

From Barriers to Adaptation: Freshmen's Self-Regulatory Strategies in University-Level Mathematics

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ABSTRACT:

The transition from secondary to tertiary education requires freshmen to adapt to increased academic autonomy, a challenge intensified by shifts between synchronous and asynchronous learning modalities, particularly in mathematics. Guided by Schlossberg's Transition Theory and a conceptual mediation model, this sequential explanatory mixed-methods study examined how academic barriers relate to academic achievement in Mathematics in the Modern World and how self-regulation and time-management practices shape students' adjustment. Quantitative data were drawn from the final grades of 310 freshmen students at a Philippine state university, while qualitative insights were obtained through a focus group discussion with seven purposively selected students and analyzed using Reflexive Thematic Analysis. Findings indicate that learning barriers influenced achievement indirectly through students' regulatory capacities, while modality transitions were interpreted as transformative experiences fostering autonomy, self-awareness, and responsibility for learning.

Keywords: Academic achievement; Academic barriers; Asynchronous learning; Learning modalities; Self-regulation; Synchronous learning

Introduction

The shift from high school to university marks a crucial stage of development for first-year students, involving cognitive, emotional, and behavioral changes as they face greater academic independence and heightened expectations, particularly in challenging areas like mathematics (Turnbull et al., 2021).

This transition is complex, involving academic, situational, and psychological aspects that are shaped by personal resources, coping mechanisms, and institutional support systems (Ramírez-Mera et al., 2022). Schlossberg's

Transition Theory provides a useful framework for understanding these changes as interactions between situation, self, support, and strategies, highlighting the diverse adaptation outcomes among students (Coe et al., 2025). Recent disruptions, particularly the COVID-19 pandemic, have hastened the shift towards blended and online learning, necessitating repeated student adjustments and revealing challenges related to autonomy, engagement, and wellbeing (Agarkov et al., 2021; Luo & Zhou, 2024). These changes highlight the importance of integrated support systems in higher education

that address the complexity and non-linear nature of modern learning paths (Galvis, 2018).

Synchronous and asynchronous learning methods have become integral components of higher education, evolving from emergency remote teaching to established instructional models (Turnbull et al., 2021). These approaches foster unique learning rhythms and interaction styles that differ from traditional in-person education, introducing specific pacing challenges (Li et al., 2020; Mallon et al., 2023). While learning continuity is enhanced, students often face obstacles such as delayed feedback, reduced interaction with peers and instructors, connectivity issues, and cognitive overload from self-directed tasks (Persada et al., 2022; Turnbull et al., 2021). Mathematics education is particularly affected due to its dependence on immediate feedback and guided, step-by-step reasoning (Azar & Tan, 2023).

Despite shifts in teaching modalities, institutions frequently fail to adequately support the development of students' self-regulation and time-management skills, assuming that learners will adapt independently (Noguera Fructuoso et al., 2022). This oversight can impede effective engagement and performance, highlighting the necessity for integrated institutional practices that align modality changes with the enhancement of learner competencies (Mallon et al., 2023; Vu & Tran, 2022).

First-year university students taking mathematics courses often encounter difficulties with understanding concepts, building confidence, and maintaining engagement, especially in classes like Mathematics in the Modern World (Lahdenperä et al., 2022). These newcomers must adapt to not only the increased expectations of college-level mathematics but also to changes in learning modes, including synchronous, asynchronous, and in-person formats, along with a greater responsibility for their own learning management (Kaspar et al., 2023). Developing effective self-regulation and time-management skills is crucial for overcoming these academic challenges across various learning environments (Roberts, 2021). However, these vital skills are

often unevenly developed among freshmen and frequently neglected in course design, resulting in unregulated learning and motivational issues (Lahdenperä et al., 2022). Implementing scaffolding and co-regulation in student-centered learning environments has been shown to aid in regulated learning and alleviate these challenges (Lahdenperä et al., 2022). Additionally, intervention strategies like personalized communications can boost student engagement and academic success by fostering a sense of belonging and aiding in navigating university systems (Dart & Spratt, 2021).

