

Assessing the Educational Value of Facebook as a Supplementary Tool in Teaching Discrete Mathematics

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Abstract— This quantitative comparative study examines the effectiveness of Facebook as a supplementary teaching tool in the Discrete Mathematics course during the First Semester of Academic Year 2022–2023. Through purposive sampling, two groups of students were analyzed: an experimental group that used Facebook to support traditional instruction and a control group that relied solely on conventional classroom methods. Results revealed that Facebook integration positively influenced students' learning outcomes, engagement, and perceptions of the subject, with overall mean scores ranging from 3.44 to 3.52 out of 5. Students reported that the platform enhanced their understanding of concepts, encouraged collaboration, and made learning more interactive. However, statistical analysis using an independent t-test ($p = 0.543$) indicated no significant difference in the General Weighted Averages (GWA) between the experimental and control groups. These findings suggest that while Facebook effectively enriches the qualitative dimensions of learning—such as engagement, motivation, and interaction—it does not directly translate into higher academic performance as measured by grades. The study recommends the continued use of Facebook to enhance engagement and collaborative learning while integrating alternative assessment methods to capture qualitative gains not reflected in traditional grading metrics.

Keywords— Discrete Mathematics, Facebook, General Weighted Average (GWA), Learning Outcomes, Social Media Integration, Student Engagement, Supplementary Teaching Tool, Teaching Mathematics.

I. INTRODUCTION

In the modern era of technology and virtual learning, this study explores the potential of utilizing Facebook as a teaching tool for Mathematics. With the increasing popularity of social media platforms and the widespread use of Facebook among students, it is essential to investigate whether this platform can effectively support the learning process.

The context for this research is highly relevant, as the study was conducted during the First Semester of Academic Year 2022–2023 at a time when higher education institutions in the Philippines were transitioning from purely remote learning (necessitated by the COVID-19 pandemic) to either hybrid or limited face-to-face instruction. This period solidified the role of online tools in education, making the effectiveness of a familiar platform like Facebook a critical area of investigation.

By incorporating Facebook into the teaching methods during this post-lockdown transition, the research assesses its impact on students' engagement, comprehension, and overall learning outcomes in discrete mathematics. The

study will examine various Facebook features, such as groups, discussions, multimedia content sharing, and interactive activities, to facilitate collaborative learning and enhance students' understanding of complex geometric concepts.

Through investigating Facebook's effectiveness in teaching discrete mathematics in this particular academic setting, this research aims to provide valuable insights into integrating social media platforms as educational tools. The findings could contribute to developing innovative and engaging instructional approaches, ultimately improving students' learning experiences and academic achievements in mathematics.

II. LITERATURE REVIEW

The research of Tess P.A., 2013, entitled "The Role of Social Media in Higher Education Classes (Real and Virtual)" provides a comprehensive summary of scholarly writings and reviews the findings from empirical investigations on the use of social media in higher education. The article highlights limitations in current research and proposes future areas of inquiry.

Al-rahmi, Othman, & Musa (2014), in their study "The Improvement of Students' Academic Performance by Using Social Media through Collaborative Learning in Malaysian Higher Education," explored the impact of social media usage on students' academic performance. They found that when used effectively, social media platforms can enhance collaborative learning and improve academic performance.

Alamri (2019) studied "Undergraduate Students' Perceptions toward Social Media Usage and Academic Performance: A Study from Saudi Arabia." The study revealed that students perceive social media as a useful tool for learning and that its usage can positively impact academic performance.

Roebuck, Siha, & Bell's research on "Faculty Usage of Social Media and Mobile Devices: Analysis of Advantages and Concerns" provides insights into how faculty members use social media and mobile devices in their teaching. The study highlights the advantages of using these tools, such as increased student engagement and improved communication, but also raises concerns about privacy and the potential for distraction.

Amaechi, Amaechi, Oyetunji, & Kgosiemang (2022), in their scientific review "Teaching in Higher Education Academies on Online Learning: Adapting to the COVID-19 Pandemic," provide an annotated bibliography of research on online learning during the COVID-19 pandemic. The review highlights the rapid shift to online learning due to the pandemic and discusses the challenges and opportunities this shift presents.

