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Role of School Students' Engagement in Digital Resources to Shape Academic Procrastination in Mathematics Learning

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Abstract: *With the advancement of technology, the use of digital devices and engagement in social media technologies are increasing day by day. These technologies have provided many opportunities as well as added a new dimension to procrastination behavior. The present study aims to investigate how school student engagement in digital resource shapes the academic procrastination in mathematics learning. This study adopts a cross-sectional survey research design among 415 secondary level school students. Mean, standard deviation, t-test and one way ANOVA were major statistical techniques applied in this research. The finding reveals that students' access of digital device, time used on digital device for academic purpose, use of social media and their engagement have significant role in shaping academic procrastination. Further, the findings highlight the students without digital resources tend to experience higher procrastination, likely due to limited access, social comparison, and reduced autonomy. To reduce academic procrastination, the finding suggests increasing access of digital resources and providing proper guidance for use of these tools by high school students.*

Keywords: Academic procrastination, digital resource, digital devices, mathematics, social media

Introduction

In the contemporary digital era, most people's working lives are connected with digital devices and social media platforms; students cannot be exempt from these connections. Use of smartphones, tablets, social media and internet connectivity has made easy to collaborative learning, information sharing, and self-directed study (Morrison & Koole, 2018). The digital educational information and learning activities can offer many educational opportunities that obviously plays crucial role to enhance students' educational performance (Timotheou et al., 2023). However, their excessive and unregulated use may raise negative academic behaviors, particularly academic procrastination.

Academic procrastination is the intentional delay of academic activities without awareness of potential negative outcomes (Tawil et al., 2026). Most students often lag behind in reading, writing or problem solving in mathematics education due to its difficult nature (Chapai et al., 2024). Additionally, they also delay in preparation for exam, keeping up assignment or project work or homework in other subjects too. This trend has been found in their extra-curricular activities, regularity in classes and other educational work. Regarding educational institutions, it is a common phenomenon among students across different educational levels (Moonaghi & Beydokhti, 2017).

Academic procrastination consistently linked to lower academic performance (Adam & Hasbullah, 2019; Setiyowati et al., 2020) increased stress and anxiety, poor time management (Chapai

& Joshi, 2025), lack of personal initiatives and sincerity (Chapai & Joshi, 2026) and reduced academic motivation. With the advancement of technology, the integration of digital technologies into students' daily lives has added a new dimension to procrastination behavior. Previous studies (e.g., Caratiquit & Caratiquit, 2023; Chen & Lyu, 2024; Gur et al., 2018) show students' excess use of technology and constant availability of entertainment, instant messaging, and algorithm-driven content in digital platform divert students' attention from academic tasks and postpone rate is growing.

Existing research (e.g.Przepiorka et al., 2023; Rasouli et al., 2025; Sarfaraz et al., 2026) reported that excessive engagement of students' with social media and digital devices contributes significantly to academic procrastination. The engagement on these platforms often leads to habitual checking behaviors, multitasking, and reduced concentration (Alblwi et al., 2021). Notifications, peer interactions, and continuous content updates create a highly stimulating environment that competes with academic responsibilities. Consequently, students may prioritize short-term gratification derived from social media over long-term academic goals, resulting in delayed task completion. However, some researches suggest that guided digital engagement (Alblwi et al.,2021), digital wellbeing interventions (Zhao et al., 2024), smartphone-based intervention (Lukas & Berking, 2017) are useful to reduce screen time and social media use that significantly reduced procrastination levels.

In addition to technological factors, subject-specific academic challenges also play a crucial role in shaping procrastination behaviors. In Nepalese context, many students often perceive mathematics as a difficult subject at the secondary level (Pokhrel, 2023). On their perception, certain domain such as geometry, mensuration and trigonometry perceived as difficult due to their abstract nature, cognitive demands, and problem-solving complexity (Joshi et al., 2022). Students' perceived difficulty in mathematics may develop avoidance tendencies, leading to increased academic procrastination. This aligns with the task aversiveness (Chapai & Joshi, 2025), which suggests that students are more likely to delay mathematical tasks when they find difficult, irrelevant in daily life and unpleasant. Furthermore, lack of students' self-regulated learning behavior, digital distractions and challenging mathematical content can intensify procrastination. The combination of high digital engagement and perceived mathematical difficulty may create a dual burden in students. Students struggle with understanding of the mathematical contents; however, they fail to manage their time and attention effectively. This issue persist in developing contexts like Nepal, where digital literacy and self-regulation skills are not adequate among students.

