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A MEDIATION TEST OF SOCIAL INTERACTION AND TECHNOLOGY USE ON THE RELATIONSHIP BETWEEN MOTIVATED STRATEGY FOR LEARNING AND ACADEMIC PERFORMANCE AMONG CRIMINOLOGY STUDENTS

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Abstract:
The present study examined the effects of motivated learning strategies on criminology students' academic achievement, with Classroom Social Interaction and Technology Use serving as mediating variables. It was conducted in three higher education institutions in Misamis Occidental, Philippines, and involved 420 randomly selected students. Data were gathered through three adapted questionnaires, while students' grades were used to measure academic performance. The analysis employed mean, standard deviation, Pearson product–moment correlation, and mediation analysis using the Generalized Linear Model (GLM) in Jamovi software. Findings revealed that students exhibited moderately high levels of motivated learning strategies and classroom social interaction, alongside very high levels of technology use, yet their academic performance remained comparatively low. Strong correlations emerged between motivated learning strategies and both mediators, technology use and social interaction, as well as with academic performance. Although both mediators were significantly associated with academic achievement, only Classroom Social Interaction demonstrated a statistically significant mediating effect. The mediation results further indicated that classroom social interaction partially mediated the relationship between motivated learning strategies and academic performance, suggesting that while technology improved access to learning resources, the quality of social interaction within the classroom played a more influential role in determining student success. Overall, the study recommended that criminology

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instructors and academic program heads foster cooperative, interactive, and socially enriching learning environments to enhance students' academic outcomes.

Keywords: criminal justice, learning strategies, mediating effect, motivated strategy for learning, Philippines, social interaction, technology use

1. Introduction

Academic achievement was widely regarded as a central indicator of student success in higher education; however, many students continued to struggle due to ineffective learning techniques and limited classroom participation (Kassaw & Demareva, 2023). While the increasing integration of technology in education offered numerous benefits, it also introduced distractions that hindered learning (Mote, 2024). At the same time, insufficient social interaction—particularly in online or blended learning environments—tended to weaken students' motivation, reduce teamwork, and negatively affect academic performance (Gherghel *et al.*, 2023). Despite the use of motivated learning strategies, variations in student performance still persisted, suggesting that external factors such as technology use and social engagement continued to shape academic outcomes (Gao *et al.*, 2024). Understanding how these factors worked together was vital for developing instructional approaches that supported students in achieving optimal academic performance.

Academic performance also served as a key measure of students' learning progress and readiness for future professional roles (Syed Uzma *et al.*, 2024). Previous studies deepened the understanding of the determinants of student success, offering guidance for educators and academic planners in designing evidence-based interventions and supportive learning environments (Vitoria *et al.*, 2024). Research further highlighted the dual nature of technology—it could enhance learning or, conversely, become a distraction that undermined academic achievement (Gurung, 2024). Reduced social interaction, especially in virtual or hybrid settings, similarly diminished motivation and collaborative engagement, ultimately affecting learning outcomes (Gherghel *et al.*, 2023). By examining the influence of technology use and social interaction on academic performance, the study sought to improve instructional practices and ensure that students were provided with the support needed to succeed academically.

Effortful learning strategies also played a critical role in students' academic success. Learners who employed effective cognitive and metacognitive strategies tended to demonstrate stronger comprehension and memory (Araujo *et al.*, 2023; Acosta-Gonzaga & Ramirez-Arellano, 2021). Social interaction was closely tied to motivation, as students who sustained effortful learning were more likely to engage in goal setting, self-monitoring, and collaborative discussions (Sharma *et al.*, 2024). Likewise, peer interaction and group work were found to promote deeper understanding and enhance academic

outcomes (Shao *et al.*, 2024). Prior research emphasized the interconnected roles of motivation, strategic learning behaviors, and social interaction in determining student success, placing emphasis on comprehensive educational approaches that strengthened these dimensions (Li & Xue, 2023). Understanding these relationships underpinned interventions aimed at improving learning strategies and fostering socially rich environments that elevated academic performance.

Despite substantial research on predictors of learning performance, the mediating roles of social interaction and technology use between goal-oriented learning strategies and academic outcomes remained insufficiently explored, particularly within university contexts (Graciela *et al.*, 2024). The present study addressed this gap by examining these variables simultaneously, offering deeper insight into how digital engagement and social connectedness influenced learning (Tiantian *et al.*, 2024; Malik *et al.*, 2020). This inquiry was timely, especially within academic settings where students increasingly relied on technology yet often experienced reduced social interaction, particularly in hybrid or online learning environments (Belmonte *et al.*, 2024). Broadly, the study contributed to global educational discourse by generating insights that informed instructional policy, curriculum design, and student support initiatives that led to improved academic achievement.

Previous studies consistently identified strong relationships among motivated learning strategies, technology use, classroom social interaction, and students' academic performance. Together, these factors formed a central part of criminology students' learning outcomes and provided meaningful guidance for designing effective instructional strategies. Motivated learning strategies were especially vital in criminology education, as they fostered engagement, critical thinking, and the application of knowledge in practical and field-based contexts (Trebilcock & Griffiths, 2021). Intrinsic motivation promoted deeper learning and stronger academic performance, while self-efficacy improved students' confidence to navigate academic challenges (Salce, 2025; Fakhrou & Habib, 2022). Although test anxiety disrupted performance, targeted support helped mitigate its impact (Jerrim, 2022; Hsu & Goldsmith, 2021). Self-regulated learning further empowered students to manage their time, set goals, and adjust learning strategies, promoting autonomy and long-term success (Orbigo & Gonzales, 2024). Collectively, these elements strengthened academic achievement and prepared criminology students to excel in future roles within the criminal justice profession.