Previous studies have explored general transitions to university life, the challenges associated with either synchronous or asynchronous learning formats, and how self-regulation predicts academic success. Yet, there is a significant lack of comprehensive research that simultaneously investigates the experiences of freshmen as they navigate changes between learning formats, especially in mathematics courses. Specifically, there has been minimal focus on the academic obstacles students encounter in these settings and how self-regulation and time management mediate the relationship between these obstacles and academic outcomes.

Additionally, few studies utilize a mixed-methods approach that integrates objective academic performance metrics with qualitative insights into students' adaptation and coping mechanisms. This gap is particularly evident in the context of Philippine higher education, where empirical research from state universities on these interconnected factors is limited. Addressing this gap is crucial for understanding the impact of learning format transitions on freshmen's learning processes and outcomes in mathematics, a subject that heavily relies on immediate feedback and sequential reasoning.

This study aims to fill these gaps by examining freshmen's academic performance, challenges, and experiences in Mathematics in the Modern World across both synchronous and asynchronous formats, while also exploring how self-regulation and time-management skills

influence their adaptation and performance, thereby guiding targeted instructional and support strategies.

Research Questions

Main Research Question

How do freshmen students' academic barriers, self-regulation, and time-management practices influence their academic achievement in Mathematics in the Modern World across synchronous and asynchronous learning modalities?

Specific Research Questions

1. What is the level of freshmen students' academic achievement in Mathematics in the Modern World?
2. What academic barriers do freshmen students experience when learning Mathematics in the Modern World across synchronous and asynchronous learning modalities?
3. How do freshmen students use self-regulation and time-management strategies to cope with academic barriers across learning modalities?
4. How do self-regulation and time-management practices conceptually mediate the relationship between academic barriers and freshmen students' academic achievement?
5. How do freshmen students interpret and make meaning of their learning experiences during transitions across learning modalities?

Framework Model of the Study

The study's conceptual and theoretical framework integrates a conceptual mediation model with Schlossberg's Transition Theory to elucidate freshmen students' academic achievement in Mathematics in the Modern World across both synchronous and asynchronous learning modalities.

The upper section of the framework delineates the conceptual mediation process, wherein academic barriers—such as the absence of real-time feedback, connectivity issues, and learning

challenges—are posited to indirectly influence students' academic achievement through self-regulation and time-management practices. These barriers do not exert a direct effect; rather, they shape how students plan, monitor, and discipline their learning, thereby enhancing or constraining academic performance and grades.

This conceptual pathway reflects the study's qualitative findings, which underscore self-regulation and time management as critical mechanisms through which students address learning difficulties. The lower section of the framework is grounded in Schlossberg's Transition Theory, emphasizing the four interrelated dimensions of situation, self, support, and strategies. In this study's context, the situation pertains to shifts in learning modalities, particularly transitions between synchronous and asynchronous instruction.

The self dimension represents students' personal resources, including motivation, responsibility, and self-awareness, while support encompasses institutional and instructional assistance available to students. The strategies dimension aligns with students' coping skills, particularly self-regulation and time-management practices, which enable them to adapt to academic demands. Collectively, these elements facilitate student adjustment and adaptation during the transition to university-level mathematics learning.

Overall, Figure 1 conceptualizes academic achievement as an outcome of a dynamic adjustment process, wherein learning modality shifts introduce academic barriers that are negotiated through students' self-regulation and time-management strategies.

By integrating a mediation-oriented conceptual model with a transition-based theoretical framework, the figure provides a coherent explanation of how freshmen navigate learning challenges and achieve academic outcomes in mathematics across varied instructional modalities.

