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Structural Relationships Between Self-Regulated Learning and Academic Motivation: The Mediating Role of Academic Resilience Among Upper Secondary School Students

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ABSTRACT

Purpose: This study aimed to examine the structural relationship between self-regulated learning and academic motivation through the mediating role of academic resilience among upper secondary school students in Babolsar.

Methods and Materials: This applied, correlational study was conducted using structural equation modeling. The statistical population comprised all Grade 10, 11, and 12 upper secondary school students in Babolsar during the 2025–2026 academic year. Using multistage cluster random sampling, 300 students were selected for the final analysis. Data were collected using the Bouffard et al. Self-Regulated Learning Questionnaire, the Vallerand et al. Academic Motivation Scale, and the Martin and Marsh Academic Resilience Scale. Data were analyzed using Pearson correlation coefficients and covariance-based structural equation modeling with maximum likelihood estimation in SPSS version 26 and AMOS version 24. Bootstrap analysis with 5,000 resamples was used to assess the significance of the indirect effect.

Findings: The proposed structural model demonstrated good fit to the data (CMIN/df = 1.81, RMSEA = .052, CFI = .990, IFI = .990, GFI = .976). Self-regulated learning had significant positive direct effects on academic motivation (β = .448, p < .001) and academic resilience (β = .590, p < .001). Academic resilience also had a significant positive direct effect on academic motivation (β = .244, p < .001). The indirect effect of self-regulated learning on academic motivation through academic resilience was significant (β = .1416, 95% CI [.0922, .1628], p < .001), confirming the mediating role of academic resilience. The model explained 42% of the variance in academic motivation.

Conclusion: Self-regulated learning contributes to students' academic motivation both directly and indirectly through academic resilience, indicating that strengthening students' regulatory learning capacities and resilience may help sustain motivation in the face of academic challenges.

Keywords: *Self-Regulated Learning, Academic Motivation, Academic Resilience, Structural Equation Modeling, Upper Secondary School Students*

1. Introduction

Academic functioning during upper secondary education is shaped by a complex interaction of motivational, cognitive, emotional, and contextual processes. At this stage of schooling, students are expected to manage increasingly demanding curricula, prepare for high-stakes examinations, make decisions about future educational and occupational pathways, and sustain engagement despite academic pressure and uncertainty.

Academic motivation is therefore a central construct for understanding why some students persist, invest effort, and remain actively engaged in learning while others become disengaged or fail to sustain purposeful academic behavior. Contemporary research increasingly conceptualizes academic motivation not as a fixed individual characteristic but as a dynamic process influenced by students' perceptions of competence, interpersonal experiences, emotional states, learning environments, and opportunities for autonomous participation in educational activities. Evidence from diverse educational settings suggests that motivation is associated with academic engagement, learning behavior, persistence, and performance and may itself be strengthened or weakened by social and instructional conditions (Aslam et al., 2025; Kurniasih et al., 2025; Murcia Murcia et al., 2025). Recent theoretical developments have further emphasized that student agency is embedded within interpersonal and cultural contexts, such that academic motivation emerges partly through interactions between individual regulation and the social environment (Liem, 2026). Consistent with this perspective, perceived belongingness and social identification have been associated with stronger well-being and academic motivation, while teacher emotional support has been shown to facilitate student engagement partly through motivational mechanisms (Andreadis & Marshall, 2025; Longakit et al., 2025). These findings indicate that understanding academic motivation requires attention not only to whether students are motivated, but also to the psychological processes that enable them to initiate, organize, sustain, and adapt their learning behavior.

One of the most important processes in this regard is self-regulated learning. Self-regulated learning refers to the active process through which learners establish academic goals, select and employ learning strategies, monitor their progress, regulate cognition and motivation, evaluate their performance, and modify their behavior when existing strategies prove ineffective. Rather than positioning students as passive recipients of instruction, the self-regulated learning framework views them as active agents who deliberately manage their learning processes. Contemporary conceptualizations typically include cognitive strategies used to process and organize information, metacognitive strategies concerned with planning and monitoring, and motivational regulation strategies that help learners maintain effort and persistence. Recent advances in the assessment of self-regulated learning have also highlighted the need to distinguish students' beliefs about regulation from the specific practices and challenges they experience while learning (Hadwin et al., 2025). Reflection constitutes an important component of this regulatory process because it enables learners to evaluate their actions, identify weaknesses, and make strategic adjustments to subsequent learning attempts (Arvatz et al., 2025). Accordingly, self-regulated learning is increasingly considered a multidimensional and temporally dynamic process rather than a single static learning habit.

The importance of self-regulated learning has become particularly evident as contemporary education increasingly incorporates digital, online, and technology-mediated learning environments. Such environments often require students to exercise greater autonomy because immediate teacher supervision is reduced and learners must independently determine how to allocate attention, time, effort, and cognitive resources. Systematic reviews of technology-supported learning have demonstrated growing interest in using multimodal data and artificial intelligence to identify the regulatory strategies students employ during learning (de Mooij et al., 2025). Similarly, research on artificial-intelligence-supported learning has emphasized that technologies become educationally effective when students can strategically regulate their interactions with them rather than merely access digital resources (Lan & Zhou, 2025). Empirical studies have shown that patterns of self-regulated learning strategies and instructional scaffolding are associated with learning performance (Li et al., 2025), while longitudinal examination of learning behavior indicates that the effectiveness of particular self-regulatory strategies may vary across different periods of a course (Cristea et al., 2025). Research in writing contexts likewise demonstrates that self-regulated learning contributes to students' ability to make productive use of feedback and technological assistance (Hwang, 2025; Jin et al., 2025). More recent findings concerning large language model-supported instruction further suggest that changes in learning environments can influence both regulatory strategies and students' motivation, reinforcing the close functional connection between how students regulate learning and why they remain engaged in it (Y. Liu et al., 2026).

The relationship between self-regulated learning and academic motivation is theoretically compelling because effective regulation depends partly on students' willingness to invest effort, whereas successful regulation can itself reinforce motivation by increasing perceptions of progress, control, and competence. Students who establish goals, monitor their learning, select appropriate strategies, and

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adapt their behavior are more likely to experience their academic activity as purposeful and manageable. Such experiences can strengthen persistence and reduce the likelihood of disengagement when academic tasks become difficult. Recent empirical research has increasingly demonstrated reciprocal or structurally interconnected relationships between motivational processes and self-regulatory strategies. For example, motivation and perceived capability in online learning have been associated with the use of self-regulated learning strategies, with regulatory strategies operating as an explanatory mechanism within the broader learning process (Almayez et al., 2025). Similarly, research examining affective mechanisms in learning has documented meaningful connections among academic motivation, self-efficacy, evaluative concerns, and self-regulated learning (Toprak & Yavuz, 2026). Studies of academic achievement motivation have also identified academic self-regulation as an important predictor of students' motivational functioning (Tahmasbi et al., 2024), and structural work has positioned academic motivation as a mediating mechanism through which students' academic self-perceptions and regulatory capacities contribute to broader indicators of educational success (Najafi & Rezaei, 2025). These findings suggest that self-regulated learning may represent a particularly important antecedent of academic motivation because it equips students with practical psychological tools for maintaining purposeful engagement under changing academic demands.