Second, the application of technology was crucial for criminology students, as it enabled access to computerized resources that supported learning, teamwork, and the development of competencies needed for contemporary careers in the justice sector (Home, 2023; Meenaghan & Sintemaartensdijk, 2024). Perceived ease of use and perceived usefulness motivated learners to adopt user-friendly tools that enhanced academic achievement, critical thinking, and problem-solving (Noawanit Songkram *et al.*, 2023; Halford *et al.*, 2024). Strong behavioral intention also sustained regular technology use, promoting digital literacy and adaptability (Zheng *et al.*, 2025). As a

result, students gained hands-on experience through virtual simulations, immediate access to information, and improved communication—all of which prepared them for technology-integrated careers in the criminal justice field (Frenkel, 2025).

Third, classroom social interaction was vital to criminology students' academic success, as it enhanced collaboration, participation, and the development of essential skills such as communication, critical thinking, and teamwork (Nagy *et al.*, 2023; George, 2023). Peer engagement, classroom participation, and instructor–student interaction boosted learning, while positive environments, social inclusion, and effective communication encouraged motivation, confidence, and academic achievement (Van & Roseth, 2020; Wang, 2023; Nephat Shumba & Hussaini, 2023). Together, these factors prepared students to handle real-world challenges in law enforcement and criminal justice professions.

Fourth, academic performance indicated criminology students' mastery of both theoretical knowledge and practical skills. It was typically measured through grades and was influenced by learning strategies, technology use, and classroom interactions (Slaviša Radović *et al.*, 2021; Alamban, 2023). Supportive academic environments, effective pedagogical approaches, timely feedback, and positive classroom climates enhanced motivation, engagement, and critical thinking (Lumingkit *et al.*, 2024; Kamran *et al.*, 2023). Strong relationships with teachers and peers promoted teamwork, resilience, and confidence, enabling students to cope with challenges and achieve academic success (Pope & Miles, 2022; Epperson, 2021). Collectively, these elements strengthened academic performance and helped prepare criminology students for careers in the criminal justice system.

Research also illustrated strong correlations among motivated learning strategies, academic achievement, classroom social interaction, and technology use (Chen *et al.*, 2023; Wu *et al.*, 2021). Interventions that fostered intrinsic motivation, self-efficacy, and self-regulation increased engagement and improved academic outcomes (Celcima *et al.*, 2024), while peer and teacher interactions facilitated collaboration and deeper learning (To *et al.*, 2025). Appropriate use of technology supported learning and social interaction, leading to greater participation and understanding (Bashiri & Kowsari, 2024). The MSLQ also served as a valid predictor of academic performance through its measurement of self-regulated and socially oriented learning behaviors (de Araujo *et al.*, 2023). Although excessive or uncontrolled technology use negatively affected performance (Saray Ramírez *et al.*, 2021), strategic use of digital resources enhanced higher-order thinking and learning outcomes (Navarro-Martinez & Peña-Acuña, 2022). These findings aligned with the study's focus on the mediating roles of social interaction and technology use in the relationship between motivated learning strategies and academic achievement.

This research employed several theoretical frameworks to comprehensively analyze the mediating influences of social interaction and technology use on the relationship between motivated learning strategies and academic achievement. Social Cognitive Theory (SCT), developed by Bandura (1986), conceptualized learning as an

active process shaped by personal, behavioral, and environmental factors, with self-efficacy serving as a key determinant of students' ability to manage their learning, utilize technology, and engage socially. The present study used SCT to examine how students' perceived capabilities and external influences—including peer interaction and technology use—affected their motivation and involvement. Research by Morelli *et al.* (2022), Saks (2024), and Owolabi and Owolabi (2024) highlighted self-efficacy as a major predictor of goal-setting, persistence, and academic success. Hayat *et al.* (2020) likewise found that students with higher self-efficacy were more active and academically successful.

Complementing SCT, Zimmerman's (2000) Self-Regulated Learning (SRL) Theory underscored the learner's role in planning, monitoring, and regulating learning strategies. This study applied SRL to investigate how intrinsic motivation, self-efficacy, and test anxiety affected academic performance, and how social interaction and technology use facilitated self-regulation. Findings from Brenner (2022), Jin *et al.* (2023), and Chen (2022) supported the importance of motivation, strategic learning behaviors, and technology use in fostering SRL and enhancing academic achievement.

The study also drew on Davis's (1989) Technology Acceptance Model (TAM), which explained technology adoption based on perceived ease of use, perceived usefulness, and behavioral intention. Fuchs (2022) extended TAM by incorporating behavioral factors such as personal innovativeness and perceived enjoyment. Misirlis and Munawar (2023) found that subjective norms and self-efficacy influenced attitudes toward technology, while Liu *et al.* (2022) showed that social media supported learning through communication and collaboration. Lin and Yu (2023) expanded TAM through additional social and cognitive components, and Kemp *et al.* (2024) examined its application in teachers' adoption of digital tools. Mat *et al.* (2024) further emphasized how social media promoted peer interaction and academic performance.