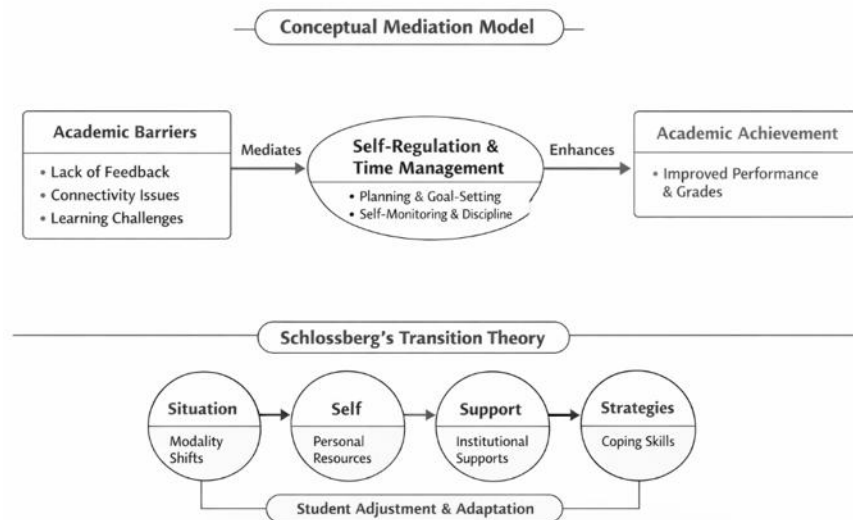


Figure 1: Conceptual and Theoretical of the Study.

Methodology

Research Design

This research utilized a sequential explanatory mixed-methods approach, beginning with the collection and analysis of quantitative data, followed by a qualitative investigation to interpret and provide context to the quantitative findings. This approach was suitable as the research sought to assess the academic performance of first-year students in Mathematics in the Modern World and then delve into the academic challenges, adaptation processes, and coping mechanisms that influenced these results in both synchronous and asynchronous learning settings. The qualitative phase was directly guided by the quantitative outcomes, enabling a thorough exploration of students' lived experiences and the ways they made sense of their academic achievements.

Research Locale and Participants

The research took place at State University and included first-year students taking the Mathematics in the Modern World course from various academic disciplines, such as Information Technology, Automotive Technology, Agriculture, Entrepreneurship, Education, Criminal Justice, and Arts. In the quantitative segment, the study examined the academic records of 310 first-year students, representing the entire group officially registered in the course during the study period. These records served as

the foundation for assessing the students' academic performance levels. For the qualitative segment, seven (7) first-year students were intentionally chosen from the larger group to engage in a focus group discussion. The selection aimed to reflect diversity in academic performance, academic programs, and experiences with different learning methods.

Quantitative Data Source and Analysis

Quantitative data consisted of students' final grades in Mathematics in the Modern World, which served as objective indicators of academic achievement. Grades were classified according to the university's official grading system and analyzed using descriptive statistics, including frequency counts and percentage distributions. The quantitative analysis focused on identifying overall performance trends rather than testing causal relationships, and the results served as the basis for framing the qualitative inquiry.

Qualitative Data Collection

Qualitative data were gathered through a semi-structured focus group discussion (FGD) guided by key concepts from Schlossberg's Transition Theory, particularly the dimensions of situation, self, support, and strategies. This framework ensured that the discussion captured students' experiences of academic barriers, adjustment challenges, and coping strategies across learning modalities. Prior to data collection, participants were informed of the study's purpose and

procedures, provided written consent, and were assured of confidentiality and voluntary participation. The FGD was audio-recorded with permission and transcribed verbatim for analysis.

Qualitative Data Analysis

The qualitative data were analyzed using Reflexive Thematic Analysis (RTA) following the approach of Braun and Clarke. This method was selected due to its suitability for examining subjective experiences and meaning-making processes within educational transitions. Analysis involved iterative familiarization with the transcripts, initial coding, theme development, and refinement. Emergent themes were interpreted in relation to the quantitative findings and the study's theoretical framework, allowing for a coherent explanation of students' academic barriers, adjustment factors, and coping strategies.