The significance of this relationship is also supported by research on academic emotions and broader instructional conditions. Self-regulated learning does not occur independently of students' affective experiences; instead, academic emotions can influence the strategies learners select, the effort they maintain, and the extent to which they persist after setbacks. Recent research among adolescents has demonstrated that academic emotions help explain the relationship between self-regulated learning and academic achievement, suggesting that successful regulation operates through interconnected cognitive, motivational, and emotional pathways (Sun & Zhang, 2026). Educational environments likewise influence these processes. Research examining teacher-related and student-level resources has shown that classroom and teacher characteristics can be associated with students' psychological functioning and academic burnout, underscoring the importance of examining internal regulatory resources within the broader educational ecology (Z. M. Liu et al., 2026). Intervention-oriented research similarly indicates that learning environments designed around adaptive beliefs and professional learning processes may strengthen academic motivation (Kamel, 2026). Taken together, these studies support a process-oriented interpretation in which academic motivation is influenced not only by immediate incentives but also by students' capacity to regulate cognition and behavior while responding adaptively to the emotional and contextual demands of schooling.

An especially important construct that may explain how self-regulated learning translates into sustained academic motivation is academic resilience. Academic resilience refers to the capacity to maintain or regain effective academic functioning when confronted with educational adversity, pressure, repeated difficulty, failure, stress, or other conditions that threaten progress. Resilient students are not necessarily those who experience fewer academic challenges; rather, they are characterized by their ability to respond adaptively to those challenges and continue engaging with educational goals. Contemporary research demonstrates that academic resilience is associated with academic performance and can be shaped by supportive educational relationships (Cai & Meng, 2025). Teacher emotional support has likewise been linked with stronger learning engagement through psychological mechanisms that include academic resilience (Guo et al., 2025). More broadly, systematic evidence indicates that perceived social support can function as an important resource for strengthening academic resilience, suggesting that resilience develops through transactions between personal capacities and supportive environments (McMullin et al., 2025). Qualitative research also indicates that academic resilience should be understood as a temporally developing and agentic process through which learners negotiate constraints and mobilize available resources across their educational trajectories (Huang & Yan, 2026). Thus, academic resilience offers a useful conceptual bridge between students' regulatory competencies and their ability to preserve motivation when educational experiences become demanding.

The potential connection between self-regulated learning and academic resilience is particularly plausible because the behaviors that characterize self-regulated learners—goal setting, planning, monitoring, strategic adjustment, effort regulation, and reflection—are also resources for responding effectively to setbacks. When students experience low grades, demanding assignments, examination pressure, or temporary failure, those who can evaluate the source of difficulty and modify their learning strategy may be less

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likely to interpret adversity as an endpoint. Instead, they can reorganize their behavior and continue working toward academic goals. Iranian research has provided support for this conceptual linkage by showing relationships between approaches to learning and academic resilience through academic self-regulation (Arbazi & Sheikholeslami, 2024). Structural research has also situated academic resilience within a network of metacognitive awareness, coping strategies, hardiness, and emotion-regulatory processes, further indicating that resilience is closely connected to the broader capacity for adaptive self-management (Ebrahimi Ghavam et al., 2024). Similarly, studies of coping-related pathways suggest that resilience reflects an adaptive psychological system influenced by how individuals respond to emotional and situational demands (Soltani et al., 2024). The mediating role of resilience has also been demonstrated in relationships involving cognitive emotion regulation and test anxiety, indicating that resilience can transmit the effects of students' regulatory resources to important academic and emotional outcomes (Jahanbakhsh & Vafaeizadeh, 2025). These findings provide a theoretical basis for proposing that students who are more capable of regulating their learning may also become more resilient when facing academic adversity.

Academic resilience may, in turn, make an important contribution to academic motivation. Students who are able to persist following academic setbacks are more likely to maintain effort, continue participating in learning activities, and sustain confidence that academic goals remain attainable. By contrast, repeated exposure to stress without sufficient adaptive resources may undermine motivation and contribute to disengagement. Research among secondary school students has linked educational stress with differences in academic motivation, indicating that motivational functioning must be interpreted in relation to how students manage academic pressure (Pali & Roshanfekr, 2025). Studies of academic resilience have similarly demonstrated its relevance to achievement and other educational outcomes under adverse conditions. For example, resilience has been identified as an intervening mechanism in the association between problematic smartphone use, cognitive test anxiety, and academic achievement (Koğar et al., 2025). Research focused on designing resilience-oriented educational interventions likewise reflects growing recognition that resilience is modifiable and can be deliberately supported within academic environments (Napoli et al., 2025). Evidence concerning digital stress also suggests that academic resilience reflects the combined contribution of personal psychological resources and environmental pressures in contemporary learning settings (Lelis & Morales, 2026). These findings indicate that academic resilience may help explain why some students remain motivated despite pressure, whereas others facing comparable demands become less engaged.

The relevance of these mechanisms is especially pronounced during adolescence. Upper secondary school students encounter substantial developmental and educational transitions simultaneously. They must manage greater curricular specialization, heightened expectations, important examinations, competition for future educational opportunities, and increasingly consequential decisions concerning academic pathways. Motivation in this period may therefore depend strongly on whether students possess the regulatory capacities required to organize learning and the resilience required to respond to setbacks without abandoning their goals. Recent studies across educational contexts have increasingly examined structural relationships among personal resources, motivation, and academic outcomes rather than treating each construct independently. Research on secondary and university populations suggests that motivational functioning is embedded in broader networks involving educational stress, achievement orientations, perceived competence, regulatory processes, and interpersonal support (Sadeghi et al., 2025; Yari Kordshouli & Zanbouri, 2025). International studies have likewise modeled personal psychological resources as mechanisms linking students' perceptions and experiences to academic performance and adaptation (Newar et al., 2025). Although the specific constructs and populations differ across these studies, their collective implication is that educational outcomes are better understood through models that specify the pathways through which students' internal resources influence one another.