Together, these theories provided a robust framework for understanding how self-regulated learning processes related to academic achievement, and how social interaction and technology use functioned as mediating variables. The integration of SCT, SRL, and TAM enabled the researcher to account for the interplay among cognitive, social, and technological factors that shaped learning outcomes in tertiary education.

This study focused on four primary variables: Motivated Strategies for Learning as the independent variable, following the model of Pardo *et al.* (2016); Academic Performance as the dependent variable, measured through grades and indicators of academic achievement (Hayat *et al.*, 2020); and Social Interaction and Technology Use as the mediating variables. Social Interaction was based on the dimensions identified by Kuzu (2007), while Technology Use followed the constructs of the Technology Acceptance Model (Davis, 1989). The conceptual paradigm presented below illustrates how social interaction and technology use mediated the relationship between intrinsic motivation–based learning strategies and academic performance among college students.

2. Materials and Methods

The research used a quantitative, non-experimental, descriptive–correlational design to investigate the relationships among motivated learning strategies, social interaction, technology use, and academic performance of 420 criminology students from three higher education institutions in Misamis Occidental, Philippines. The respondents, selected through stratified random sampling, were officially enrolled second- to fourth-year students during the second semester of AY 2024–2025, and all participated voluntarily under UMERC-approved ethical procedures. Data were collected using validated and reliability-tested instruments: the Motivated Learning Strategies Questionnaire (Pardo *et al*., 2016), the Social Interaction Questionnaire (Kuzu, 2007), and the Technology Use Questionnaire (Davis, 1989), all employing a five-point Likert scale. Academic performance was measured using the students' General Weighted Average (GWA) obtained from official school records. Descriptive statistics (mean, standard deviation, frequency, and percentage) were used to determine the levels of the variables, Pearson's r was employed to examine correlations, and mediation analysis using the Generalized Linear Model (GLM) identified the indirect effects of social interaction and technology use on motivated learning strategies and academic performance. Strict procedures—including expert validation, pilot testing, and reliability analysis—were applied to ensure the accuracy, representativeness, and credibility of the results.

3. Result and Discussion

3.1 Motivated Strategy for Learning, Classroom Social Interaction, Technology Use among Criminology Students

The levels of the variables Motivated Strategy for Learning, Classroom Social Interaction, and Technology Use among criminology Students are presented in Table 1. Initially, Motivated Strategy for Learning shows an overall high level (M = 4.13, SD = 0.52), indicating that students actively employ strategies that enhance their academic success. Among the indicators, Intrinsic Motivation had a very high level (M = 4.47), indicating students are driven by internal interest and enjoyment in learning. Self-efficacy scored the lowest in this construct (M = 3.97), though still high, suggesting some variation in students' confidence in their academic capabilities. Test Anxiety (M = 4.06) and Self-regulated Strategy Use (M = 4.03) were also rated high, indicating that despite experiencing stress, students can effectively apply self-management and learning strategies. These findings indicate that students are generally motivated, though varying levels of self-belief and anxiety suggest areas for targeted academic support. Enhancing self-efficacy and helping students manage test anxiety may further boost their learning strategies and overall academic engagement.

Moreover, Classroom Social Interaction was rated high overall (M = 4.09, SD = 0.59), reflecting frequent engagement among students and with teachers. Student-

Student Participation (M = 4.05), Classroom Participation (M = 4.04), Peer Support Networks (M = 4.02), and Classroom Climate (M = 4.11) all contributed to this rating, demonstrating that students actively interact and support one another in a positive learning environment. Social Inclusion/Exclusion (M = 4.01) remained high, suggesting a generally inclusive classroom climate. Teacher-Student Interaction (M = 4.22) reached a very high level, emphasizing strong relationships between students and faculty, while Communication Patterns (M = 4.18) were also high, indicating practical classroom discourse. These results underscore the importance of fostering both peer and teacher relationships to maintain a collaborative and respectful academic setting. A strong social environment supports motivation and engagement, potentially enhancing both academic and personal development.

In addition, Technology Use recorded a very high overall mean (M = 4.44, SD = 0.46), suggesting students extensively utilize technology to support learning. Subcomponents, such as Perceived Ease of Use (M = 4.38), Perceived Usefulness (M = 4.40), and Behavioral Intention (M = 4.53), were all rated very high, indicating that students not only find the technology user-friendly and beneficial but also intend to continue using it in the future. This reflects a high level of technological acceptance and integration in academic routines. It also suggests that students are prepared to navigate digital learning environments, a critical skill in modern higher education. Continued investment in accessible and relevant educational technology could further strengthen these favorable perceptions and improve learning outcomes.

The high levels of intrinsic motivation, self-efficacy, and self-regulated learning among criminology students are consistent with findings that motivated and self-regulated learners show better understanding, persistence, and academic performance (Araujo *et al.*, 2023; Acosta-Gonzaga & Ramirez-Arellano, 2021; Orbigo & Gonzales, 2024). Similarly, the positive classroom social interaction in this study supports prior evidence that peer participation, teacher–student interaction, and inclusive climates enhance engagement and achievement (Nagy *et al.*, 2023; Van & Roseth, 2020; Wang, 2023). The very high technology use aligns with the Technology Acceptance Model and studies showing that perceived ease of use, usefulness, and behavioral intention drive technology adoption and support learning when tools are user-friendly and relevant (Davis, 1989; Noawanit Songkram *et al.*, 2023; Halford *et al.*, 2024; Home, 2023).

