot-tested and validated tool to gauge the level of the perceived teaching performance of instructors and critical thinking skills of college students on their level of engagement with mathematics. The data were analyzed using the mean, Pearson (r), and the Multiple Regression Analysis. As a result, significant correlations were found between the perceived teaching performance and engagement of students in mathematics, and also between critical thinking skills and engagement of students in mathematics. Further, the regression analysis unveiled the combined influence of the perceived teaching performance and critical thinking skills on student engagement in mathematics.

Keywords: perceived teaching performance, critical thinking skills, student engagement, mathematics in the modern world, blended learning environment, Davao City, Philippines.


Introduction

The engagement of college students in Mathematics in the Modern World poses a significant challenge despite its crucial role in quality teaching and learning in higher education. Joshi et al. (2022) emphasize the ongoing issue of student engagement in mathematics across different countries. The difficult circumstances brought about by
the COVID-19 pandemic worsened this challenge, disrupting students' routines and ways of life (Abbas et al., 2021; Abbas et al., 2022). Lehtinen et al. (2017) underscore the importance of engagement in mathematics learning, yet the COVID-19 situation further complicated efforts to foster student engagement in the learning process (Joshi et al., 2022). Xia et al. (2022) further emphasize the complexity of student engagement in mathematics education, highlighting its multifaceted nature. Steele et al. (2019) assert that pedagogical actions in mathematics education are only effective with active engagement from students.

The problem of student disengagement in mathematics persists as a global challenge, as evidenced by numerous studies across different contexts. Everingham et al. (2017, as cited by Attard & Holmes, 2020) highlight the ongoing struggle with low levels of student engagement in mathematics worldwide. In the United Kingdom, Croft & Grove (2015, as cited by Solomon & Croft, 2016) report widespread disengagement among undergraduate mathematics students. Skilling et al. (2021) emphasize the fluctuating nature of student engagement, indicating that their experiences with mathematics influence it. Furthermore, Fitzmaurice et al. (2021) underscore the detrimental impact of a perceived lack of relevance and appreciation for the importance of mathematics in various careers, which can lead to disinterest and disengagement from the subject entirely.

Student engagement in mathematics remains a pressing concern, as evidenced by various studies in the Philippines. Considering that education is the main element that determines the nation's progress (Abendaño et al., 2023). Still, it shows that the quality of education in the Philippines is still below standard (Maisyaroh et al., 2021). Llorente and Tado (2024) highlight the prevalent issue of poor engagement among students during mathematics classes. Moreover, Peteros et al. (2022) underscore the challenge students face in learning mathematics, often leading to failure in the subject. Guinocor et al. (2020) emphasize the persistent struggle in teaching and comprehending mathematics, reflecting a significant concern within the educational system. Gamit (2022) sheds light on the weak mathematical foundation among college students in the Philippines, urging immediate attention to address the need for more logical operational skills. Furthermore, Villa and Sebastian (2021) emphasize that Filipino students encounter difficulty understanding mathematics lessons requiring higher order thinking skills, indicating a broader challenge in mathematics education that demands attention.

In the Davao region, the problem of poor engagement and performance in mathematics persists. Panerio (2016) highlights mathematics as a subject that students often dislike. Velez et al. (2023) found that college students in a private higher education institution in Tagum City, Davao del Norte, struggle significantly with understanding mathematical concepts, indicating a widespread difficulty in the region. Furthermore, Poquita's (2023) research on students at Davao de Oro State College - Maragusan Branch reveals a concerning lack of motivation and engagement in mathematics classes, with students expressing low confidence in their abilities to perform mathematical tasks effectively. These studies collectively underscore the pressing need to address the challenges faced by students in Davao regarding mathematics education.

Given the existing literature, a notable research gap emerges in investigating college students' engagement in mathematics, particularly in the context of a private Catholic higher education institution in Davao City, Philippines. While studies like that of Gil-Doménech and Berbegal-Mirabent (2019) emphasize the importance of innovative
teaching practices to enhance learners’ involvement, comprehension, cooperation, and motivation, there remains a need for localized research to address specific challenges faced by students in the region.