Despite this growing body of evidence, important conceptual and empirical gaps remain. A substantial portion of recent research has examined self-regulated learning in university settings, technology-enhanced environments, online learning, language learning, or specific performance tasks (Almayez et al., 2025; Cristea et al., 2025; Jin et al., 2025; Lan & Zhou, 2025). Similarly, much contemporary research on academic resilience has focused on university students, graduate students, digital stress, teacher support, or specific academic risk conditions (Cai & Meng, 2025; Huang & Yan, 2026; Lelis & Morales, 2026; McMullin et al., 2025). These studies offer valuable evidence but do not

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fully clarify whether the same structural pathways operate among upper secondary school students who face distinctive developmental and educational pressures. Furthermore, studies showing associations between self-regulated learning and achievement or motivation do not by themselves explain the mechanism through which regulatory capacities may be translated into sustained motivational functioning. A direct relationship is theoretically reasonable, but it is equally plausible that students who regulate their learning effectively become more capable of withstanding academic setbacks and that this enhanced resilience subsequently contributes to stronger academic motivation. Testing academic resilience as a mediator therefore provides a more process-oriented account of the relationship between self-regulated learning and motivation.

A structural equation modeling approach is particularly appropriate for investigating this proposition because the hypothesized relationships involve both direct and indirect pathways among conceptually interdependent psychological constructs. Rather than evaluating isolated bivariate associations, structural modeling permits simultaneous examination of whether self-regulated learning predicts academic motivation directly, whether it predicts academic resilience, whether academic resilience contributes to academic motivation, and whether a statistically meaningful indirect pathway operates from self-regulated learning to academic motivation through resilience. This approach is consistent with the increasingly relational and multicomponent understanding of motivation, regulation, and adaptation evident in recent educational research (Liem, 2026; Toprak & Yavuz, 2026). It is also responsive to emerging evidence that academic behavior develops through coordinated systems of cognitive strategy use, affective regulation, contextual support, and adaptive persistence rather than through a single isolated student characteristic (Ebrahimi Ghavam et al., 2024; Guo et al., 2025). Examining these pathways among upper secondary school students in Babolsar can therefore contribute context-specific evidence while also addressing a broader theoretical question regarding the psychological mechanism linking effective regulation of learning to sustained academic motivation.

Accordingly, the aim of the present study was to examine the structural relationship between self-regulated learning and academic motivation through the mediating role of academic resilience among upper secondary school students in Babolsar.

2. Methods and Materials

2.1. Study Design and Participants

The present study was an applied study in terms of purpose and employed a correlational research design based on structural equation modeling (SEM). The primary objective was to examine the structural relationship between self-regulated learning and academic motivation and to determine the mediating role of academic resilience in this relationship among upper secondary school students. The statistical population consisted of all students enrolled in Grades 10, 11, and 12 in upper secondary schools in Babolsar, Iran, during the 2025–2026 academic year. According to official information obtained from the Department of Education of Babolsar, the total population comprised 4,242 students. Because adequate sample size is particularly important in structural equation modeling for obtaining stable parameter estimates, sufficient statistical power, accurate estimation of standard errors, and acceptable model fit, the sample size was determined conservatively according to commonly recommended criteria for SEM studies. Considering the number of observed and latent components included in the hypothesized model, the minimum required sample size was estimated at approximately 240 participants. To improve the precision of parameter estimates, compensate for incomplete questionnaires, and enhance the statistical adequacy of the structural model, the target sample was increased to approximately 300–320 students. Following data screening and the exclusion of incomplete or invalid questionnaires, data from 300 students were retained for the final analyses. Participants were selected using a multistage cluster random sampling procedure. For this purpose, Babolsar was divided into four geographical areas consisting of the northern, southern, eastern, and western parts of the city. One school was randomly selected from each geographical area, and within each selected school, one class from each of Grades 10, 11, and 12 was randomly chosen. Each selected class generally included approximately 25–30 students. This procedure was continued until the planned sample size was achieved, and after the removal of incomplete questionnaires, the final analytic sample consisted of 300 students. Eligibility criteria included willingness to participate in the study and provision of informed agreement, appropriate physical and psychological condition for completing the questionnaires, current enrollment in upper secondary education, and being within the age range corresponding to the targeted educational

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level. Students who did not wish to participate or who had a serious psychiatric disorder that could interfere with participation or questionnaire completion were excluded from the study.

Following development of the research framework and review of the relevant theoretical and empirical literature, the standardized measurement instruments were selected and finalized. The required administrative and ethical permissions were subsequently obtained, and coordination was established with the Babolsar Department of Education and the administrators of the selected schools. Data were collected through an electronic questionnaire made available to students in the selected Grade 10, Grade 11, and Grade 12 classes. At the beginning of the questionnaire, participants were provided with information regarding the general objectives of the research, instructions for questionnaire completion, the voluntary nature of participation, and the confidentiality of their responses. No personally identifying information, including participants' names, was collected, and students were informed that the collected information would be used exclusively for research purposes and reported only in aggregate form. They were also informed that participation was entirely voluntary and that they could discontinue participation at any point without adverse consequences. Students completed the questionnaires online at an appropriate time after reviewing the study information. At the end of the data-collection period, submitted responses were screened, and questionnaires containing substantial missing information or invalid response patterns were excluded. The remaining responses were coded and entered into SPSS and AMOS for statistical analysis. Ethical approval for conducting the research was obtained from the relevant research ethics committee before data collection, and the study procedures were conducted in accordance with the principles of confidentiality, voluntary participation, informed participation, and protection of participants' personal information.

2.2. Data Collection Tools

Self-regulated learning was assessed using the Self-Regulated Learning Questionnaire developed by Bouffard et al. (1995). The instrument consists of 14 items designed to assess the extent to which students actively regulate cognitive, motivational, and metacognitive aspects of their learning. Responses are provided on a five-point Likert scale ranging from 1, indicating strongly disagree, to 5, indicating strongly agree. Accordingly, the total raw score can range from 14 to 70, with higher scores indicating a higher level of self-regulated learning. The questionnaire comprises three components: cognitive strategies, motivational strategies, and metacognitive strategies. Cognitive strategies are assessed by Items 3, 7, 9, 10, and 12 and reflect the learner's use of processes for encoding, organizing, elaborating, retaining, and recalling educational information. Motivational strategies are measured by Items 6, 8, and 11 and refer to strategies used to maintain motivation, persistence, task engagement, and continued effort when completing academic activities. Metacognitive strategies are assessed by Items 1, 2, 4, 5, 13, and 14 and represent students' capacity to plan, monitor, regulate, and evaluate their learning processes. The psychometric properties of the Persian version of the questionnaire were examined by Kadivar (2001), who reported a Cronbach's alpha coefficient of .71 for the total scale, while factor-analytic findings and item correlations supported its construct validity. Subsequent Iranian studies have also demonstrated satisfactory internal consistency, with reliability coefficients of approximately .76 being reported in student populations. These findings support the suitability of the questionnaire for assessing self-regulated learning in educational and psychological research. In the present study, the internal consistency of the instrument was also evaluated using Cronbach's alpha before conducting the structural analyses.