Overall, the results suggest that criminology students demonstrate strong motivational tendencies, engage well within social learning environments, and possess high technological readiness. These attributes collectively form a foundation conducive to innovative, learner-centered instruction. Strengthening self-efficacy, reducing test anxiety, and increasing opportunities for collaborative and technology-enhanced learning may further elevate academic engagement and performance. For criminology education, where analytical thinking, evidence-based decision-making, and digital competency are essential, these findings underscore the need for pedagogical approaches

that integrate motivation-building strategies, interactive classroom practices, and advanced technological tools.

Table 1: Level of Motivated Strategy for Learning, Classroom Social Interaction, Technology Use and Academic Performance of criminology Students

Variables	SD	Mean	Descriptive Level
Motivated Strategy for Learning	**0.52**	**4.13**	**High**
Intrinsic Motivation	0.46	4.47	Very High
Self-efficacy	0.63	3.97	High
Test Anxiety	0.62	4.06	High
Self-regulated Strategy Use	0.63	4.03	High
Classroom Social Interaction	**0.59**	**4.09**	**High**
Student-Student Participation	0.63	4.05	High
Classroom Participation	0.63	4.04	High
Peer Support Networks	0.73	4.02	High
Classroom Climate	0.64	4.11	High
Social Inclusion/Exclusion	0.72	4.01	High
Teacher-Student Interaction	0.66	4.22	Very High
Communication Patterns	0.65	4.18	High
Technology Use	**0.46**	**4.44**	**Very High**
Perceived Ease of Use	0.46	4.38	Very High
Perceived Usefulness	0.46	4.40	Very High
Behavioral Intention	0.50	4.53	Very High

Scale: 4.20-5.0 (Very High); 3.40-4.19 (Moderately High); 2.60-3.39 (High); 1.80-2.59 (Low); 1.0-1.79 (Very Low).

3.2 Academic Performance

As shown in Table 2, Academic Performance among criminology students is rated at a very high descriptive level (M = 85.1, SD = 7.37), indicating that students generally perceive themselves as achieving well within their coursework. This mean score falls under the "Satisfactory" range based on the institutional rating scale, yet it sits closer to the upper boundary, suggesting that most students consistently meet the expected academic standards. The standard deviation further indicates moderate variation in performance, implying that while the majority perform well, some students may fluctuate between higher and lower achievement levels.

When examined in relation to earlier findings, this favorable performance aligns with students' strong intrinsic motivation, active classroom engagement, and very high level of technology use. These psychosocial and instructional factors collectively reflect an academic environment where learners are not only equipped with strategic learning behaviors but are also socially and technologically supported. High motivation encourages sustained effort, positive social interaction reinforces participation and belonging, and effective technology use expands access to learning resources—together cultivating conditions that promote academic success.

The satisfactory to high level of academic performance parallels research showing that supportive teaching, constructive feedback, and positive classroom climates promote motivation, engagement, and achievement (Lumingkit *et al.*, 2024; Kamran *et al.*, 2023). Moreover, the role of motivation, social interaction, and technology in sustaining criminology students' performance is consistent with studies emphasizing that academic success reflects the combined influence of learning strategies, interpersonal support, and contextual learning conditions (Slaviša Radović *et al.*, 2021; Alamban, 2023; Pope & Miles, 2022; Epperson, 2021).

These results highlight the importance of maintaining and further strengthening the interconnected roles of motivation, social interaction, and technology integration in learning. Instructional programs that continue to foster task engagement, collaborative activities, digital-based learning tasks, and self-regulatory practices may enhance performance further. Since the current performance level, though high, remains below the Very Satisfactory bracket, interventions aimed at boosting self-efficacy, deepening academic reflection, and refining learning strategies could help push students toward higher academic excellence. Continuous support in these areas may sustain student achievement and contribute to improved learning trajectories within criminology education.

Table 2: Level of Academic Performance of Criminology Students

Variable	SD	Mean	Descriptive Level
Academic Performance	7.37	85.1	Good

Scale: 93-100 (Outstanding); 88-92 (Very Satisfactory); 83-87 (Satisfactory); 80-82 (Fair); 75-79 (Poor)

3.3 Relationship between Independent and Dependent Variables

The results in Table 3 reveal that Motivated Strategy for Learning is significantly related to Academic Performance. Self-efficacy and self-regulated strategy use demonstrated the strongest relationships ($r = .352$, $p < .01$), indicating that students who believe in their abilities and apply organized, goal-directed strategies tend to achieve higher academic results. Intrinsic motivation also showed a positive, though weaker, correlation ($r = .192$, $p < .01$), suggesting that while interest and enjoyment support learning, confidence and active regulation of study behaviors exert stronger effects on performance. These patterns imply that interventions aimed at strengthening self-belief, task management, and metacognitive awareness may have a substantial impact on academic achievement, even when internal motivation is already present.

Technology Use also showed a significant but comparatively weaker association with Academic Performance (overall $r = .212$, $p < .01$). Perceived ease of use ($r = .246$) and perceived usefulness ($r = .230$) were both positively associated with performance, whereas behavioral intention ($r = .138$) was the weakest. This suggests that merely intending to use technology does not translate into improved outcomes unless accompanied by practical application and perceived utility. Consistent with the Technology Acceptance Model (TAM), results highlight the importance of user-friendly

and functionally beneficial digital tools in enhancing learning. Institutions may thus enhance academic performance by ensuring that technologies are accessible, effective, and embedded in everyday learning practices rather than relying solely on students' willingness to use them.