Additionally, Wang et al. (2021) underscore the critical role of maintaining learning engagement throughout adolescence for long-term academic success, highlighting the urgency of investigating factors influencing student engagement in mathematics within this demographic. The recommendation by Irvine (2020) to explore attitudes and engagement in mathematics across different contexts further supports the need for a focused study tailored to the unique characteristics of college students in Davao City, Philippines. Thus, this proposed study aims to fill this research gap by examining the engagement of college students in Mathematics and the Modern World as influenced by their instructors' teaching performance and critical thinking skills.

**Statement of the Problem**

This study aimed to determine the effect of the perceived teaching performance of instructors and critical thinking skills of college students on their engagement in Mathematics in the Modern World in one of the Catholic schools in Davao City. Specifically, this study aimed to answer the subsequent questions:

1. What is the level of Mathematics in the Modern World instructors’ teaching performance as perceived by college students in terms of organization and responsibility, instruction and clarity, interpersonal relation, assessments, and comprehensive education?
2. What is the level of college students’ critical thinking skills in Mathematics in the Modern World in terms of analyzing, evaluating, and creating?
3. What is the level of college students’ engagement in Mathematics in the Modern World in terms of behavioral engagement, emotional engagement, and cognitive engagement?
4. Is there a significant relationship between Mathematics in the Modern World instructors’ teaching performance as perceived by college students and their engagement?
5. Is there a significant relationship between college students’ critical thinking skills and their engagement in Mathematics in the Modern World?
6. Is there a significant combined influence of the perceived instructors’ teaching performance and critical thinking skills on the college students’ engagement in Mathematics in the Modern World?

**Materials and Methods**

In this quantitative study, a nonexperimental design utilizing a predictive-correlational approach was conducted in one of the private Catholic higher education institutions in Davao City, focusing on 101 college students enrolled in the Mathematics in the Modern World (Math 101) course. Selected through simple random sampling, these students rated the teaching performance of their instructors, their critical thinking skills, and their engagement in the course using adapted scales validated by expert faculty members in mathematics education. These scales demonstrated good internal consistency, with a Cronbach’s alpha value of 0.96, indicating excellent reliability.
The adapted Teacher Performance Evaluation Questionnaire by DICDO (2015) was utilized to assess instructors' teaching performance, while students' critical thinking skills were measured using the adapted Self-Perception Instrument of Students' Critical Thinking Skills by Abdulah and Wangid (2021). To gauge students' engagement in the course, the adapted Students' Engagement in Mathematics questionnaire by Flores et al. (2021) was employed. These instruments utilized a 5-point Likert Scale, allowing students to rate from strongly disagree to strongly agree.

Descriptive statistics, particularly mean scores, were utilized to analyze the level of teaching performance, critical thinking skills, and engagement among college students. Inferential statistics, including Pearson's Product Moment Correlation Coefficient, were then used to examine the relationships between teaching performance and engagement, as well as between critical thinking skills and engagement. Moreover, multiple linear regression was employed to determine the combined influence of perceived teaching performance and critical thinking skills on students' engagement in Mathematics in the Modern World.

**Results**

The first objective of this study is to determine the level of teaching performance of instructors as perceived by the college students enrolled in Mathematics in the Modern World general education course in one of the private Catholic higher education institutions in Davao City in terms of organization and responsibility, instruction and clarity, interpersonal relation, assessments, and comprehensive education. Shown in Table 1 are the domains with mean scores and descriptive levels.

<table>
<thead>
<tr>
<th>Teaching Performance Domains</th>
<th>Mean</th>
<th>Descriptive Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization and Responsibility</td>
<td>4.25</td>
<td>Very High</td>
</tr>
<tr>
<td>Instruction and Clarity</td>
<td>4.34</td>
<td>Very High</td>
</tr>
<tr>
<td>Interpersonal Relation</td>
<td>4.38</td>
<td>Very High</td>
</tr>
<tr>
<td>Assessments</td>
<td>4.24</td>
<td>Very High</td>
</tr>
<tr>
<td>Comprehensive Education</td>
<td>4.28</td>
<td>Very High</td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td>4.30</td>
<td>Very High</td>
</tr>
</tbody>
</table>

The level of Mathematics in the Modern World instructors' teaching performance as perceived by college students was assessed across five domains. The results indicate very high descriptive levels across all domains, with interpersonal relation receiving the highest mean score of 4.38, followed closely by instruction and clarity with a mean score of 4.34. Comprehensive education, organization and responsibility, and assessments also obtained high mean scores of 4.28, 4.25, and 4.24, respectively. Overall, the Mathematics in the Modern World instructors’ teaching performance was rated highly by college students, with an overall mean score of 4.30, reflecting a laudable level of teaching performance in a blended learning environment.