Academic motivation was measured using the Academic Motivation Scale developed by Vallerand et al. (1992) on the basis of Self-Determination Theory. The scale consists of 28 items and was originally designed to assess seven dimensions of academic motivation, including three forms of intrinsic motivation, three forms of extrinsic motivation, and amotivation. For analytical purposes, these dimensions may be organized into the three broader domains of intrinsic motivation, extrinsic motivation, and amotivation, and this three-dimensional structure was used in the present study. Intrinsic motivation was represented by Items 2, 4, 6, 9, 11, 13, 16, 18, 20, 23, 25, and 27; extrinsic motivation was represented by Items 1, 3, 7, 8, 10, 14, 15, 17, 21, 22, 24, and 28; and amotivation was represented by Items 5, 12, 19, and 26. Participants respond to each item on a seven-point Likert-type scale ranging from 1, indicating that the statement does not correspond at all to my reason for studying, to 7, indicating that the statement corresponds completely to my reason for studying. The total raw score across the 28 items can range from 28 to 196, while the scores of the three major dimensions provide more specific information regarding students' motivational orientation.

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Vallerand et al. (1992) examined the construct validity of the scale using confirmatory factor analysis and reported Cronbach's alpha coefficients ranging from .62 to .86 across its subscales. Test–retest reliability coefficients ranging from .71 to .83 were also reported, demonstrating satisfactory temporal stability. Further psychometric examination of the 28-item scale among secondary school students has provided additional support for its factorial structure and internal consistency. For example, Stover et al. (2012), in a study involving 393 secondary school students, reported satisfactory confirmatory factor-analytic results and acceptable reliability coefficients. Accordingly, the Academic Motivation Scale has been widely used as a valid and reliable measure of academic motivational orientations among adolescents and students. Internal consistency coefficients for the dimensions used in the present study were reassessed using Cronbach's alpha prior to testing the structural model.

Academic resilience was measured using the Academic Resilience Scale developed by Martin and Marsh (2006). This instrument was specifically designed to assess students' capacity to respond adaptively to academic challenges, obstacles, pressure, setbacks, and stressful educational circumstances. The scale is a unidimensional measure containing six items. Responses are recorded on a five-point Likert scale ranging from 1, representing strongly disagree, to 5, representing strongly agree. Consequently, possible scores range from 6 to 30, with higher scores reflecting a greater capacity to maintain effective academic functioning and adapt successfully when confronted with academic adversity. The Persian version of the scale was psychometrically evaluated by Hashemi (2011). Exploratory factor analysis using principal components analysis supported a single-factor structure, with the extracted factor accounting for approximately 47.90% of the total variance. The Kaiser–Meyer–Olkin index was reported as .83, indicating satisfactory sampling adequacy, and Bartlett's test of sphericity was statistically significant, supporting the appropriateness of the correlation matrix for factor analysis. Factor loadings for the six items ranged approximately from .55 to .77 in the Persian validation study, and Cronbach's alpha for the overall scale was reported as .77. Evidence from the original development and validation studies also supported the external and construct validity of the instrument through correlational, path-analytic, cluster-analytic, and factorial procedures. Reported item factor loadings in previous studies have generally ranged from approximately .62 to .86, while reliability analyses have demonstrated satisfactory internal consistency. Collectively, these findings indicate that the six-item Academic Resilience Scale provides an appropriate brief measure of students' adaptive functioning in the face of academic difficulties. In the present study, Cronbach's alpha was calculated to reassess the internal consistency of the scale in the study sample.

2.3. Data Analysis

Following completion of data collection, the questionnaires were reviewed for completeness and response quality, and records with substantial missing data or invalid response patterns were excluded before statistical analysis. The final dataset containing 300 valid questionnaires was coded and analyzed using IBM SPSS Statistics version 26 and AMOS version 24. SPSS was used for data preparation, descriptive statistical analyses, examination of the distributions of the study variables, and calculation of reliability coefficients and bivariate relationships among self-regulated learning, academic motivation, and academic resilience. Descriptive statistics, including means, standard deviations, minimum and maximum scores, were calculated to characterize the major study variables. The internal consistency of the research instruments and their relevant dimensions was assessed using Cronbach's alpha. The correlations among the principal study constructs were also examined as a preliminary assessment of the direction and magnitude of their relationships before testing the hypothesized structural model.

Structural equation modeling was subsequently performed in AMOS to simultaneously examine the hypothesized relationships among the study constructs. The proposed model specified self-regulated learning as the predictor construct, academic motivation as the outcome construct, and academic resilience as the mediating construct. Structural equation modeling was selected because it permits the simultaneous examination of multiple relationships among observed and latent variables and allows direct, indirect, and total effects to be estimated within a theoretically specified model. Model parameters were estimated using the maximum likelihood estimation method. The adequacy of the proposed model was evaluated using conventional model-fit criteria, including the chi-square statistic relative to its degrees of freedom and comparative and absolute fit indices such as the Comparative Fit Index, Tucker–Lewis Index, Goodness-of-Fit Index, and

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Root Mean Square Error of Approximation. Standardized path coefficients were examined to determine the magnitude and direction of the hypothesized structural relationships. Particular attention was given to the pathway from self-regulated learning to academic resilience, the pathway from academic resilience to academic motivation, and the direct pathway from self-regulated learning to academic motivation. The indirect effect of self-regulated learning on academic motivation through academic resilience was evaluated to determine whether academic resilience functioned as a mediator in the proposed structural relationship. Direct, indirect, and total effects were interpreted together to provide a comprehensive assessment of the hypothesized mediation model. Statistical significance was evaluated at an alpha level of .05, and the overall interpretation of the results was based jointly on the statistical significance and magnitude of the structural coefficients and the adequacy of the overall model fit.

3. Findings and Results

A total of 300 upper secondary school students from Babolsar participated in the study. The participants ranged in age from 15 to 18 years, with a mean age of 16.85 years (SD = 1.26). Of the total sample, 152 students (50.7%) were male and 148 (49.3%) were female. The distribution across educational grades was approximately equal: 99 students (33.0%) were in Grade 10, 100 (33.3%) were in Grade 11, and 101 (33.7%) were in Grade 12. Regarding academic field of study, 92 students (30.7%) were enrolled in humanities, 118 (39.3%) in experimental sciences, and 90 (30.0%) in mathematics. Thus, students in experimental sciences constituted the largest academic-track group, whereas students in mathematics represented the smallest group.