Despite the increasing concern over academic procrastination, there is a gap on research that has examined the combined influence of digital device use, social media engagement, and perceived difficulty in mathematics domains, especially at the secondary level. Most existing studies , for example, Chen and Lyu (2024), Gur et al.(2018), Caratiquit and Caratiquit (2023), Nwosu et al. (2020), Tezer (2020), Margaretha et al.(2022), and Chapai et al. (2024) either focus on digital device or social media in isolation, leaving a gap in understanding their integrated effects on students' academic procrastination. In Nepalese context, a little researches have been conducted on role of procrastination in mathematics achievement (Chapai et al., 2024), and cause of academic procrastination (Chapai & Joshi, 2025,2026). However, research about integrated studies of technology with academic procrastination has been underexplored. Therefore, this study aims to investigate how high school students' engagement in digital resource shapes the academic procrastination in mathematics learning among ninth-grade students. To achieve the aim the following research question was devised in this study.

1. What is the role of school students' engagement in digital resource to shape their academic procrastination in mathematics learning?

Literature Review

With the rapid expansion of technology, students' engagement with social media and digital devices has been increasing. This increment in platforms like WhatsApp, Facebook and YouTube is growing up. On the other hand, students, especially in mathematics, are struggling with problems due to abstract nature of mathematics. This section explores the existing literature on student engagement with digital resources and their impacts on academic procrastination. Research shows both advantage and disadvantage of digital device and platform. Study conducted by Arhimah et al.(2025) explored how socio-economic factors, such as household income, geographic location, and racial background, influence students' access to essential digital devices. Their findings showed that students from low-income and minority backgrounds were disproportionately affected by these disparities, resulting in lower academic performance, reduced engagement and college readiness. Disparities on personal digital devices can develop feelings of humiliation and inferiority when comparing themselves with peers who own such devices. This social comparison can negatively affect students' self-confidence and motivation, leading to disengagement from academic tasks (Pellegrino, 2024) and, consequently, higher levels of academic procrastination.

A meta-analysis conducted by Chen and Lyu (2024) revealed a significant positive correlation between problematic smartphone or internet use and academic procrastination. Specifically, students who excessively used phones or the internet were more likely to delay academic tasks, as these devices provide immediately rewarding distractions such as social media, streaming, and gaming, which compete with study-related activities. In contrast research conducted by Garcia et al.(2022) revealed that lower or unstructured technology engagement is associated with increased procrastination, whereas more sustained and purposeful use reflects better self-regulation and reduced delay behaviors.

Gur et al.(2018) found that male students exhibited significantly higher levels of academic procrastination compared to female students. Additionally, the study revealed that students with a high dependency on social media were more likely to display increased academic procrastination behavior. The findings of Caratiquit and Caratiquit (2023) also indicated that a positive and significant relationship between social media addiction and academic procrastination. Nwosu et al. (2020) found that internet addiction was the strongest predictor of academic procrastination compared to other factors. While social media use did not have a direct significant effect on academic procrastination, it indirectly influenced procrastination through its connection to internet addiction. This suggests that social media use may not result in academic procrastination unless it reaches a problematic level.

Türel and Dokumaci (2022) explored the potential mediating role of academic procrastination in the relationship between adolescents' media and technology use and their academic performance. The findings indicated that increased media and technology use was associated with lower academic performance. Moreover, academic procrastination played a mediating role in this relationship, suggesting that adolescents' media and technology use leads to procrastination, which in turn negatively affects their academic achievement. Tezer (2020) investigated the relationship between academic procrastination behaviors and problematic Internet use among high school students during the COVID-19 pandemic. Their results showed that male students have a significantly stronger relationship between problematic Internet use and academic procrastination than female students. Additionally, this study shows that frequency of Internet use was found to increase problematic behaviors, and students' academic procrastination. The findings further indicated that as problematic Internet use declined, students' general grade point averages (GPAs) improved, and as academic procrastination decreased, both GPAs and problematic Internet usage levels diminished. Margaretha et al.(2022) explored the relationship between academic procrastination and problematic Internet use among high school students during the COVID-19 pandemic. The findings revealed that male students had a much stronger correlation between problematic Internet use and academic procrastination compared to female students. Additionally, students in the early stages of high school exhibited higher levels of problematic

Internet use than those in later years. The study also found that increased frequency of Internet use was linked to more problematic behaviors, with academic procrastination rising as students spent more time online during the day. Moreover, a reduction in problematic Internet use corresponded with improved general grade point averages (GPAs), and decreases in academic procrastination were associated with higher GPAs and lower levels of problematic Internet use.