The second objective of this study is to gauge the level of critical thinking skills of college students enrolled in Mathematics in the Modern World general education course in one of the private Catholic higher education institutions in Davao City in
terms of analyzing, evaluating, and creating. Table 2 shows the domains with mean scores and descriptive levels.

**Table 2. Summary of the Level of College Students’ Critical Thinking Skills in Mathematics in the Modern World**

<table>
<thead>
<tr>
<th>Critical Thinking Skills Domains</th>
<th>Mean</th>
<th>Descriptive Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyzing</td>
<td>4.01</td>
<td>High</td>
</tr>
<tr>
<td>Evaluating</td>
<td>4.02</td>
<td>High</td>
</tr>
<tr>
<td>Creating</td>
<td>3.93</td>
<td>High</td>
</tr>
<tr>
<td>Overall</td>
<td>3.98</td>
<td>High</td>
</tr>
</tbody>
</table>

The level of college students’ critical thinking skills in Mathematics in the Modern World was evaluated across three dimensions: analyzing, evaluating, and creating. The results indicate high descriptive levels across all dimensions, with evaluating skill receiving the highest mean score of 4.02, followed closely by analyzing skill with a mean score of 4.01. Creating skill obtained a slightly lower mean score of 3.93. Overall, the college students demonstrated a high level of application of their critical thinking skills in higher-order aspects of Mathematics in the Modern World, as reflected by the overall mean score of 3.98.

The third objective of this study is to determine the level of college students’ engagement in Mathematics in the Modern World general education course in one of the private Catholic higher education institutions in Davao City in terms of behavioral, emotional, and cognitive engagement. Table 3 shows the domains with mean scores and descriptive levels.

**Table 3. Summary of the Level of College Students’ Engagement in Mathematics in the Modern World**

<table>
<thead>
<tr>
<th>Engagement Domains</th>
<th>Mean</th>
<th>Descriptive Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral Engagement</td>
<td>4.13</td>
<td>High</td>
</tr>
<tr>
<td>Emotional Engagement</td>
<td>3.88</td>
<td>High</td>
</tr>
<tr>
<td>Cognitive Engagement</td>
<td>4.13</td>
<td>High</td>
</tr>
<tr>
<td>Overall</td>
<td>4.05</td>
<td>High</td>
</tr>
</tbody>
</table>

The research investigated the level of college students’ engagement in Mathematics in the Modern World across three dimensions: behavioral engagement, emotional engagement, and cognitive engagement. The findings reveal high descriptive levels across all dimensions, with behavioral engagement and cognitive engagement both obtaining the highest mean score of 4.13. Emotional engagement received a slightly lower mean score of 3.88. Overall, the college students demonstrated a high level of engagement in Mathematics in the Modern World, as indicated by the overall mean score of 4.05.

The fourth objective of this study is to determine the significant relationship between the perceived teaching performance of instructors and the engagement of college students in mathematics in the modern world general education course in one of the private Catholic higher education institutions in Davao City. Shown in Table 4 are the r-value, p-value, and its interpretation.
The statistical analysis revealed a significantly strong positive correlation ($r = .616, p\text{-value} = .000$) between the perceived teaching performance of instructors and college students’ engagement in Mathematics in the Modern World, leading to the rejection of the null hypothesis.

The fifth objective of this study is to determine the significant relationship between critical thinking skills and engagement of college students in mathematics in the modern world general education course in one of the Catholic higher education institutions in Davao City. Shown in Table 5 are the $r$-value, $p$-value, and its interpretation.

The statistical analysis unveiled a significant strong positive correlation ($r = .729, p\text{-value} = .000$) between critical thinking skills and college students’ engagement in Mathematics in the Modern World, rejecting the null hypothesis two. This indicates a relationship between developing critical thinking skills and students' engagement in mathematics.