Descriptive statistics for self-regulated learning, academic resilience, and academic motivation and their respective dimensions are presented in Table 1. Among the components of self-regulated learning, cognitive strategies had a mean of 13.75 (SD = 3.11), motivational strategies had a mean of 9.02 (SD = 2.06), and metacognitive strategies had a mean of 16.61 (SD = 3.71). The mean total self-regulated learning score was 39.86 (SD = 8.34). Academic resilience had a mean score of 17.01 (SD = 4.09). With respect to academic motivation, the mean scores were 36.92 (SD = 10.14) for intrinsic motivation, 35.45 (SD = 9.34) for extrinsic motivation, and 11.92 (SD = 3.19) for amotivation. The mean total academic motivation score was 86.20 (SD = 22.10).

Table 1

Descriptive Statistics for the Study Variables (N = 300)

Variable	Dimension	Mean	SD	Range	Skewness	Kurtosis
Self-regulated learning	Cognitive strategies	13.75	3.11	5–25	0.03	0.19
	Motivational strategies	9.02	2.06	3–15	-0.06	0.35
	Metacognitive strategies	16.61	3.71	6–30	-0.03	0.63
	Total self-regulated learning	39.86	8.34	15–69	0.04	0.56
Academic resilience	Total academic resilience	17.01	4.09	6–30	-0.04	0.12
Academic motivation	Intrinsic motivation	36.92	10.14	12–72	0.17	0.16
	Extrinsic motivation	35.45	9.34	12–72	0.19	0.27
	Amotivation	11.92	3.19	4–24	0.05	0.56
	Total academic motivation	86.20	22.10	31–168	0.04	0.25

Pearson correlation coefficients among the study variables are presented in Table 2. Significant positive relationships were observed among the dimensions of self-regulated learning, academic resilience, and the dimensions and total score of academic motivation. The three self-regulated learning dimensions were strongly associated with the total self-regulated learning score, with correlations ranging from .84 to .88. Total self-regulated learning was positively correlated with academic resilience ($r = .57$, $p < .01$) and total academic motivation ($r = .63$, $p < .01$). Academic resilience was also positively correlated with total academic motivation ($r = .56$, $p < .01$). At the dimensional level, academic resilience was associated with intrinsic motivation ($r = .51$), extrinsic motivation ($r = .50$), and amotivation ($r = .50$), while total self-regulated learning was associated with intrinsic motivation ($r = .54$), extrinsic motivation ($r = .56$), and amotivation ($r = .57$). The three academic motivation dimensions also demonstrated relatively strong intercorrelations. Overall, the pattern of

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correlations provided preliminary support for testing the proposed structural relationships.

Table 2

Pearson Correlation Matrix for the Study Variables

Variable	1	2	3	4	5	6	7	8	9
1. Cognitive strategies	1								
2. Motivational strategies	.70**	1							
3. Metacognitive strategies	.72**	.66**	1						
4. Total self-regulated learning	.88**	.84**	.85**	1					
5. Academic resilience	.47**	.49**	.48**	.57**	1				
6. Intrinsic motivation	.52**	.42**	.48**	.54**	.51**	1			
7. Extrinsic motivation	.50**	.47**	.51**	.56**	.50**	.70**	1		
8. Amotivation	.49**	.47**	.48**	.57**	.50**	.73**	.75**	1	
9. Total academic motivation	.57**	.50**	.59**	.63**	.56**	.88**	.87**	.87**	1

As an additional preliminary analysis, possible demographic confounding was examined by testing the relationships of gender, educational grade, and academic field with the endogenous outcome variable, academic motivation. None of these demographic characteristics showed a statistically significant relationship with academic motivation ($p > .05$). Accordingly, no statistically significant demographic confounding variable was identified for inclusion in the structural model.

Before testing the proposed structural model, the assumptions underlying structural equation modeling were examined, including missing data, univariate and multivariate outliers, univariate normality, multivariate normality, and multicollinearity. The dataset was first examined for incomplete responses and missing values. In accordance with the predetermined data-screening procedure, incomplete questionnaires were removed, and the retained dataset consisted of 300 valid cases. Where necessary during preliminary data processing, missing information was handled using the specified prediction-maximization procedure before the final analytic dataset was established.

Univariate outliers were investigated by examining standardized Z scores for the study variables in SPSS version 26. No observations exceeded the acceptable boundaries for univariate outliers. Multivariate outliers were subsequently evaluated using Mahalanobis distance. The maximum Mahalanobis distance did not exceed the critical chi-square value at the .001 significance level for the relevant degrees of freedom; therefore, no problematic multivariate outliers were identified.

Univariate normality was assessed using the skewness and kurtosis coefficients reported in Table 1. The absolute skewness values ranged from 0.03 to 0.19 and were therefore substantially below the criterion of 3. Likewise, the absolute kurtosis coefficients ranged from 0.12 to 0.63 and were substantially below the criterion of 10. Consequently, no substantial violation of univariate normality was detected for any of the observed variables included in the model.

Multivariate normality was additionally assessed using Mardia's standardized multivariate kurtosis coefficient and its critical ratio. The Mardia coefficient was 4.201, and the corresponding critical ratio was 2.213. Because the critical ratio was below the criterion of 5, the assumption of multivariate normality was considered satisfactorily met. These results supported the use of maximum likelihood estimation for testing the measurement and structural models.

Multicollinearity was evaluated using tolerance statistics and variance inflation factors (VIFs). For the indicators of self-regulated learning, tolerance values were .39 for cognitive strategies, .45 for motivational strategies, and .42 for metacognitive strategies, with corresponding VIF values of 2.56, 2.19, and 2.34, respectively. For the indicators of academic motivation, tolerance values were .41 for intrinsic motivation, .38 for extrinsic motivation, and .35 for amotivation, while the corresponding VIF values were 2.42, 2.63, and 2.83. All tolerance coefficients were greater than .10 and all VIF values were substantially below 10, indicating that multicollinearity did not constitute a problem in the data.

Following confirmation of the major statistical assumptions, appropriate indicators for the latent constructs were evaluated through confirmatory factor analysis. Self-regulated learning was represented by its three subscales of cognitive strategies, motivational strategies, and

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metacognitive strategies. All three indicators demonstrated satisfactory standardized factor loadings above .80 and were therefore retained in the measurement model. Academic motivation was similarly represented by intrinsic motivation, extrinsic motivation, and amotivation. Each of these indicators demonstrated a standardized factor loading of at least .83 and was retained in the subsequent analyses. Academic resilience was included as the observed overall score of its unidimensional scale.