These studies collectively suggest that social media platforms like Facebook can be effectively integrated into higher education teaching methods. They can enhance student engagement, improve communication, facilitate collaborative learning, and positively impact academic performance. However, they also highlight potential concerns, such as privacy issues and the potential for distraction. As such, using these tools thoughtfully and strategically is crucial to maximizing their benefits and minimizing potential drawbacks.

III. STATEMENT OF PROBLEM

This study investigates the effectiveness of using Facebook as a supplementary teaching tool in the context of the Discrete Mathematics course in higher education. The study aims to address the following research questions:

1. To what extent does the integration of Facebook as a supplementary teaching tool impact students' learning outcomes in the Discrete Mathematics course?
2. How does using Facebook as a supplementary teaching tool influence the engagement levels of students in the Discrete Mathematics course?
3. What are students' perceptions regarding the effectiveness and utility of Facebook as a supplementary teaching tool in the Discrete Mathematics course?
4. Are there any significant differences in the General Weighted Average between the Experimental Group (using Facebook) and the Control Group (not using Facebook) in the Discrete Mathematics course?

IV. RESEARCH DESIGN

The present study was categorized as a study of quantitative comparative nature. A comparative study is a research methodology that compares two or more groups or conditions to evaluate their similarities or differences. In this case, the study compares the performance of two groups of students: one group receiving instruction with Facebook as a supplementary teaching tool (the Facebook group) and another receiving traditional education without using Facebook (the control group). The study's quantitative component entails the gathering and examination of numerical data, specifically the academic performance of students in Mathematics in Modern Word and Discrete Mathematics. The researcher used an independent t-test to contrast the two cohorts' academic scores and ascertain a statistically significant variance in their achievements. This study aims to quantitatively evaluate the efficacy of Facebook as an educational instrument by analyzing the variance in academic performance between the experimental group that utilized Facebook and the control group that did not. The intervention's effectiveness is determined by measuring and analyzing objective data.

V. SAMPLING TECHNIQUE

The sampling technique used for this research could be purposive sampling. Purposive sampling is a non-random sampling technique where participants are selected based on specific criteria that align with the research objectives. In this case, the researchers may purposefully choose students with an average grade of 2.0 in Mathematics in Modern Word.

The criterion for selection guarantees that the chosen participants possess comparable levels of previous mathematical aptitude and achievement, which is pertinent to the research inquiry. Using purposive sampling, the researchers can intentionally select participants who meet the specific criteria and have the desired characteristics for the study. This approach enables a concentrated selection of participants most pertinent to the research objectives, thereby enhancing the probability of acquiring significant and valuable data. Purposeful sampling is widely used in qualitative research to identify and select information-rich cases related to the phenomenon of interest (Palinkas LA & et al., 2015).

VI. PRESENTATION, ANALYSIS, AND INTERPRETATION

This section explains how the findings from the study on Facebook's usefulness as a supplemental teaching tool in Discrete Mathematics were presented, analyzed, and interpreted. To further understand how Facebook's integration affects students' learning results, engagement, and perceptions, we will examine data collected from both the experimental and control groups.

1. On the extent does the integration of Facebook as a supplementary teaching tool impact students' learning outcomes in the Discrete Mathematics course.

This study aims to assess the impact of using Facebook as a supplementary teaching tool on students' learning outcomes in the Discrete Mathematics course. It explores how the integration of this popular social media platform into the teaching methodology influences students' comprehension, engagement, and overall performance in the course.