Among the three independent variables, Classroom Social Interaction showed the strongest overall correlation with Academic Performance ($r = .378$, $p < .01$). Classroom participation ($r = .396$) emerged as the most influential indicator, followed closely by communication patterns (.361) and social inclusion/exclusion (.360). These findings indicate that students who engage more actively in class discussions, maintain effective communication, and feel socially integrated tend to perform better academically. While teacher-student interaction remained significant (.264), peer-based interaction appeared more influential, suggesting that collaborative learning experiences may enhance academic performance more strongly than instructor-driven exchanges. Strengthening peer collaboration, group learning tasks, and inclusive classroom practices may therefore contribute meaningfully to academic gains.

The interrelationship between Motivated Strategy for Learning and Classroom Social Interaction was notably strong ($r = .809$), reflecting a reciprocal relationship between motivation and engagement. Students who regulate their learning strategies and possess strong self-efficacy tend to participate more actively in class and build peer support networks. This suggests a reinforcing cycle wherein motivation promotes interaction, and interaction strengthens motivation, ultimately leading to better academic outcomes. Instructional approaches that simultaneously develop self-regulation and encourage collaborative participation may therefore amplify learning benefits.

The strongest correlations in the dataset were found between Motivated Strategy for Learning and Technology Use, particularly between intrinsic motivation and perceived usefulness ($r = .950$) and ease of use ($r = .946$). The overall correlation ($r = .781$) demonstrates that highly motivated learners are more likely to view technology as valuable and simple to use, which increases their likelihood of integrating it meaningfully into academic tasks. These results underscore the critical role of intrinsic motivation in technology adoption and utilization. Supporting students' internal drive to learn may therefore maximize the educational benefits of digital tools, particularly when institutions provide platforms that are intuitive, accessible, and aligned with learning goals.

The significant correlations between motivated learning strategies and academic performance support prior evidence that intrinsic motivation, self-efficacy, and self-regulation are strong predictors of engagement and achievement (Celcima *et al.*, 2024; Chen *et al.*, 2023; Wu *et al.*, 2021). The strong role of classroom social interaction echoes studies showing that peer and instructor interactions foster collaboration, deeper understanding, and higher academic outcomes (To *et al.*, 2025; Shao *et al.*, 2024; Gherghel *et al.*, 2023). Meanwhile, the mixed role of technology use reflects findings that strategic digital integration enhances learning, whereas excessive or unregulated use can

undermine performance (Gurung, 2024; Saray Ramírez *et al.*, 2021; Navarro-Martinez & Peña-Acuña, 2022).

Table 3: Correlation Estimates between Variables

Motivated Strategy for Learning	**Academic Performance**	
	r-value	**P-value**
Intrinsic Motivation	.192**	.000
Self-efficacy	.352**	.000
Test Anxiety	.303**	.000
Self-regulated Strategy Use	.352**	.000
Overall	**.349****	**.000**
Technology Use	**Academic Performance**	
	r-value	**P-value**
Perceived Ease of Use	.246**	.000
Perceived Usefulness	.230**	.000
Behavioral Intention	.138**	.005
Overall	**.212****	**.000**
Classroom Social Interaction	**Academic Performance**	
	r-value	**P-value**
Student-Student Participation	.359**	.000
Classroom Participation	.396**	.000
Peer Support Networks	.300** .	3000
Classroom Climate	.305**	.000
Social Inclusion/Exclusion	.360**	.000
Teacher-Student Interaction	.264**	.000
Communication Patterns	.361**	.000
Overall	**.378****	**.000**

Note: * p < .05, ** p < .01, *** p < .001

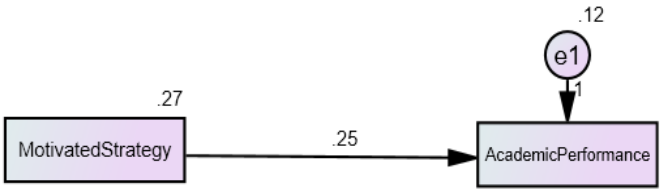
3.4 Effect of Motivated Strategy on Academic Performance

A positive relationship was found between Motivated Strategy and Academic Performance, such that for every one-unit increase in Motivated Strategy, Academic Performance increased by 0.248. The regression weight estimate of 0.248 had a standard error of 0.033, yielding a z-value of 7.623 (0.248 / 0.033). This result indicates that the regression weight estimate is 7.623 standard errors above zero. The probability of obtaining a critical ratio as large as 7.623 in absolute value is less than 0.001, suggesting that the regression weight for Motivated Strategy in predicting Academic Performance is significantly different from zero at the 0.001 level (two-tailed). These findings hold approximately for large samples under suitable assumptions.

These results support the premise that students who employ motivated learning behaviors—such as goal-setting, strategic studying, and confidence in task completion—tend to perform better academically. The strength of the effect suggests that motivation is not merely an emotional state but a functional predictor of achievement, contributing to academic outcomes in measurable increments.

The significant positive effect of motivated strategy on academic performance aligns with Social Cognitive Theory and Self-Regulated Learning theory, which both emphasize self-efficacy, persistence, and strategy use as key determinants of academic success (Bandura, 1986; Zimmerman, 2000). Empirical studies likewise show that motivated students who employ cognitive and metacognitive strategies tend to achieve higher grades and exhibit better learning outcomes (Morelli *et al.*, 2022; Saks, 2024; Brenner, 2022; Jin *et al.*, 2023).