The proposed model was then evaluated using the two-stage approach to structural equation modeling. In the first stage, confirmatory factor analysis was conducted to assess the adequacy of the measurement model. In the second stage, the hypothesized structural relationships were examined using covariance-based structural equation modeling in AMOS version 24. Model parameters were estimated using the maximum likelihood method. The fit of both the measurement and structural models was assessed using the chi-square statistic, chi-square divided by degrees of freedom (CMIN/df), Root Mean Square Error of Approximation (RMSEA), Parsimony Normed Fit Index (PNFI), Comparative Fit Index (CFI), Parsimony Comparative Fit Index (PCFI), Incremental Fit Index (IFI), and Goodness-of-Fit Index (GFI).

As presented in Table 3, the measurement model demonstrated very good fit to the observed data. The chi-square value was 10.01 with 8 degrees of freedom and was nonsignificant ($p = .264$). The relative chi-square value was 1.25, while RMSEA was .029 with a 90% confidence interval ranging from .001 to .077. In addition, PNFI = .529, CFI = .998, PCFI = .532, IFI = .998, and GFI = .989. These indices collectively supported the adequacy of the measurement model. The structural model also demonstrated satisfactory fit. The chi-square value was 30.90 with 17 degrees of freedom ($p = .020$), and CMIN/df was 1.81. The RMSEA value was .052, with a 90% confidence interval of .020 to .081, while PNFI = .594, CFI = .990, PCFI = .601, IFI = .990, and GFI = .976. Thus, the principal absolute, incremental, comparative, and parsimonious fit indices indicated that the proposed structural model provided an acceptable-to-good representation of the observed covariance structure.

Table 3

Goodness-of-Fit Indices for the Measurement and Structural Models

Model	χ^2	df	p	CMIN/df	RMSEA (90% CI)	PNFI	CFI	PCFI	IFI	GFI
Measurement model	10.01	8	.264	1.25	.029 (.001–.077)	.529	.998	.532	.998	.989
Structural model	30.90	17	.020	1.81	.052 (.020–.081)	.594	.990	.601	.990	.976

Examination of the standardized factor loadings further supported the adequacy of the measurement component. For self-regulated learning, the standardized factor loading was .869 for cognitive strategies, with a standard error of .052 and a critical ratio of 16.78; .803 for motivational strategies, with a standard error of .034 and a critical ratio of 15.46; and .834 for metacognitive strategies, which served as the reference indicator in the estimation procedure. For academic motivation, intrinsic motivation had a standardized factor loading of .830 and served as the reference indicator, whereas extrinsic motivation had a standardized loading of .859, a standard error of .055, and a critical ratio of 17.20. Amotivation demonstrated a standardized loading of .876, a standard error of .019, and a critical ratio of 17.55. All freely estimated factor loadings were statistically significant at $p < .001$, and all standardized loadings were substantially above the minimum criterion of .30. These results confirmed that the observed indicators adequately represented their respective latent constructs.

Following confirmation of the measurement model, the hypothesized structural pathways were examined. As shown in Table 4, self-regulated learning had a statistically significant positive direct effect on academic motivation ($\beta = .448$, SE = .200, CR = 6.03, $p < .001$). Self-regulated learning also had a significant positive direct effect on academic resilience ($\beta = .590$, SE = .073, CR = 10.57, $p < .001$). Among the direct structural pathways, the relationship between self-regulated learning and academic resilience was the strongest. Academic resilience, in turn, exerted a significant positive direct effect on academic motivation ($\beta = .244$, SE = .120, CR = 4.17, $p < .001$). Thus, all direct pathways specified in the proposed model were statistically significant.

The coefficient of determination for academic motivation was $R^2 = .420$, indicating that the variables included in the structural model accounted for 42.0% of the variance in academic motivation among upper secondary school students. This magnitude of explained variance indicates substantial predictive capacity for the proposed model. The

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standardized structural coefficients therefore demonstrated that higher levels of self-regulated learning were associated both directly with higher academic motivation and indirectly with academic motivation through greater academic resilience.

The mediating role of academic resilience was evaluated using bootstrap analysis with 5,000 resamples and a 95% confidence interval. The indirect effect of self-regulated learning on academic motivation through academic resilience was .1416, with a bootstrap standard error of .0357. The 95% bootstrap confidence interval ranged from .0922 to .1628 and therefore did not include zero. The indirect effect was statistically significant ($p < .001$), confirming that academic resilience significantly mediated the relationship between self-regulated learning and academic motivation. Because the direct effect of self-regulated learning on academic motivation remained statistically significant after inclusion of academic resilience in the model, the pattern of results was consistent with partial mediation.

Table 4

Direct and Indirect Effects in the Proposed Structural Model

Effect Type	Structural Path	Standardized Effect	SE	CR	95% CI Lower	95% CI Upper	p
Direct	Self-regulated learning → Academic motivation	.448	.200	6.03	—	—	< .001
Direct	Self-regulated learning → Academic resilience	.590	.073	10.57	—	—	< .001
Direct	Academic resilience → Academic motivation	.244	.120	4.17	—	—	< .001
Indirect	Self-regulated learning → Academic resilience → Academic motivation	.1416	.0357	—	.0922	.1628	< .001

The first hypothesis proposed that self-regulated learning would have a direct effect on students' academic motivation. The structural analysis supported this hypothesis, as self-regulated learning had a positive and statistically significant direct effect on academic motivation ($\beta = .448$, $p < .001$). Accordingly, students reporting higher self-regulated learning also tended to report higher levels of academic motivation, and the first hypothesis was supported.

The second hypothesis proposed that self-regulated learning would have a direct effect on academic resilience. This hypothesis was also supported. Self-regulated learning exerted a positive and statistically significant direct effect on academic resilience ($\beta = .590$, $p < .001$). This was the strongest direct pathway in the structural model, indicating a substantial association between students' regulation of their learning processes and their capacity to adapt to academic challenges and setbacks.

The third hypothesis proposed that academic resilience would have a direct effect on academic motivation. The results supported this hypothesis, showing that academic resilience had a positive and statistically significant direct effect on academic motivation ($\beta = .244$, $p < .001$). Therefore, greater academic resilience was associated with higher academic motivation after accounting for the direct contribution of self-regulated learning.

The final mediation hypothesis proposed that self-regulated learning would exert an indirect effect on academic motivation through academic resilience. Bootstrap analysis supported this hypothesis. The indirect effect was .1416, and its 95% bootstrap confidence interval ranged from .0922 to .1628. Because zero was not contained within the confidence interval and the effect was statistically significant at $p < .001$, academic resilience was confirmed as a significant mediator of the relationship between self-regulated learning and academic motivation. Taken together, the direct and indirect pathways indicate that self-regulated learning was related to academic motivation both directly and through its positive association with students' academic resilience.