Results

Table 1 Academic Achievement of Freshmen Students in Mathematics in the Modern World

Grade Range	Frequency	Percentage (%)	Interpretation
1.00–1.25	6	1.94	Excellent
1.50–1.75	28	9.03	Very Satisfactory
2.00–2.25	83	26.77	Satisfactory
2.50–2.75	135	43.55	Fair
3.00	58	18.71	Poor
Total	310	100.00	

Freshmen's performance in Mathematics reveals that the majority of students are in the middle to lower achievement levels. Specifically, 43.55% receive "Fair" grades (2.50–2.75), and 18.71% earn "Poor" grades (3.00). A mere 1.94% achieve "Excellent" grades (1.00–1.25), 9.03% are rated as "Very Satisfactory" (1.50–1.75), and 26.77% are classified as "Satisfactory" (2.00–2.25). Studies show that excelling in mathematics is associated with positive academic results, as higher math performance is linked to increased perceived competence and motivation (Rodríguez et al., 2020). Additionally, cognitive flexibility and

Integration of Quantitative and Qualitative Findings

Integration occurred at the interpretive stage, where qualitative findings were used to explain the quantitative patterns of academic achievement. Students' narratives clarified how academic barriers across synchronous and asynchronous learning modalities influenced performance and how self-regulation and time-management practices functioned as conceptual mediators in this relationship. Rather than statistically testing mediation, the study adopted a theory-informed explanatory approach, culminating in the development of a conceptual model illustrating the dynamic relationships among academic barriers, self-regulation, time management, and academic achievement.

critical thinking are beneficial for math success (Gökçe & Güner, 2024). Factors such as the school's socioeconomic status and the quality of teacher-student relationships also affect math performance (Xu & Qi, 2019; Xuan et al., 2019), while logical mathematical intelligence is linked to success (Shirawia et al., 2023). These insights imply that student performance is influenced by both personal abilities and external conditions, suggesting that strategies focusing on motivation, relationships, and cognitive skills could improve outcomes (Xu & Qi, 2019; Zee et al., 2021).

Thematic Analysis Academic Barriers and Adjustment Factors in Learning Modalities

Table 2 Academic Barriers Experienced by Freshmen Across Learning Modalities

Theme	Description	Sample Participant Responses (FGD Codes)
Difficulty with Abstract and Sequential Topics	Students struggled with mathematical concepts requiring step-by-step reasoning and abstraction, particularly during independent learning.	P3: "May mga topic talaga na kahit anong basa ko, parang hindi ko pa rin maintindihan." P7: "Mas mahirap kapag ikaw lang mag-isa ang nag-iisip ng solution."
Lack of Real-Time Feedback	Absence of immediate instructor feedback created uncertainty and hindered conceptual clarification.	P3: "Pag may 'di ka ma-gets, wala kang makakausap on the spot." P7: "Hindi mo sure kung tama ba ginagawa mo."
Limited Teacher-Student Interaction	Reduced opportunities for questioning and dialogue constrained engagement, especially in asynchronous learning.	P2: "Tba pa rin kapag nasa klase ka, kasi puwede ka agad magtanong."
Connectivity and Pacing Issues	Internet instability and fast pacing during synchronous sessions disrupted comprehension and continuity.	P5: "May times na nagla-lag, tapos hindi ko na masundan ang discussion."

Table 2 outlines the primary academic challenges faced by first-year students in the Mathematics in the Modern World course, considering both synchronous and asynchronous learning formats. The students' struggles with abstract and sequential mathematical concepts highlight the well-known dependency of mathematics education on guided instruction and step-by-step reasoning, which becomes challenging in self-directed or self-paced settings (Azar & Tan, 2023; Lahdenperä et al., 2022). The noted absence of immediate feedback and limited interaction between teachers and students further exacerbated confusion and impeded the clarification of concepts, supporting previous research that indicates delayed feedback in online

and asynchronous environments limits engagement and confidence in learning (Persada et al., 2022; Turnbull et al., 2021). Issues with connectivity and pacing during synchronous classes also disrupted the continuity of learning, reflecting studies that identify technological instability as a significant obstacle to consistent understanding in online mathematics education (Mallon et al., 2023; Vu & Tran, 2022). Overall, these obstacles suggest that changes in learning modalities intensify existing difficulties in mathematics education by reducing the immediacy of support and interaction, thereby helping to explain the generally fair to poor academic performance observed among first-year students.