Methodology

This study utilized a quantitative research approach with cross-sectional survey research design. This study is a part of the Small Research Development and Innovation Grants (SRDIG) of the University Grants Commission, Nepal. This study was conducted among secondary level students in Bardiya district of Nepal. According to EMIS report, 2082 there were 7011 students in grade nine in community schools. Therefore, we considered that number as a study population for this research. Using the online sample size calculator (https://www.calculator.net/sample-size-calculator.html), a sample size of 365 was deemed appropriate for this population (Costa et al., 2022), by adding 10% non-response errors (Joshi et al., 2021), it became 402. However, due to the attendance rate (41.5%) of secondary level students in Lumbini province (Bhattarai et al., 2020; MoE, 2015; UNICEF, 2019), all students in class during data collection in selected schools were considered for data collection, that reduced gender bias and ensured natural proportionate. Hence, the study sample became 415 for this study. A multi-stage stratified proportionate sampling technique was employed to select sample schools and students. It ensures adequate representation of heterogeneous subgroups within a population and increases precision(Bart et al., 2009). First author collected the data through the survey instrument designed by a team of researchers. The survey tool was then examined by another researcher for suitability, simplicity, readability, and contextual. Data were collected through face-to-face mode by visiting the selected schools and distributing the questionnaire to the grade nine students of those schools. The instrument had 24 items related to academic procrastination that were in five point Likert scale at strongly disagree to strongly agree. Reliability of tool was calculated by using Cronbach's alpha and that was found 0.93 that exceeds threshold value 0.70 (Izah et al., 2024). Mean, SD, t-test and ANOVA were used to find the role of students' engagement.

Results

The analysis of the differences between students based on having personal digital device access and usage patterns revealed several meaningful findings. A statistically significant difference was observed between students who own personal digital devices and those who do not. ($t = 2.19$, $p = 0.03$), in terms of academic procrastination behavior. Table 1 shows those students who have no personal devices (Mean = 3.09, SD=0.49) perceived slightly higher academic procrastination compared to those who have own devices (M = 2.99, SD=0.46) with t-value= 2.19 and p=value=0.03<0.05. Regarding the purpose of digital device usage, there was no significant difference found among students' academic procrastination using devices for entertainment, communication, and academic work (t-value= 1.94, p-value= 0.15). Although students using devices for communication showed a slightly higher mean (Mean = 3.14, SD=0.52), the difference was not strong enough to confirm a meaningful effect, indicating that purpose of use alone may not significantly influence the academic procrastination. Additionally, in regarding the time spent by students on digital devices for academic purposes, one way ANOVA result showed a highly significant difference ($F = 6.93$, $p = 0.00$). Students who used devices for less than one hour in academic purpose (Mean = 3.19, SD=0.52) have high academic procrastination comparatively than those who used them for longer durations (1–2 hours: Mean = 2.99, SD= 0.43; greater than 2 hours: Mean = 2.98, SD= 0.52).

Table 1 Mean difference in students' academic procrastination based on access and use of digital resource

Categories	N	Mean	SD	t-value	p-value
Access of digital device					
No	206	3.09	0.49	2.19	0.03
Yes	209	2.99	0.46		
Purpose of using digital resource				F-value	
Entertainment	110	3.06	0.49		
Communication	59	3.14	0.52	1.94	0.15
Academic Work	246	3.01	0.46		
Time of using digital device for academic purpose					
< 1 hrs	105	3.19	0.52		
1-2 hrs	247	2.99	0.43	6.93	0.00
> 2 hrs	63	2.98	0.52		

Based on students' social media engagement, Table 2 shows that significant difference between those who engaged in social media and who did not ($t = 4.17$, $p = 0.00$). Students who did not engage in social media scored higher (Mean = 3.22, SD=0.58) than those who did (Mean = 2.99, SD=0.43), indicating that social media users were less procrastinating than non-users. Similarly, type of social media uses by students showed significant differences having F-value= 2.79 and p-value=0.04. Students using WhatsApp (Mean = 3.32, SD=0.51) had the highest mean score, followed by those who did not use social media (Mean = 3.18, SD=0.47), while Facebook (Mean = 3.00, SD=0.52) and YouTube (Mean = 3.03, SD=0.46) users had relatively lower scores. These results suggest that more communication-oriented platforms are less distracting compared to content-heavy platforms.