4. Discussion and Conclusion

The present study examined the structural relationship between self-regulated learning and academic motivation through the mediating role of academic resilience among upper secondary school students in Babolsar. The findings showed that the proposed structural model had a good fit with the observed data, as indicated by CMIN/df = 1.81, RMSEA = .052, CFI = .990, IFI = .990, and GFI = .976. The model explained 42% of the variance in academic motivation, indicating substantial explanatory capacity.

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More specifically, self-regulated learning had a significant positive direct effect on academic motivation (β = .448, p < .001), self-regulated learning had a significant positive effect on academic resilience (β = .590, p < .001), and academic resilience had a significant positive effect on academic motivation (β = .244, p < .001). In addition, bootstrap analysis confirmed a significant indirect effect of self-regulated learning on academic motivation through academic resilience (indirect effect = .1416, 95% CI [.0922, .1628], p < .001). Because the direct effect of self-regulated learning on academic motivation remained statistically significant after academic resilience was included in the model, the findings support a partial mediation pattern. Taken together, these results indicate that students who are better able to regulate their own learning tend to report stronger academic motivation both directly and because their regulatory capacities contribute to greater resilience when they encounter academic difficulties.

The significant direct effect of self-regulated learning on academic motivation is consistent with the theoretical proposition that students' active management of cognition, behavior, effort, and learning strategies contributes to the maintenance of purposeful academic engagement. This finding is aligned with research showing that self-regulated learning is closely connected to motivational functioning and academic success. Toprak and Yavuz found meaningful interrelationships among academic motivation, self-efficacy, affective mechanisms, and self-regulated learning, emphasizing that effective learning is shaped by the interaction of motivational and regulatory processes (Toprak & Yavuz, 2026). Similarly, Almayez et al. demonstrated that self-regulated learning strategies played an important explanatory role in relationships involving motivation and perceived competence in online learning environments (Almayez et al., 2025). Research conducted in Iranian educational settings has likewise identified academic self-regulation as an important predictor of achievement motivation (Tahmasbi et al., 2024), while Najafi and Rezaei positioned academic motivation within a structural network linking academic self-regulation and other student-level psychological resources to educational success (Najafi & Rezaei, 2025). The present results therefore reinforce the argument that self-regulated learning is not simply a technical set of learning strategies but also a motivationally relevant psychological resource.

The positive relationship between self-regulated learning and academic motivation can be explained by the greater sense of control and intentionality experienced by self-regulated learners. Students who set goals, organize their learning activities, monitor their understanding, regulate their effort, and evaluate the effectiveness of their strategies are more likely to perceive themselves as active participants in the learning process. Such experiences can make educational tasks more manageable and personally meaningful, thereby strengthening persistence and willingness to invest effort. Recent research supports this interpretation. Hadwin et al. emphasized that self-regulated learning involves students' beliefs, practices, and challenges and should therefore be understood as a multidimensional process through which students actively manage learning demands (Hadwin et al., 2025). Arvatz et al. further highlighted reflection as a mechanism through which learners evaluate and modify their strategies, allowing them to become increasingly deliberate and adaptive in their academic behavior (Arvatz et al., 2025). Cristea et al. also demonstrated that the effectiveness of self-regulated learning strategies varies dynamically across learning periods, suggesting that regulation supports students by enabling ongoing adaptation rather than through rigid adherence to one strategy (Cristea et al., 2025). From this perspective, students who can adaptively regulate their learning are more likely to experience progress and competence, which may in turn contribute to sustained academic motivation.

The present finding is also compatible with evidence from technology-supported and contemporary learning environments. Studies have increasingly shown that students' ability to use learning resources effectively depends on the extent to which they can regulate their behavior, attention, and strategy use. Li et al. reported meaningful associations between self-regulated learning strategies, instructional scaffolding, and learning performance (Li et al., 2025). Hwang showed that self-regulated learning strategies contributed to students' ability to make effective use of feedback in writing contexts (Hwang, 2025), while Jin et al. found that self-regulation influenced learning outcomes in AI-assisted writing environments (Jin et al., 2025). Liu et al. similarly reported that integrating large language models into instruction affected not only performance but also self-regulated learning strategies and motivation (Y. Liu et al., 2026). Systematic reviews likewise indicate that self-regulated learning is becoming increasingly important in technology-rich educational systems where students are required to exercise greater autonomy (de Mooij et al., 2025; Lan & Zhou, 2025). Although the present study was conducted

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among upper secondary school students rather than exclusively in digital learning environments, these findings provide convergent support for the view that self-regulation is an important foundation for motivated learning across educational contexts.

A second major finding was that self-regulated learning had a strong positive direct effect on academic resilience, and this pathway represented the largest standardized coefficient in the structural model (β = .590). This finding suggests that students who more effectively regulate their learning are also more capable of maintaining or recovering adaptive academic functioning when they encounter setbacks, pressure, or difficult learning conditions. The result is consistent with Arbazi and Sheikholeslami, who reported that academic self-regulation played an important role in the relationship between learning approaches and academic resilience (Arbazi & Sheikholeslami, 2024). It also aligns with findings showing that academic resilience is embedded within broader systems of metacognitive awareness, coping strategies, and adaptive regulation (Ebrahimi Ghavam et al., 2024). Similarly, Jahanbakhsh and Vafaeizadeh demonstrated that resilience can function as a mediating psychological mechanism linking regulatory processes to academic emotional outcomes (Jahanbakhsh & Vafaeizadeh, 2025). These studies collectively support the idea that academic resilience is partly grounded in students' capacity to regulate their responses to academic demands rather than being merely a stable personal characteristic.

This association can be explained by considering how self-regulated learners respond to academic difficulty. When such students experience a disappointing grade, complex assignment, examination pressure, or temporary failure, they are more likely to analyze the problem, adjust their strategy, regulate effort, seek useful resources, and continue pursuing their goals. These behaviors reduce the likelihood that academic difficulty will be interpreted as uncontrollable or final. In this sense, self-regulated learning provides the cognitive and behavioral architecture through which resilience can be enacted. Academic resilience itself has increasingly been conceptualized as an adaptive and context-sensitive process. Huang and Yan emphasized the temporal and agentic nature of academic resilience, showing that students actively negotiate constraints and mobilize resources over time (Huang & Yan, 2026). McMullin et al. similarly highlighted the importance of social support as a resource that strengthens academic resilience (McMullin et al., 2025), while Cai and Meng showed that resilience is meaningfully related to academic performance and can be supported through educational relationships (Cai & Meng, 2025). Thus, the present findings extend prior research by suggesting that internal regulatory capacities are also important resources through which students can sustain adaptive functioning under academic pressure.