Given the predictive significance of motivated strategy, instructional programs may benefit from fostering self-regulation, mastery-oriented study habits, and skill-building activities that increase learners' academic confidence. Interventions such as guided study planning, reflective learning journals, and goal-tracking systems may reinforce motivation and translate into higher academic performance. Strengthening motivation is therefore not only desirable but instrumental in elevating criminology students' academic achievement, as indicated by the positive regression effect.



Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Academic Performance	<---	Motivated Strategy	.248	.033	7.623	***	

Figure 2: Regression analysis on the effect of motivated strategy to academic performance

3.5 Test of double mediation

A series of regression analyses was conducted to examine the relationships between Motivated Strategy, Social Interaction, Technology Use, and Academic Performance. Results showed that for every one-unit increase in Motivated Strategy, Social Interaction increased by 0.921, Technology Use increased by 0.687, and Academic Performance increased by 0.179. For every one-unit increase in Social Interaction, Academic Performance increased by 0.185. Conversely, for every one-unit increase in Technology Use, Academic Performance decreased by 0.147.

The regression weight estimate for Motivated Strategy predicting Social Interaction was 0.921 with a standard error of 0.033, yielding a z-value of 28.201 (0.921 / 0.033). This indicates that the regression weight for Motivated Strategy in predicting Social Interaction is significantly different from zero at the 0.001 level (two-tailed). Similarly, the regression weight estimate for Motivated Strategy predicting Technology Use was 0.687 with a standard error of 0.027, yielding a z-value of 25.586 (0.687 / 0.027), which is also significantly different from zero at the 0.001 level (two-tailed).

The regression weight estimate for Motivated Strategy predicting Academic Performance was 0.179 with a standard error of 0.067, yielding a z-value of 2.657 (0.179 /

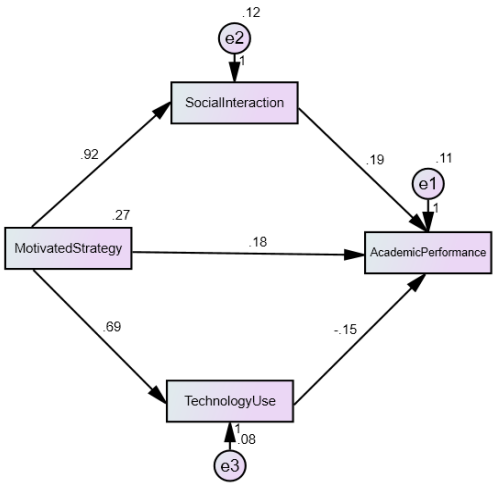
0.067). This result is significantly different from zero at the 0.01 level (two-tailed). Additionally, the regression weight estimate for Social Interaction predicting Academic Performance was 0.185 with a standard error of 0.048, yielding a z-value of 3.885 (0.185 / 0.048). This value is significantly different from zero at the 0.001 level (two-tailed). Lastly, the regression weight estimate for Technology Use predicting Academic Performance was -0.147 with a standard error of 0.058, yielding a z-value of -2.533 (-0.147 / 0.058), which is significantly different from zero at the 0.05 level (two-tailed).

These results suggest that Motivated Strategy significantly predicts Social Interaction, Technology Use, and Academic Performance. At the same time, Social Interaction also predicts Academic Performance, and Technology Use has an adverse effect on Academic Performance.

These findings suggest a multi-pathway mechanism whereby Motivated Strategy enhances performance both directly and indirectly through Social Interaction, supporting the idea that motivated learners are more socially engaged, collaborative, and participatory—behaviors that facilitate improved academic outcomes. Conversely, while motivation also increases Technology Use, the negative pathway suggests that technological engagement may not always translate into meaningful learning gains, especially if usage leans toward convenience rather than cognitive depth.

The results highlight the importance of designing learning environments that capitalize on motivational strengths by promoting social collaboration, peer support, and participatory classroom structures. Instructional frameworks that blend motivated learning with community-driven academic interaction may yield stronger performance outcomes. At the same time, educators and institutions must consider how technology is used—not just how frequently it is accessed. Guided digital literacy, structured online activities, and academically aligned platforms may mitigate the negative effects of unregulated technology use on performance.

In essence, motivation is a foundation; social interaction strengthens it, while technology requires intentional guidance to support it. Intervention programs should therefore simultaneously enhance motivated learning strategies, encourage collaborative engagement, and regulate technology integration to maximize academic achievement.



Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Social Interaction	<---	Motivated Strategy	.921	.033	28.201	***	
Technology Use	<---	Motivated Strategy	.687	.027	25.586	***	
Academic Performance	<---	Motivated Strategy	.179	.067	2.657	.008	
Academic Performance	<---	Social Interaction	.185	.048	3.885	***	
Academic Performance	<---	Technology Use	-.147	.058	-2.533	.011	

Figure 3: Mediation Analysis

Table 4 presents the results of the double mediation analysis examining the role of Social Interaction and Technology Use in the relationship between Motivated Strategy and Academic Performance. Findings revealed that Motivated Strategy had significant direct effects on Social Interaction ($\beta = 0.921$, SE = 0.033, $p < 0.001$), Technology Use ($\beta = 0.687$, SE = 0.027, $p < 0.001$), and Academic Performance ($\beta = 0.179$, SE = 0.067, $p = 0.008$). These results suggest that students with higher motivated strategies tend to engage more in peer interaction, make greater use of technology, and perform better academically. However, the strength of association varies across outcomes.