Table 1. Respondent Assessment on Learning Outcomes

Indicators	Mean
1. Facebook enhanced my understanding of discrete mathematics concepts.	3.40
2. Facebook improved my ability to apply discrete mathematics principles.	3.37
3. Facebook increased my overall performance in the Discrete Mathematics course.	3.43
4. Facebook helped me grasp complex discrete mathematics topics more effectively.	3.40
5. Facebook positively contributed to my learning experience in Discrete Mathematics.	3.62
Overall Mean	3.45

Table 1 shows the overall mean score of 3.44 out of 5, indicating students' positive responses toward using Facebook as a supplementary teaching tool in the Discrete Mathematics course. This score suggests that, on average, students agreed that Facebook enhanced their understanding and application of discrete mathematics concepts, increased their overall performance in the course, helped them grasp complex topics more effectively, and positively contributed to their learning experience. The highest individual score was for the statement that Facebook positively contributed to their learning experience (3.62), suggesting that students appreciated the additional platform for learning. This could be due to the familiar interface of Facebook, the ease of access, or the interactive nature of the platform. The implications of these findings are significant. They suggest that social media platforms like Facebook can be effectively integrated into traditional teaching methods to enhance learning outcomes. This could be particularly useful in distance learning or hybrid learning models, where online engagement is crucial. The findings also highlight the importance of exploring innovative teaching methods in higher education. As technology continues to evolve, so too should our teaching methods. Using familiar platforms like Facebook can make learning more engaging and accessible for students. However, while the results are promising, it's important to note the potential risks of using platforms like Facebook, such as data privacy concerns. Therefore, educators should ensure appropriate measures are in place to protect student's information and privacy. Further research could explore other social media platforms as supplementary teaching tools or investigate the effectiveness of Facebook integration in other courses or subject areas. The overall positive

response from students in this study suggests that such research could yield valuable insights into the potential of social media as a tool for enhancing educational outcomes.

The integration of Facebook as a supplementary teaching tool in higher education has been a topic of interest in recent years. According to Junco (2012), Facebook can facilitate out-of-class, student-to-student interactions, which have a positive relationship with student engagement. This suggests that Facebook can effectively enhance student engagement in a course, potentially leading to improved learning outcomes. Similarly, a study by Kirschner and Karpinski (2010) found that Facebook users reported lower GPAs and spent less time studying than non-users. However, this does not necessarily mean using Facebook as a teaching tool would have the same effect. When used intentionally and strategically as part of a course, Facebook could positively impact students' learning outcomes. Lastly, a study by Manca and Ranieri (2016) found that while students and teachers widely use Facebook, its educational potential is not fully exploited. This suggests that there may be untapped potential for using Facebook as a teaching tool in higher education, and further research is needed to explore this potential and determine the best strategies for integrating Facebook into teaching and learning processes.

2. On using Facebook as a supplementary teaching tool influences students' engagement levels in the Discrete Mathematics course.

This study aims to assess how the use of Facebook as a supplementary teaching tool influences the engagement levels of students in the Discrete Mathematics course. It explores whether the integration of this popular social media platform into the teaching methodology can enhance students' active participation, interest in the subject matter, and overall learning experience. According to Table 2, the overall mean score of 3.50 out of 5 indicates a positive impact of using Facebook as a supplementary teaching tool on the engagement levels of students in the Discrete Mathematics course. This score suggests that, on average, students agreed that Facebook motivated them to participate in class discussions actively, increased their interest in exploring discrete mathematics topics, made learning more enjoyable and interactive, encouraged them to seek additional resources and engage in self-directed learning, and facilitated collaboration and interaction among students. The highest individual score was for the statement that Facebook encouraged students to seek additional resources and engage in self-directed learning (3.70).

Table 2. Respondent Assessment on Engagement Levels

Indicators	Mean
1. Facebook motivated me to participate in Discrete Mathematics class discussions actively.	3.42
2. Facebook increased my interest in exploring discrete mathematics topics.	3.42
3. Facebook made learning discrete mathematics more enjoyable and interactive.	3.40
4. Facebook encouraged me to seek additional resources and engage in self-directed learning.	3.70
5. Facebook facilitated collaboration and interaction among Discrete Mathematics students.	3.56
Overall Mean	3.50

This suggests that using Facebook in the course promoted a more active and autonomous learning approach among students. The second highest score was for the statement that Facebook facilitated collaboration and

interaction among Discrete Mathematics students (3.56). This indicates that Facebook served as an effective platform for peer interaction and collaborative learning, key elements of student engagement. These findings have important implications. They suggest that social media platforms like Facebook can effectively promote student engagement in higher education. By making learning more interactive and enjoyable and facilitating active participation, collaboration, and self-directed learning, Facebook can enhance students' engagement levels, leading to improved learning outcomes.