Table 3 Self-Regulation and Time-Management Strategies Used by Freshmen

Theme	Description	Sample Participant Responses (FGD Codes)
Strategic Time Management and Planning	Students organized tasks through schedules and routines to manage workload across modalities.	P1: "Nag-set talaga ako ng schedule para sa activities at lessons." P2: "Kailangan kong sundin ang schedule ko kung gusto kong maging okay sa klase."

Goal-Setting and Self-Monitoring	Use of checklists and progress tracking to regulate learning pace and sustain engagement.	P4: “May checklist ako lalo na sa asynchronous para hindi ako mahuli.”
Personal Accountability and Self-Discipline	Increased awareness of responsibility for one’s own learning and behavior.	P5: “Mas malaki na talaga ang responsibility na maging accountable sa sarili mong learning.”
Management of the Learning Environment	Establishing conducive study spaces and minimizing distractions to support focus.	P6: “Mas okay kapag may space talaga na doon lang ako nag-aaral.” P3: “Pag nasa classroom, mas focused talaga ako.”

Table 3 reveals that first-year students heavily depended on self-regulation and time-management techniques to handle academic pressures across different learning formats. Activities like planning, setting objectives, and self-assessment are consistent with previous studies that highlight self-regulated learning as a crucial factor for success in online and blended settings, especially where external guidance is minimal (Roberts, 2021; Luo & Zhou, 2024). The emphasis on personal responsibility and self-discipline underscores the greater independence required in higher education, a shift that often

tests the readiness of freshmen for autonomous learning (Kaspar et al., 2023). Additionally, students' focus on controlling their learning environment aligns with findings that environmental management is vital for maintaining concentration and engagement in online learning scenarios (Lahdenperä et al., 2022). These findings imply that self-regulation and time management are not just additional skills but essential adaptive strategies that help freshmen tackle challenges related to learning modalities in mathematics.

Table 4 Conceptual Mediation of Academic Barriers, Self-Regulation, and Academic Achievement

Conceptual Component	Description	Sample Participant Responses (FGD Codes)	Interpretive Link to Academic Achievement
Academic Barriers	Learning difficulties arising from modality shifts, feedback delays, interaction gaps, and connectivity issues.	P3: “Hindi ako confident sa mga natutunan ko.” P5: “Kapag naputol ang discussion, nawawala ako.”	Barriers disrupt comprehension and confidence, contributing to fair to poor performance.
Self-Regulation	Students’ ability to plan, monitor, and control learning behaviors.	P1: “Kailangan kong maging mindful sa oras at tasks.” P4: “Kung hindi ko babantayan sarili ko, mapapabayaang ko ang lessons.”	Self-regulation enables adaptive responses to learning challenges.
Time-Management Practices	Strategic scheduling and pacing of tasks across	P2: “Kailangan talagang sundin ang schedule ko.”	Effective time management reduces

	synchronous and asynchronous learning.		overload and supports persistence.
Conceptual Mediation Process	Self-regulation and time management act as intermediary mechanisms between barriers and outcomes.	Integrated interpretation of P1–P7 narratives	Academic barriers influence achievement indirectly through regulatory capacities.
Academic Achievement	Students' performance in Mathematics in the Modern World.	Quantitative grades (Table 1) + FGD reflections	Variations in achievement reflect differences in regulatory skills.

Table 4 presents a conceptual mediation model where self-regulation and time-management strategies influence how academic challenges affect the academic success of first-year students. In line with transition-focused theories, academic obstacles related to changes in learning modalities—such as decreased feedback, interaction gaps, and disrupted pacing—did not directly impact learning outcomes. Instead, they interacted with students' regulatory abilities (Schlossberg, as cited in Coe et al., 2025). Students who effectively planned, monitored, and managed their time were better equipped to handle learning disruptions, supporting the idea

that self-regulation mediates the link between instructional context and academic performance (Lahdenperä et al., 2022; Luo & Zhou, 2024). This conceptual framework is consistent with previous research showing that success in mathematics depends not only on content delivery but also on students' capacity to manage cognitive and behavioral demands in changing instructional environments (Azar & Tan, 2023). The findings underscore the explanatory power of a theory-based mediation model in understanding performance differences among first-year students.