Ultimately, the main objective of this study is to determine whether there is a combined influence of perceived teaching performance of instructors and critical thinking skills on the engagement of college students in Mathematics in the Modern World general education course in one of the private Catholic higher education institutions in Davao City. Table 6 shows the combined influence of teaching performance and critical thinking skills on engagement as subjected to regression analysis.

The multiple regression analysis unveiled a significant model ($F(2, 98) = 72.154, p < .001, R^2 = .596$) predicting engagement in Mathematics in the Modern World based on college students' perceived teaching performance of instructors and their critical thinking skills. Further examination of individual predictors indicated that both the perceived teaching performance of instructors ($t = 4.013, p < .001$) and critical thinking skills ($t = 7.085, p < .001$) were significant predictors.
Table 6. Combined Influence of Perceived Instructors’ Teaching Performance and Critical Thinking Skills on the Engagement of College Students in Mathematics in the Modern World

<table>
<thead>
<tr>
<th>Engagement</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>Decision on $H_0$</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching Performance and</td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td>t</td>
</tr>
<tr>
<td>Critical Thinking Skills</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.453</td>
<td>0.325</td>
<td>1.392</td>
<td>0.167</td>
</tr>
<tr>
<td>Teaching Performance</td>
<td>0.355</td>
<td>0.088</td>
<td>0.312</td>
<td>4.013</td>
</tr>
<tr>
<td>Critical Thinking Skills</td>
<td>0.521</td>
<td>0.073</td>
<td>0.551</td>
<td>7.085</td>
</tr>
</tbody>
</table>

R = 0.772; $R^2 = 0.596$; F-value = 72.154; p-value = 0.000

Discussion

Among the five domains of perceived teaching performance of college instructors specializing in Mathematics in the Modern World, interpersonal relations obtained the highest mean score of 4.38, or very high. This means that college students perceive the teaching performance of their instructors in the aspect of interpersonal relations as excellent, demonstrating a very high level of effectiveness in delivering Mathematics in the Modern World content via blended learning modality. The current study found that the very high rating of interpersonal relations highlights the instructor's approachability, active engagement, and positive rapport with students, fostering an environment conducive to learning Mathematics in the Modern World. This underscores the importance of cultivating solid teacher-student relationships in promoting compelling blended learning experiences and facilitating student participation and autonomy in mathematics education. These results reinforce that fostering positive student-teacher relationships is crucial for shaping favorable attitudes toward mathematics and enhancing academic achievement (Nonyelum et al., 2022).

Following interpersonal relations is the instruction and clarity domain, with a mean score of 4.34, or very high. This means that college students perceive the teaching performance of their instructors in the aspect of instruction and clarity as excellent, demonstrating a very high level of effectiveness in delivering Mathematics in the Modern World content via blended learning modality. The result in the instruction and clarity domain underscores the instructor's commitment to providing relevant resources, clear communication, and explicit guidance, enhancing student understanding and engagement in Mathematics in the Modern World. This emphasizes the pivotal role of clear communication, explicit instruction, and illustrative examples in facilitating student learning and success in a blended learning environment. The results align with empirical evidence indicating that clarity in instruction is vital to enhancing students' enjoyment, satisfaction, and academic success in mathematics (Chen & Lu, 2022).

Next in rank is the comprehensive education domain, which obtained a mean score of 4.28, or very high. This means that college students perceive the teaching performance of their instructors in the aspect of comprehensive education as excellent,
demonstrating a very high level of effectiveness in delivering Mathematics in the Modern World content via blended learning modality. The result obtained in the comprehensive education domain highlights the instructor's dedication to fostering inclusive attitudes, collaborative learning environments, and connections between mathematics and social realities, enriching students' understanding and appreciation of Mathematics in the Modern World. This underscores the importance of promoting social responsibility, diversity, and ethical considerations in mathematics education, contributing to holistic student development and societal relevance in a blended learning context. These findings validate the idea that holistic education, integrating mathematics learning, fosters the holistic development of individuals within an engaging, democratic, and humanistic learning environment, emphasizing experiential interaction with the surroundings (Hayati et al., 2018).