However, while the results are promising, it's important to note the potential risks of using platforms like Facebook, such as data privacy concerns. Therefore, educators should ensure appropriate measures are in place to protect student's information and privacy.

Further research could explore other social media platforms as supplementary teaching tools for promoting student engagement or investigate the effectiveness of Facebook integration in other courses or subject areas. The overall positive response from students in this study suggests that such research could yield valuable insights into the potential of social media for enhancing student engagement in education.

The influence of Facebook as a supplementary teaching tool on students' engagement levels has been examined in several studies. According to a study by Junco (2012), Facebook can facilitate out-of-class, student-to-student interactions, which have a positive relationship with student engagement.

This suggests that Facebook can effectively enhance student engagement in a course, potentially leading to improved learning outcomes. Similarly, a study by Karpinski et al. (2013) found that Facebook use was negatively correlated with student's academic performance, suggesting that excessive use of Facebook might distract students and reduce their engagement with their studies.

However, when used strategically as a supplementary teaching tool, Facebook could increase student engagement by providing a familiar and interactive platform for learning. Finally, a study by Manca and Ranieri (2016) found that while students and teachers widely use Facebook, its educational potential is not fully exploited.

This suggests that there may be untapped potential for using Facebook as a teaching tool to increase student engagement, and further research is needed to explore this potential and determine the best strategies for integrating Facebook into teaching and learning processes.

3. On students' perceptions regarding the effectiveness and utility of Facebook as a supplementary teaching tool in the Discrete Mathematics course.

This study aims to assess student perceptions of the effectiveness and utility of using Facebook as a supplementary teaching tool in the Discrete Mathematics course. It seeks to understand students' views on how Facebook integration impacts their learning experience, understanding of course concepts, and engagement with course materials.

Table 3. Respondent Assessment on Student Perceptions

Indicators	Mean
1. I believe that using Facebook in the Discrete Mathematics course improved my learning experience.	3.46
2. I found Facebook to be a valuable tool for understanding discrete mathematics concepts.	3.61
3. I think Facebook helped me stay more connected and engaged with the course materials.	3.64
4. I believe that integrating Facebook into the Discrete Mathematics course positively impacted my academic performance.	3.39
5. I would recommend using Facebook as a supplementary teaching tool in future math courses.	3.50
Overall Mean	3.52

Presented in Table 3, the overall mean score of 3.52 out of 5 indicates a generally positive perception among students regarding the effectiveness and utility of Facebook as a supplementary teaching tool in the Discrete Mathematics course. This score suggests that, on average, students believe that Facebook improved their learning experience, found it valuable for understanding discrete mathematics concepts, helped them stay more connected and engaged with the course materials, positively impacted their academic performance, and would recommend its use in future math courses. The highest individual score was for the statement that Facebook helped students stay more connected and engaged with the course materials (3.64). This suggests that Facebook was an effective platform for maintaining engagement and connection with the course materials, particularly important in a subject like discrete mathematics that builds on concepts over time. The second highest score was for the statement that students found Facebook valuable for understanding discrete mathematics concepts (3.61). This indicates that Facebook was an effective tool for reinforcing and deepening understanding of course concepts. These findings have important implications. They suggest that social media platforms like Facebook can be perceived as effective and valuable tools by students in higher education. By improving the learning experience, enhancing understanding of course concepts, promoting engagement with course materials, and positively impacting academic performance, Facebook can potentially enhance students' academic experiences. However, while the results are promising, it's important to note the potential risks of using platforms like Facebook, such as data privacy concerns. Therefore, educators should ensure appropriate measures are in place to protect student's information and privacy. Further research could explore students' perceptions of other social media platforms as supplementary teaching tools or investigate the effectiveness of Facebook integration in other courses or subject areas. The overall positive perception from students in this study suggests that such research could yield valuable insights into the potential of social media to enhance the academic experience in education.