Table 2 Mean difference in students' academic procrastination based on social media usage

Categories	Items	N	Mean	SD	t-value	p-value
Engagement in social media						
	No	90	3.22	0.58	4.17	0.00
	Yes	325	2.99	0.43		
Commonly used Social Media					F-value	
	No use	19	3.18	0.47		
	WhatsApp	17	3.32	0.51		
	Facebook	90	3.00	0.52	2.79	0.04
	YouTube	289	3.03	0.46		

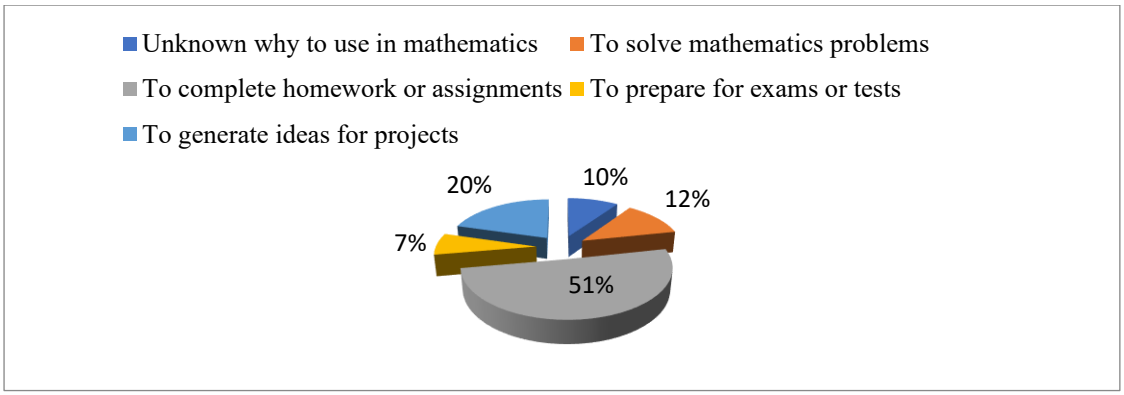

Figure 1 Status of students using AI technology for mathematical purpose

Figure 1 shows the status of students using AI technology for mathematical purpose. Figure shows 51% students used this technology to complete homework or assignments whereas 10% students are still unknown about the technology.

The results of Table 3 indicate that students' academic procrastination significantly differs based on their purpose for using technology, like AI tools. The descriptive statistics show that students with unknown purposes of AI use have the highest level of academic procrastination (Mean = 3.31, SD = 0.48), followed by those who use AI to prepare for exams or tests (Mean = 3.16, SD=0.58) and to solve mathematics problems (Mean = 3.06, SD=0.56). In contrast, students who use AI to complete homework or assignments (Mean = 3.01, SD=0.43) and to generate ideas for projects (Mean = 2.95, SD=0.45) exhibit comparatively lower levels of procrastination. These results suggest that more structured and task-oriented use of AI tools can be associated with reduced procrastination. The one-way ANOVA results further confirmed that these differences were statistically significant, $F(4, 41) = 4.82$, $p = .00$, indicating that the purpose of AI tool usage had a significant effect on students' academic procrastination.

The Tukey HSD post hoc analysis reveals specific group differences. Students with unknown purposes of AI use show significantly higher procrastination than those who use AI to complete homework or assignments ($p = .00$) and to generate ideas for projects ($p = .00$). However, no significant differences were found between other groups, such as between solving mathematics problems, preparing for exams, and other purposes.

Table 3 Mean difference of academic procrastination based on purpose to use technology in mathematics learning

Categories	N	Mean	SD	F-value	p-value
Unknown why to use in mathematics	40	3.31	0.48		
To solve mathematics problems	50	3.06	0.56		
To complete homework or assignments	210	3.01	0.43	4.82	0.00
To prepare for exams or tests	30	3.16	0.58		
To generate ideas for projects	85	2.95	0.45		

Discussion

The aim of this study was to investigate how school students' engagement in digital resource shapes their academic procrastination in mathematics learning among ninth grade students. The finding of this study indicated that students who had no personal digital devices perceived slightly higher procrastination than those students who had own devices. This finding may seem paradoxical; however, it clearly explained disparities and inconsistent access to digital resources. This finding is consistent with Arhimah et al.(2025). Their finding suggested students' disparities on access to digital devices, broadband, and digital literacy training can reduce engagement and college readiness resulting in lower academic performance. Students without personal digital devices may develop feelings of humiliation and inferiority when comparing themselves with peers who own such devices. Pellegrino (2024) suggests that social comparison can negatively affect students' self-confidence and motivation, leading to disengagement from academic tasks and, consequently, higher levels of academic procrastination. In contrast, students with personal devices may have greater flexibility to access learning materials, complete assignments on time, and manage their academic responsibilities more efficiently.