In terms of indirect effects, Social Interaction significantly predicted Academic Performance ($\beta = .185$, SE = .048, $p < .001$), highlighting the value of collaborative learning and peer support in enhancing achievement. In contrast, Technology Use demonstrated an adverse effect on Academic Performance ($\beta = –.147$, SE = .058, $p = .011$), suggesting that excessive or unregulated reliance on technology may impede rather than facilitate student outcomes. This negative link could reflect the potential distractions of non-academic technology use or inefficient study practices mediated by digital platforms.

The total effects model reinforces these dynamics. Motivated Strategy exerted an overall positive influence on Academic Performance ($\beta = .248$), underscoring its central role in driving student success both directly and indirectly. Notably, the positive mediating pathway through Social Interaction appears to outweigh the negative mediation through Technology Use, resulting in a net beneficial impact of motivation on achievement. The positive contribution of social interaction ($\beta = 0.185$) further

demonstrates that peer collaboration can strengthen the effects of motivated strategies. In contrast, the negative contribution of technology use (β = –0.147) reveals the potential risks associated with unstructured digital engagement.

Taken together, the findings present a nuanced picture of academic performance: motivated strategies serve as a key driver of achievement, but the mediating roles of peer interaction and technology use shape their influence on this achievement. While structured social interaction amplifies the benefits of student motivation, unmoderated or non-strategic use of technology may dampen these gains. Thus, balancing motivated learning with collaborative engagement and disciplined use of technology appears critical in translating motivation into sustained academic success.

Table 4: Total Effects (Group number 1 - Default model)

	Motivated Strategy	Technology Use	Social Interaction
Technology Use	.687	.000	.000
Social Interaction	.921	.000	.000
Academic Performance	.248	-.147	.185

3.6 Total effects (Group number 1 - Default model)

The total (direct and indirect) effect of Motivated Strategy on Academic Performance is .248. That is, due to both direct (unmediated) and indirect (mediated) effects of Motivated Strategy on Academic Performance, when Motivated Strategy goes up by 1, Academic Performance goes up by 0.248.

The total (direct and indirect) effect of Technology Use on Academic Performance is -.147. That is, due to both direct (unmediated) and indirect (mediated) effects of Technology Use on Academic Performance, when Technology Use goes up by 1, Academic Performance goes down by 0.147.

The total (direct and indirect) effect of Social Interaction on Academic Performance is .185. That is, due to both direct (unmediated) and indirect (mediated) effects of Social Interaction on Academic Performance, when Social Interaction goes up by 1, Academic Performance goes up by 0.185.

The total effects show that Motivated Strategy had the strongest influence on Academic Performance (β = .248), indicating that motivated learners tend to achieve more both directly and through related behaviors. Social Interaction also contributed positively (β = .185), suggesting that peer connection and participation support achievement. In contrast, Technology Use showed a negative total effect (β = –.147), implying that increased technology use—when unregulated or unfocused—may hinder rather than enhance academic outcomes.

Strengthening student motivation and promoting collaborative learning may yield higher academic gains, while technology use should be guided to avoid distractions. Structured group tasks, peer discussions, and targeted digital engagement may help maximize learning outcomes and reduce the negative influence of uncontrolled technology use.

3.7 Effects (Group number 1 - Default model)

The direct (unmediated) effect of Motivated Strategy on Academic Performance is .179. That is, due to the direct (unmediated) effect of Motivated Strategy on Academic Performance, a 1-point increase in Motivated Strategy corresponds to a 0.179-point increase in Academic Performance. This is in addition to any indirect (mediated) effect that Motivated Strategy may have on Academic Performance.

The direct (unmediated) effect of Technology Use on Academic Performance is -.147. That is, due to the direct (unmediated) effect of Technology Use on Academic Performance, when technology use increases by 1, academic performance decreases by 0.147. This is in addition to any indirect (mediated) effect that Technology Use may have on Academic Performance.

The direct (unmediated) effect of Social Interaction on Academic Performance is .185. That is, due to the direct (unmediated) effect of Social Interaction on Academic Performance, a 1% increase in social interaction corresponds to a 0.185% increase in academic performance. This is in addition to any indirect (mediated) effect that Social Interaction may have on Academic Performance.

The direct effects analysis revealed that Motivated Strategy was a strong positive predictor of both Social Interaction ($\beta = 0.921$, $p < 0.001$) and Technology Use ($\beta = 0.687$, $p < 0.001$). This suggests that students with higher-motivated strategies tend to engage more actively with their peers and rely more on technology as part of their learning process. Motivated Strategy also directly influenced Academic Performance, though with a smaller effect size ($\beta = .179$, $p = .008$), indicating that motivation contributes to achievement independently of other mediators.

Regarding the mediators, Social Interaction exhibited a significant positive direct effect on Academic Performance ($\beta = .185$, $p < .001$), underscoring the value of peer collaboration and supportive academic exchanges in enhancing achievement. In contrast, Technology Use demonstrated a significant adverse direct effect on Academic Performance ($\beta = –.147$, $p = .011$). This finding suggests that while motivated students may increase their technology use, such reliance does not necessarily translate into improved academic outcomes; instead, it may hinder performance when use is unregulated, distracting, or misaligned with academic tasks.