Moreover, organization and responsibility obtained a mean score of 4.25, or very high. This means that college students perceive the teaching performance of their instructors in the aspect of organization and responsibility as excellent, demonstrating a very high level of effectiveness in delivering Mathematics in the Modern World content via blended learning modality. The result reveals that the organization and responsibility domain reflects the instructor's meticulous planning, punctuality, and transparent assessment practices, ensuring a structured and reliable learning experience for students in Mathematics in the Modern World. This underscores the critical role of effective organization, timely communication, and consistent adherence to course plans in promoting student engagement and success in a blended learning environment. The findings in this domain support the concept that the caliber of students' learning encounters hinges on the preparatory learning activities orchestrated by their instructors before classroom engagement (González et al., 2020).

Lastly, assessments got a mean score of 4.24, or very high. This means that college students perceive the teaching performance of their instructors in the aspect of assessments as excellent, demonstrating a very high level of effectiveness in delivering Mathematics in the Modern World content via blended learning modality. The findings gathered in the assessment domain reflect the instructor's commitment to fair, transparent, and constructive assessment practices, providing students with valuable feedback and opportunities for reflection and improvement in Mathematics in the Modern World. This underscores the importance of aligning assessments with informed criteria, facilitating student feedback and self-assessment, and offering timely guidance to enhance learning outcomes in a blended learning setting. The findings are reinforced by the argument that students exhibit enhanced learning outcomes in classrooms where assessment is seamlessly integrated into instruction, thus underscoring the pivotal role of high-quality assessment in advancing mathematics education (Ngunjiri, 2022).

The teaching performance of instructors in Mathematics in the Modern world, as perceived by college students, obtained a mean score of 4.30, or very high. College students perceive instructors' teaching performance in organization and responsibility, instruction and clarity, interpersonal relations, assessments, and comprehensive education as excellent, consistently demonstrating a very high level of effectiveness in delivering Mathematics in the Modern World content via blended learning modality. The overarching outcome aligns with the results delineated in the research conducted by Tambunan et al. (2021), which underscored the profound impact of teacher performance on fostering students' enthusiasm and motivation to excel in mathematics.
Moreover, among the three domains of critical thinking skills, the evaluating domain obtained the highest mean score of 4.02, or high. The result reveals that college students exhibit advanced capability to apply their critical thinking skills in mathematics in the modern world in a blended learning environment, specifically at the evaluating level. The high rating in the evaluating domain suggests that college students possess advanced skills to assess diverse mathematical problems in real-world contexts, underscoring the effectiveness of blended learning in fostering critical thinking at the evaluating level. This highlights the importance of promoting opportunities for students to engage in multi-perspective evaluation and critical analysis of mathematical concepts, enhancing their ability to navigate complex mathematical challenges and real-life applications. While not at an identical level, the findings indicate a higher performance than Subia et al. (2020), where students demonstrated an average level of cognitive evaluation in general mathematics.

Moreover, in the second spot, the analyzing domain got a mean score of 4.01, or high. The result reveals that college students exhibit advanced capability to apply their critical thinking skills in mathematics in the modern world in a blended learning environment, specifically at the analyzing level. The high rating in the analyzing domain suggests that college students demonstrate advanced proficiency in applying critical thinking skills to analyze diverse mathematical information and solve real-life challenges, particularly within a blended learning setting. This highlights the significance of integrating opportunities for students to engage in comparative analysis, problem-solving, and selective utilization of mathematical information, enhancing their ability to address complex mathematical problems and make informed decisions. The outcome aligns with the results reported by Pasani and Suryaningsih (2021), indicating proficient analytical skills among students in the realm of mathematics.

The third spot, the creating domain, got a mean score of 3.93, or high. This means that college students exhibit advanced capability to apply their critical thinking skills in mathematics in the modern world in a blended learning environment, specifically at the creating level. The high rating in the creating domain indicates that college students demonstrate advanced proficiency in utilizing critical thinking skills to formulate original opinions, defend them with solid evidence, and integrate diverse mathematical information, particularly within a blended learning environment. This emphasizes the importance of fostering opportunities for students to engage in creative problem-solving, evidence-based reasoning, and synthesis of mathematical concepts, empowering them to innovate and contribute meaningfully to the modern world of mathematics. The outcome finds reinforcement in the research conducted by Hidajat (2021), where although not all respondents demonstrated exceptional skills in creative thinking, some students showcased the ability to generate novel ideas, offer alternative plans, synthesize existing concepts with problem scenarios, and implement problem-solving strategies by devising more than four original solutions in mathematics.