However, this advantage depends on how effectively the devices are used; structured and academic-oriented use can reduce procrastination, whereas excessive non-academic use may increase it. Regarding the purpose of digital device usage, the findings of this study indicated students' academic procrastination using was slightly higher in those students who use digital devices only for communication. This result suggested that communication-oriented use (e.g., messaging, chatting) of

digital device can create frequent interruptions and habitual checking behaviors such as frequently using TikTok, Instagram, Facebook, WhatsApp etc. may increase delay tendencies. The finding of Alblwi et al.(2021) indicates that communication features of social media such as notifications and peer interactions act as activates for procrastination. However, the difference is not strong enough to confirm a meaningful effect, indicating that purpose of use alone may not significantly influence the academic procrastination.

Regarding the social media engagement, finding indicates that students who do not engage in social media have higher academic procrastination than those who did, indicating that social media users are less procrastinate than non-users. Similarly, students using WhatsApp had the highest procrastination than who did not use social media, while Facebook and YouTube users had relatively equal procrastinating behavior. These findings support students' academic procrastination behavior is slightly higher in those students who use digital devices only for communication. The results also showed communication-oriented platforms were more distracting to students' academic works compared to content-heavy social media platforms.

Additionally, regarding the time spent by students in digital devices, present study showed that students who used devices for less than one hour in academic purpose had high academic procrastination than those who used them for longer durations. This finding is consistent with previous study conducted by Garcia et al.(2022), and their finding indicated that lower or unstructured technology engagement was associated with increased procrastination, whereas more sustained and purposeful use reflected better self-regulation and reduced delay behaviors.

The findings of this study further indicated that students' academic procrastination significantly differed based on purpose of using technology like AI tools. Students who were unknown about the purposes of AI technology use showed significantly higher procrastination than those who used AI technology to complete their homework or assignments and to generate ideas for projects. However, no significant difference was found between other groups, such as between students who used social media for solving mathematics problems, preparing for exams, and other purposes.

Implications

The findings of this study carry some important implications for educational practice, policy, and future research. First, the result that students without personal digital devices exhibit slightly higher academic procrastination highlights the need to address digital inequality. Schools and policymakers should ensure equitable access to digital devices and internet facilities, particularly in developing contexts, so that students are not disadvantaged in completing academic tasks. Providing shared but structured access (e.g., school-based digital labs, guided usage time) may help reduce delays caused by inconsistent access.

Second, the role of purposeful and structured use of digital devices suggests that simply providing access to digital tools and social media is not sufficient. Teachers and schools should guide students toward academic-oriented use of technology rather than purely communication-based or entertainment-driven use. Training students in self-regulated learning strategies, time management, and responsible technology use can help minimize distractions and reduce procrastination.

Third, the findings on social media engagement indicate that not all usage leads to negative outcomes. Moderate and purposeful engagement may support communication and collaboration, whereas excessive use of communication-oriented platforms can increase distractions. Therefore, educators should focus on promoting balanced and mindful use of social media, integrating it into learning activities where appropriate.

Fourth, the results related to AI tool usage emphasize that unclear or unstructured use leads to higher procrastination, while goal-oriented use (e.g., completing assignments, generating ideas) reduces

it. This implies the importance of AI literacy and guided usage, where students are trained to effectively use AI tools for academic purposes.

Conclusion

This study examined how school students' engagement in digital resource shapes their academic procrastination in mathematics learning among ninth grade students. The findings reveal that students without personal digital devices tend to experience slightly higher procrastination, likely due to limited access, social comparison, and reduced autonomy. While communication-based use of digital devices is associated with slightly higher procrastination than content-based use, though its effect is not statistically strong, suggesting that the purpose of use alone is not a decisive factor.

The study also reveals that purposeful and well-organized use of technology, including AI applications, is associated with lower levels of academic procrastination, while ambiguous or unregulated usage contributes to greater postponement of tasks. Social media findings indicate a nuanced relationship, where moderate use does not necessarily increase procrastination, but communication-heavy platforms may contribute to distraction.

Despite these contributions, the study has some limitations. The collected data of this study are based on self-reported responses, which may be subject to bias such as social desirability or inaccurate reporting. Similarly, this study adopted cross-sectional research design and it may not explain the causal relationships between variables. It focuses only on ninth grade students within a specific context, which may restrict the generalizability of the findings to other educational levels or regions. Additionally, the study does not deeply examine qualitative aspects such as students' personal experiences or contextual factors influencing technology use and procrastination.

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Declaration of generative AI in writing

The authors used ChatGPT for language refinement, reviewed and edited content however; no generative AI was used to write the paper.

Data Availability

The data will be available with reasonable request to the first author (Principal Investigator of the project).

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