Collectively, the direct effects model highlights three important dynamics: (a) motivated strategies are central to driving both peer interaction and technology use, (b) social interaction directly enhances academic outcomes, and (c) technology use, if not structured appropriately, may undermine student achievement.

Motivated Strategy directly improved academic performance ($\beta = .179$) and strongly predicted both Social Interaction and Technology Use, showing that motivated students are more engaged and more likely to use digital tools. However, only Social Interaction contributed positively to performance ($\beta = .185$), whereas Technology Use had a negative direct effect ($\beta = –.147$), emphasizing that digital engagement is beneficial only when aligned with academic tasks.

Instruction may channel motivation into meaningful social engagement and regulated technology use. Teachers may strengthen outcomes by incorporating collaboration-based activities and implementing technology-use guidelines to ensure digital tools support—not distract from—learning.

3.8 Direct Effects (Group number 1 - Default model)

	Motivated Strategy	Technology Use	Social Interaction
Technology Use	.687	.000	.000
Social Interaction	.921	.000	.000
Academic Performance	.179	-.147	.185

Effects (Group number 1 - Default model)

The mediation analysis revealed that, among the three predictor variables, only Motivated Strategy for Learning showed a statistically significant indirect effect on academic performance, with an effect size of 0.070. Although considered small by Cohen's (1988) guidelines, this statistically significant finding suggests that student motivation influences academic outcomes not only directly but also indirectly through Technology Use and Classroom Social Interaction. This supports the theoretical model that motivated learners are more likely to engage with learning environments and tools—such as digital platforms and interactive classroom settings—that enhance academic achievement.

In contrast, Technology Use and Social Interaction each recorded an indirect effect of 0.000, indicating no measurable impact on academic performance through mediation. Despite high engagement in these areas, their inability to mediate the effects of other variables suggests that they may lack standalone predictive power or were not sufficiently integrated into the learning process. As Kline (2016) notes, such results could stem from weak mediation paths or low construct reliability. Overall, the findings highlight Motivated Strategy for Learning as the primary driver of academic success in the tested model, emphasizing the need for future research to explore alternative pathways or moderating variables that might better explain the complex dynamics among motivation, interaction, technology use, and academic outcomes.

The finding that motivation influences academic performance both directly and via social interaction is consistent with research highlighting the intertwined roles of motivation, social engagement, and strategy use in promoting student success (Li & Xue, 2023; Shao *et al.*, 2024). The negative pathway via technology use reflects earlier evidence that while technology can enhance communication and higher-order thinking when used strategically, unregulated or non-academic use can reduce academic performance (Gurung, 2024; Saray Ramírez *et al.*, 2021; Navarro-Martinez & Peña-Acuña, 2022). The centrality of motivated learning as the primary driver of achievement also supports SCT, SRL, and TAM-based studies showing that self-efficacy, self-regulation, and perceived

usefulness shape how learners engage with social and digital environments (de Araujo *et al.*, 2023; Chen, 2022; Misirlis & Munawar, 2023; Lin & Yu, 2023).

Motivation remains the most critical factor to develop in learners. Programs that build self-regulation, goal orientation, and persistence may enhance achievement more effectively. Meanwhile, social interaction should be supported and technology use structured to create clearer pathways for academic benefit.

Indirect Effects (Group number 1 - Default model)

	Motivated Strategy	Technology Use	Social Interaction
Technology Use	.000	.000	.000
Social Interaction	.000	.000	.000
Academic Performance	.070	.000	.000

4. Conclusion

The research showed that criminology students demonstrated high levels of motivated learning strategies, positive social interactions within the classroom, and strong engagement with technology—factors that collectively contributed to their very high academic performance. Intrinsic motivation and self-regulation played central roles in sustaining academic persistence, while supportive teacher–student relationships and positive classroom environments further strengthened learning outcomes. Students' extensive use of educational technology and their favorable attitudes toward it, particularly their intention to continue using such tools, aligned with the theoretical assumptions of SCT, SRL, and TAM. These patterns confirmed technology's function as a learning facilitator when it was both useful and easy to use. Overall, the results suggested that the effective integration of individual motivation, social support, and purposeful technology use created an optimal learning environment that promoted academic excellence among criminology students.

5. Recommendations

It was recommended that targeted interventions be implemented to strengthen students' self-efficacy, particularly through structured initiatives such as mentoring programs, goal-setting workshops, and academic coaching, as this component emerged as the weakest among the motivated learning strategies. In addition, because the results showed lower ratings in the area of social inclusion within classroom engagement, academic departments were encouraged to cultivate more inclusive and collaborative learning environments by promoting peer-support mechanisms and diversity-awareness initiatives that would enhance students' active participation. Given that technology demonstrated both positive and negative effects on academic outcomes, institutions were urged to prioritize the development of intuitive, user-friendly, and pedagogically sound

digital tools, accompanied by appropriate training to maximize their educational value. Moreover, stronger partnerships between criminology programs and the criminal justice sector were recommended to create simulation-based and case-study learning activities that effectively bridge theoretical knowledge with real-world practice. Collectively, these recommendations underscored that while student motivation remained a powerful driver of academic achievement, its impact was greatest when supported by inclusive classroom interactions and purposeful, well-structured uses of technology.

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Conflict of Interest Statement
The authors declare no conflicts of interest.

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