Table 5 Freshmen Students' Meaning-Making During Learning Modality Transitions

Theme	Description	Sample Participant Responses (FGD Codes)	Interpretive Meaning
Transition as a Turning Point	Modality shifts reshaped students' understanding of learning and responsibility.	P1: "Ganito pala ang college—kailangan kong baguhin ang study habits ko."	Shift from dependent to autonomous learner identity.
Reframing Challenges as Growth Opportunities	Difficulties were interpreted as part of adjustment rather than failure.	P3: "Pumapasa ako, pero kailangan ko pang ayusin ang sarili ko."	Challenges became signals for improvement.
Development of Resilience and Autonomy	Students learned to persist and work independently despite reduced guidance.	P4: "Ikaw rin lang ang magsa-suffer kapag hindi ka nag-effort."	Growth in resilience and independent learning capacity.
Heightened Self-Awareness	Increased recognition of personal strengths,	P1: "Mas aware na ako kung paano ako natututo."	Self-awareness guided adaptive learning strategies.

	weaknesses, and learning needs.		
Ownership of Learning	Students internalized responsibility for academic success.	P6: “Ikaw talaga ang may hawak ng oras mo.”	Learning viewed as a personal responsibility.

Table 5 reveals that freshmen students interpreted learning modality transitions as transformative experiences that reshaped their academic identity and sense of responsibility. Students’ reframing of challenges as opportunities for growth reflects meaning-making processes commonly observed during educational transitions, where adaptation involves both cognitive and affective adjustment (Ramírez-Mera et al., 2022; Turnbull et al., 2021). The emergence of resilience, self-awareness, and ownership of learning aligns with studies suggesting that successful transition to university learning requires internalization of autonomy and self-directed engagement (Kaspar et al., 2023; Lahdenperä et al., 2022). Rather than perceiving modality shifts solely as constraints, students constructed meaning from these experiences by recognizing their role in shaping academic outcomes. This interpretation underscores the role of reflective adaptation in supporting sustained engagement and adjustment during the transition to university-level mathematics learning.

Discussion

The findings of this study demonstrate that freshmen students’ academic achievement in Mathematics in the Modern World is shaped by a dynamic interaction between academic barriers, self-regulation, and time-management practices rather than by instructional constraints alone. Consistent with previous research, challenges such as complex mathematical content, delayed feedback, limited interaction, and connectivity issues constrained comprehension and engagement in synchronous and asynchronous learning environments (Azar & Tan, 2023; Mallon et al., 2023; Turnbull et al., 2021). However, the present study extends existing literature by showing that these barriers do not

exert a direct influence on achievement; instead, they activate students’ regulatory responses—including planning, goal-setting, monitoring, and adaptive strategy use—which shape academic outcomes (Lahdenperä et al., 2022; Luo & Zhou, 2024). This interpretation is reinforced by evidence that instructional supports are most effective when they scaffold learning processes rather than operate independently. For instance, Ramilo et al. (2025) found that interactive supplementary materials enhance engagement and understanding by providing structure, feedback, and opportunities for self-paced learning, while Anselmo et al. (2025) similarly emphasized that lesson exemplars support instructional delivery by guiding learners through content in a structured and coherent manner. Together, these studies underscore that instructional tools contribute to learning only when they align with and strengthen students’ regulatory capacities.

Interpreted through Schlossberg’s Transition Theory, these findings suggest that learning modality shifts function as transitional situations that require students to mobilize personal resources (self) and coping mechanisms (strategies) to sustain learning. As illustrated in Figure 2, self-regulation and time management operate as key adjustment mechanisms that mediate how students respond to learning challenges, influencing not only performance but also the quality of their adaptation. Beyond academic outcomes, freshmen students’ meaning-making reflects a process of reflective adaptation, wherein difficulties are reframed as opportunities for growth, fostering autonomy, self-awareness, and responsibility for learning. This aligns with transition research emphasizing that successful adjustment in higher education involves both cognitive regulation and identity development (Ramírez-Mera et al., 2022; Kaspar

et al., 2023). Collectively, the discussion underscores that effective learning during modality transitions depends on students' capacity to regulate and reflect on their learning,

highlighting the importance of instructional and institutional practices that intentionally support these adaptive processes.