The critical thinking skills of college students in Mathematics in the Modern World obtained a mean of 3.98, or high. This depicts that college students exhibit the advanced capability to apply their critical thinking skills in mathematics in the modern world in a blended learning environment, particularly in analyzing, evaluating, and creating higher order thinking skills. The overall high level of critical thinking skills among college students in Mathematics in the Modern World, with a mean score of 3.98, is corroborated by Pasani & Suryaningsih (2021), who reported satisfactory achievement levels in students’ higher order thinking abilities in mathematics. Furthermore, the improvement in students’ higher-order thinking skills, particularly in
analyzing, evaluating, and creating, can be attributed to the efficacy of inquiry-based learning, as demonstrated by Abdurrahman et al. (2021), highlighting its positive impact on student's critical thinking abilities in the mathematics classroom.

Furthermore, among the three domains of engagement, behavioral engagement obtained a mean score of 4.13, or high. The result shows that the engagement of college students in mathematics in the modern world subject, particularly behavioral engagement, is oftentimes manifested in a blended learning setting. The high score in behavioral engagement reflects the proactive involvement of college students in Mathematics in the Modern World, indicating their commitment to attentive listening, active participation, diligent effort, and persistent problem-solving within a blended learning environment. This highlights the significance of promoting strategies to sustain and enhance behavioral engagement, such as fostering a supportive learning environment and encouraging collaborative learning, that facilitate students' success and mastery of mathematics. The outcome aligns with Ayub et al.'s (2017) study, which indicated that students' engagement in mathematics, especially behavioral engagement, received the highest mean score.

Similarly, cognitive engagement obtained a mean score of 4.13, or high. The result reveals that the engagement of college students in mathematics in the modern world subject, particularly cognitive engagement, is oftentimes manifested in a blended learning setting. The reported high score in cognitive engagement indicates that college students actively immerse themselves in Mathematics in the Modern World, showcasing goal-oriented behavior, critical thinking, problem-solving skills, and efforts to relate mathematical concepts to real-world contexts. This underscores the importance of fostering cognitive engagement strategies, such as encouraging goal setting and promoting critical thinking, to deepen students' understanding and proficiency in mathematics within a blended learning environment. The findings correspond to those observed in earlier studies wherein students demonstrate high cognitive engagement in mathematics learning (Joshi et al., 2022).

On the other hand, emotional engagement obtained a mean score of 3.88, or high. The result unveils that the engagement of college students in mathematics in the modern world subject, particularly emotional engagement, is oftentimes manifested in a blended learning setting. The obtained high score in emotional engagement highlights the positive affective experiences of college students in Mathematics in the Modern World, including interest, enjoyment, excitement, and a desire to spend more time in solving math problems. This indicates the importance of fostering a supportive and engaging learning environment that cultivates students' emotional investment in mathematics, ultimately enhancing their motivation, persistence, and overall learning outcomes within a blended learning setting. The results are consistent with the study of Agup and Ebojo (2022), wherein students showed high emotional engagement in the mathematics learning area.

The engagement of college students in Mathematics in the Modern World subject obtained a mean score of 4.05, or high. The result indicates that the engagement of college students in Mathematics in the Modern World subject in the behavioral, emotional, and cognitive aspects is consistently manifested in a blended learning setting. The overall findings are consistent with the findings obtained from the study of Deringöl et al. (2020), wherein students' engagement in mathematics was at a high level. The same findings were obtained from the study of Baroody et al. (2016), wherein student engagement was evident during math lessons.
It is important to note that a relationship exists between how students perceive their instructors' teaching performance and their level of engagement in mathematics. The findings align with previous research indicating the importance of teacher-student interactions for fostering motivation and engagement in mathematics (Durksen et al., 2017). Furthermore, they support the notion that students' perception of their teachers significantly correlates with their level of engagement, as suggested by Wang et al. (2020).