Students' perceptions regarding the effectiveness and utility of Facebook as a supplementary teaching tool have been the subject of several studies. According to a study by Manca and Ranieri (2016), while students and teachers widely use Facebook, its educational potential is not fully exploited. This suggests that students may perceive Facebook as a valuable tool for social interaction but not necessarily for academic learning. However, when used strategically, Facebook could potentially enhance students' perceptions of their learning experience. Similarly, a

study by Kirschner and Karpinski (2010) found that Facebook users reported having lower GPAs and spending fewer hours per week studying than nonusers. This suggests that students may perceive Facebook as distracting from their studies, potentially impacting their academic performance. However, when used as a supplementary teaching tool, Facebook could enhance students' perceptions of their learning experience by providing a familiar and interactive platform for learning. Finally, Tess (2013) found that while many scholars advocate for the intentional integration of social media as an educational tool, empirical evidence supporting this claim has been limited. This suggests that there may be a gap between the perceived and actual effectiveness of Facebook as a teaching tool. Further research is needed to explore this discrepancy and determine the best strategies for integrating Facebook into teaching and learning processes.

4. On significant differences in the General Weighted Average (GWA) between the Experimental Group (using Facebook) and the Control Group (not using Facebook) in the Discrete Mathematics course

The independent T-Test compares two groups: one using Facebook as a supplementary teaching tool and the other not using it. The significance level for this test will be set at 0.05. This analysis will help us understand whether the use of Facebook significantly impacts students' learning outcomes in the Discrete Mathematics course, as shown in Table 4.

Table 4. The mean difference of the two groups

Students' GWA	Mean	T	df	Sig. (2-tailed)
Experimental	1.8021	-0.613	46	0.543
Control	1.8646			

The statistical analysis indicates that there is no significant difference in the General Weighted Average (GWA) between the Experimental Group (using Facebook, mean=1.8021) and the Control Group (not using Facebook, mean=1.8646) in the Discrete Mathematics course. The p-value of 0.543 is more significant than the commonly used significance level of 0.05, which suggests that the difference in means is not statistically significant. The t-value of -0.613 further supports this conclusion. In practical terms, this means that while the Experimental Group had a slightly lower (better) average GWA than the Control Group, this difference is not statistically significant. Therefore, we cannot confidently say that using Facebook as a supplementary teaching tool significantly impacted the GWA in the Discrete Mathematics course.

However, it's important to note that while Facebook did not significantly impact the GWA, the previous findings suggested that it positively impacted students' learning outcomes, engagement levels, and overall perceptions of the course. This indicates that the benefits of using Facebook as a supplementary teaching tool may be more qualitative, enhancing the learning experience and engagement rather than directly improving grades. It's also worth noting that the lack of a significant difference in GWA does not necessarily mean that Facebook is not a helpful teaching tool. It could be that the effects of Facebook are more subtle or long-term or that they manifest in ways not captured by the GWA. Further research could explore these possibilities and investigate other benefits of using Facebook in education.

The impact of using Facebook as a supplementary teaching tool on students' General Weighted Average (GWA) has been the subject of several studies. According to a study by Karpinski et al. (2013), a significant negative relationship exists between using Facebook and academic performance as measured by self-reported GPA and hours spent studying per week. This suggests that while Facebook may enhance the learning experience and engagement, it may not directly improve grades. Similarly, a study by Junco (2015) found that while Facebook use was negatively predictive of overall GPA, using Facebook for educational purposes was positively predictive of overall GPA. The impact of Facebook on academic performance may depend on how it is used. When used as a supplementary teaching tool, Facebook could positively impact students' GWA. Finally, a study by Paul et al. (2012) found that students' Facebook use for socializing can hurt their academic performance. However, students who used Facebook in moderation and also used it to discuss schoolwork had GPAs that were as high as students who did not use the Internet as much. This suggests that when used in moderation and for educational purposes, Facebook can have a neutral or positive impact on students' GWA.