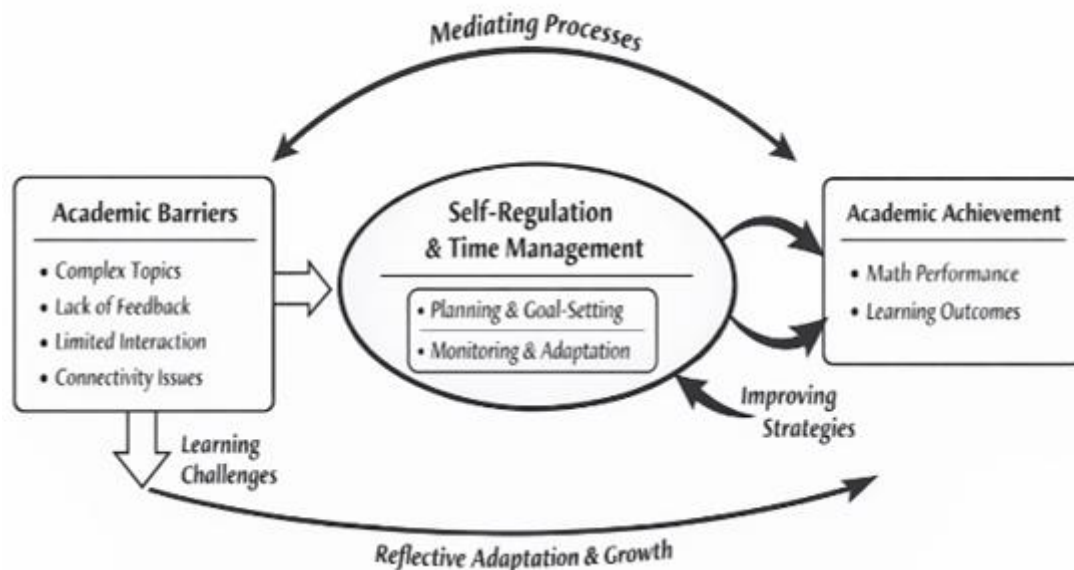


Figure 2. Conceptual Mapping of Learning Adjustment and Academic Achievement Derived from the Study Findings

Conclusions and Recommendations

This research explored the academic performance, learning obstacles, self-regulation, time management strategies, and meaning-making experiences of first-year students in the Mathematics in the Modern World course, considering both synchronous and asynchronous learning formats. The results reveal that although students managed to fulfill course requirements, their learning was influenced by ongoing challenges such as delayed feedback, limited interaction, connectivity issues, and the abstract nature of mathematics, which hindered their confidence and engagement. Importantly, the study demonstrates that self-regulation and time management are crucial in helping students navigate these obstacles, serving as essential mechanisms that influence both academic results and learning adaptation, rather than allowing barriers to directly impact performance. As students developed strategies for planning, monitoring, and self-discipline, they were better equipped to handle instructional limitations and maintain their learning, while also viewing

modality transitions as transformative experiences that promoted autonomy, self-awareness, and responsibility for their learning. These findings underscore the importance of mathematics instruction and institutional practices moving beyond mere content delivery by actively supporting students' regulatory skills, offering timely feedback, and creating structured yet adaptable learning environments that aid in adjustment during learning transitions. Future research could further investigate these adjustment processes across different disciplines or through longitudinal and quantitative methods to enhance understanding of how self-regulated learning contributes to academic success in various instructional settings.

Disclosure of AI usage

During the preparation of this work the author(s) used Chatgpt to enhance the paragraph of the study. After using this tool/service, the author(s) reviewed and edited the content as needed and took(s) full responsibility for the content of the published work.

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