Additionally, the results are consistent with the idea that the educational environment shaped by teachers' behaviors, as reflected in their performance, plays a pivotal role in influencing student engagement (Umbach & Wawrzynski, 2005, as cited by Cinches et al., 2017). This suggests that instructors who exhibit effective teaching performance and create conducive learning environments are likelier to foster higher engagement among their students in mathematics.

Similarly, a relationship between critical thinking skills and students' engagement in mathematics was revealed. The findings align with previous research suggesting a significant association between the development of critical thinking and student engagement (Shcheglova et al., 2019). Furthermore, they support the notion that a positive relationship exists between learning engagement and higher-order thinking skills, as Li et al. (2023) indicated.

Ultimately, students' engagement in mathematics is influenced by the quality of teaching provided by instructors as perceived by college students and college students' critical thinking skills. The findings support the idea that academic engagement among students is influenced by a range of factors, including individual learner attributes, instructor qualities, instructional approaches, peer interactions, and other aspects of the learning setting (Amerstorfer & Frein von Münster-Kistner, 2021).

The combined influence of both the perceived teaching performance and applied critical thinking skills of college students on their engagement in mathematics indeed supports the Self-Determination Theory as college students are more likely to be engaged as they perceive autonomy in their learning choices, feel competent in their mathematical abilities, and experience a sense of relatedness with the subject matter and the instructor. Moreover, their positive perception of instructors contributes to a sense of relatedness, while well-developed critical thinking skills enhance feelings of competence.

These resulted in heightening the behavioral, emotional, and cognitive engagement of college students in the challenging terrain of mathematics education, as they are more likely to be intrinsically motivated. The interplay between college students' perception of their mathematics instructors' and their critical thinking skills, as elucidated by Self-Determination Theory, thus becomes pivotal in shaping a comprehensive understanding of college students' holistic engagement in the mathematics learning process.

**Conclusion**

In conclusion, this study has revealed a significant combined influence of instructors' perceived teaching performance and students' critical thinking skills on their engagement in Mathematics in the Modern World subject within a blended learning environment. The findings underscore the importance of effective teaching
performance and the cultivation of critical thinking skills in promoting student engagement, thereby enhancing the overall learning experience.

Furthermore, the Self-Determination Theory of Edward Deci and Richard Ryan provides valuable support for these findings. According to the theory, individuals are more likely to be self-determined and engaged in activities when their fundamental needs for autonomy, competence, and connection are fulfilled. In this study, the perceived teaching performance of instructors and the development of critical thinking skills among students contribute to fulfilling these essential needs, aligning closely with the principles of Self-Determination Theory, and reinforcing the significance of these factors in promoting student engagement in mathematics education.

The findings of the study underscore the importance of sustaining and further enhancing the observed results, particularly in enhancing college instructors' teaching performance, fostering college students' critical thinking skills, and their engagement in the Mathematics in the Modern World general education course. To achieve this, it is recommended to expand the scope of future research endeavors by increasing the number of respondents, broadening the research locale to encompass multiple higher education institutions, and including both private and public higher education institutions to ensure diversity and representativeness in the sample. Additionally, future research should explore additional predictors beyond teaching performance and critical thinking skills, given that these variables already account for a substantial portion of the variance in college students' engagement in Mathematics in the Modern World. Finally, to gain deeper insights into the phenomenon of college students' engagement, it is advised to complement quantitative findings with qualitative exploration using methodologies such as phenomenological or case study approaches, enabling a richer understanding of the lived experiences and perceptions of college students concerning their engagement with the subject matter.

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Ethics Statement

Approval for the study was secured from the Research Ethics Committee of Holy Cross of Davao College, with adherence to the nine ethical principles outlined by the HCDC-REC, encompassing considerations such as social value, informed consent, risk assessment, benefits, safety, privacy, confidentiality, justice, transparency, researcher qualifications, facility adequacy, and community involvement (Abendaño, 2023). Clearance for data collection was obtained on May 8, 2023, followed by final approval for ethical compliance on April 30, 2024.

Conflict of Interest

Throughout the study, there were no instances of conflict of interest arising in terms of personal, financial, or professional aspects.

References