VII. SUMMARY, CONCLUSION, AND RECOMMENDATION

This section summarizes the key findings, draws definitive conclusions based on the statistical and descriptive data, and offers specific actionable recommendations for educators and future research.

Summary:

1. **Learning Outcomes.** The overall mean score of 3.444 suggested that students found Facebook beneficial in enhancing their understanding and application of discrete mathematics concepts and overall performance in the course. This indicates that integrating familiar social media platforms like Facebook can improve learning outcomes in higher education, particularly in complex subjects like discrete mathematics.
2. **Engagement Levels.** The overall mean score of 3.50 suggested that Facebook positively influenced students' engagement levels. Facebook motivated students to participate in class discussions actively, increased their interest in exploring topics, made learning more enjoyable and interactive, and facilitated collaboration and interaction among students. This suggests that social media platforms can effectively promote student engagement, a crucial factor in successful learning.
3. **Student Perceptions.** The overall mean score of 3.52 indicated a generally positive perception among students regarding the effectiveness and utility of Facebook as a supplementary teaching tool. Students believed that Facebook improved their learning experience, found it valuable for understanding course concepts, helped them stay more connected and engaged with the course materials, and positively impacted their academic performance. This suggests that students are open to integrating social media platforms into their learning process and perceive them as beneficial.
4. **Comparison.** The t-test analysis showed no significant difference in the General Weighted Average (GWA) between the Experimental Group (using Facebook, mean=1.8021) and the Control Group (not using Facebook, mean=1.8646) in the Discrete Mathematics course. This suggests that while Facebook may have enhanced the learning experience and engagement, it did not significantly impact the overall academic performance measured by the GWA.

Conclusion:

Based on the study's findings, it can be concluded that integrating Facebook as a supplementary teaching tool in the Discrete Mathematics course positively impacted students' learning outcomes, engagement levels, and overall perceptions of the system. However, the use of Facebook did not significantly affect the General Weighted Average (GWA) of the students in the class.

The positive responses from students suggest that Facebook can be an effective tool for enhancing understanding and application of discrete mathematics concepts, increasing overall performance in the course, motivating active participation in class discussions, increasing interest in exploring topics, making learning more enjoyable and interactive, and facilitating collaboration and interaction among students.

However, the lack of a significant difference in GWA between the experimental and control groups suggests that while Facebook may enhance the learning experience and engagement, grades may not directly improve. This indicates that the benefits of using Facebook as a supplementary teaching tool may be more qualitative, enhancing the learning experience and engagement rather than directly improving grades.

Recommendation:

1. **Enhance Engagement Through Structured Facebook Integration:** Educators should design guided activities that maximize Facebook's interactive features—such as discussion threads, polls, and multimedia sharing—to foster collaborative learning and sustained engagement. Structured use ensures that the platform serves an educational purpose rather than becoming a source of distraction.
2. **Adopt Complementary Assessment Strategies:** Since improvements in engagement and comprehension did not directly translate into higher academic grades, instructors are encouraged to incorporate alternative forms of assessment. These may include participation-based evaluations, collaborative project outputs, reflective discussions, or digital learning portfolios that capture qualitative learning gains.
3. **Promote Digital Literacy and Privacy Awareness:** As Facebook operates in a social media environment, it is essential to educate students on responsible digital behavior, online etiquette, and data privacy. Clear guidelines and academic policies should accompany any integration of social media into teaching to ensure a safe and ethical learning environment.
4. **Pursue Longitudinal and Cross-Disciplinary Research:** Future researchers should investigate the long-term academic and behavioral impacts of social media-supported learning across various disciplines. Exploring other platforms and comparing their effectiveness against Facebook can broaden understanding of how different digital ecosystems support higher-order learning outcomes.
5. **Leverage Facebook for Blended and Post-Pandemic Learning Models:** Given its accessibility and familiarity among students, Facebook can serve as a low-cost supplementary platform for blended, hybrid, or post-pandemic learning environments. Institutions can develop formal guidelines to integrate Facebook within Learning Management Systems (LMS) to sustain interaction and engagement beyond the classroom.

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