The third finding showed that academic resilience had a significant positive direct effect on academic motivation (β = .244). This result indicates that students who are more capable of coping constructively with academic setbacks tend to maintain stronger motivation toward their studies. This relationship is consistent with the conceptualization of resilience as a mechanism that prevents temporary academic difficulties from developing into sustained disengagement. Guo et al. found that academic resilience contributed to learning engagement within a broader model involving teacher emotional support and academic self-efficacy (Guo et al., 2025). Koğar et al. similarly demonstrated a mediating role for academic resilience in relationships involving problematic smartphone use, test anxiety, and academic achievement (Koğar et al., 2025). Research has also shown that educational stress is meaningfully associated with academic motivation among secondary school students, suggesting that students' motivational functioning depends partly on how effectively they cope with educational pressure (Pali & Roshanfekr, 2025). The present results complement these findings by demonstrating that resilience is not only associated with achievement-related outcomes but also contributes directly to the motivational processes that sustain students' involvement in learning.

One possible explanation is that academically resilient students are more likely to perceive challenges as manageable and temporary rather than as evidence that further effort is futile. Such students may recover more quickly from poor performance, adapt to difficult educational demands, and remain committed to long-term academic objectives. Over time, repeated successful adaptation to difficulty may reinforce expectations that effort can produce improvement, thereby sustaining motivation. This interpretation is compatible with research showing that resilience interventions can be deliberately designed within educational environments (Napoli et al., 2025). It is also supported by studies indicating that resilience depends on combinations of internal and contextual resources. Lelis and Morales, for instance, linked academic resilience with personal resources and digital stress (Lelis & Morales, 2026), whereas McMullin et al. emphasized perceived social support as a catalyst for resilience (McMullin et al., 2025). These findings indicate

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that resilience can act as a protective psychological process through which students preserve academic functioning and motivation despite adversity.

The most important contribution of the present study concerns the significant mediating role of academic resilience in the relationship between self-regulated learning and academic motivation. The indirect effect of self-regulated learning on academic motivation through resilience was significant, and the bootstrap confidence interval excluded zero. This finding suggests that one reason self-regulated learners exhibit stronger academic motivation is that they are better equipped to cope adaptively with academic obstacles. In other words, self-regulation appears to generate not only immediate benefits for motivation but also a resilience-related pathway that helps protect motivation when students encounter difficulty. This result is theoretically consistent with research demonstrating mediation effects for resilience in other educational relationships. Jahanbakhsh and Vafaeizadeh identified resilience as a mediator between cognitive emotion regulation strategies and test anxiety (Jahanbakhsh & Vafaeizadeh, 2025), while Koğar et al. showed that resilience can mediate associations between student risk factors and academic achievement (Koğar et al., 2025). Guo et al. also placed academic resilience within a mediated model of teacher emotional support and engagement (Guo et al., 2025). Although these studies examined different antecedents and outcomes, they converge on the proposition that resilience can serve as a transmission mechanism through which personal or contextual resources are translated into more adaptive academic outcomes.

The partial rather than complete mediation observed in the present study is also theoretically meaningful. The persistence of a significant direct effect from self-regulated learning to academic motivation indicates that self-regulated learning influences motivation through mechanisms beyond academic resilience. For example, effective self-regulation may strengthen motivation by providing students with clearer goals, greater perceived control, more efficient learning strategies, and more frequent experiences of academic progress. At the same time, part of its effect appears to operate through strengthening students' ability to withstand and recover from educational adversity. This dual pathway is compatible with contemporary models that conceptualize motivation as an outcome of interconnected intrapersonal and interpersonal processes rather than a single psychological cause. Liem's interpersonal perspective emphasizes the relational and interdependent nature of academic motivation (Liem, 2026), while Andreadis and Marshall showed that belongingness and social identity can contribute to academic motivation alongside personal psychological processes (Andreadis & Marshall, 2025). Longakit et al. similarly demonstrated that motivational processes can transmit the effects of supportive educational relationships to engagement (Longakit et al., 2025). Accordingly, the 42% explained variance in academic motivation found in the present study is substantial, while also indicating that other individual, family, peer, teacher, and school-level variables remain relevant.

The findings may be particularly important in the context of upper secondary education because students at this stage face simultaneous developmental and academic pressures. They are expected to manage increasingly complex learning tasks while preparing for examinations and making consequential educational decisions. Under these circumstances, motivation may be difficult to sustain if students lack either the regulatory skills required to organize their learning or the resilience needed to persist when those efforts are disrupted. Sun and Zhang showed that self-regulated learning operates through interconnected academic emotional processes among adolescents (Sun & Zhang, 2026), emphasizing that regulatory competence can influence educational functioning through multiple psychological pathways. Likewise, research on motivational processes suggests that academic motivation reflects the joint influence of competence-related beliefs, learning contexts, and adaptive engagement (Aslam et al., 2025; Kurniasih et al., 2025; Murcia Murcia et al., 2025). The present study adds to this literature by showing that, among upper secondary school students in Babolsar, academic resilience constitutes a meaningful mechanism connecting self-regulated learning with academic motivation.

Overall, the results support a process-oriented model of student motivation in which self-regulated learning serves as a foundational academic resource and academic resilience functions as an adaptive pathway through which part of its motivational influence is transmitted. Students who plan, monitor, regulate, and evaluate their learning appear more capable of responding adaptively to educational adversity, and this greater resilience is associated with stronger academic motivation. The findings therefore integrate two important strands of educational psychology: research emphasizing students' capacity to regulate learning and research emphasizing their capacity to adapt to academic adversity. Rather than treating these capacities as independent, the present results suggest that they operate

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sequentially and interactively. This interpretation is consistent with contemporary educational research that increasingly models learning as a coordinated system of regulation, motivation, emotion, resilience, and contextual support (Cai & Meng, 2025; Ebrahimi Ghavam et al., 2024; Toprak & Yavuz, 2026). Consequently, strengthening students' self-regulatory capacities may have broader effects than improving learning strategies alone, because these capacities may also contribute to the development of resilience and, through resilience, to the preservation of academic motivation.

A number of limitations should be considered when interpreting the findings. First, the correlational and cross-sectional design does not permit definitive causal conclusions regarding the direction of the relationships among self-regulated learning, academic resilience, and academic motivation. Although structural equation modeling permits simultaneous examination of theoretically specified direct and indirect effects, alternative causal directions cannot be ruled out. Second, the study relied entirely on self-report questionnaires, which may be affected by social desirability, response tendencies, or differences in students' self-awareness. Third, the sample was limited to upper secondary school students in Babolsar, which may restrict generalizability to students in other cities, educational systems, age groups, or sociocultural contexts. Fourth, variables such as family socioeconomic status, parental support, teacher behavior, classroom climate, academic achievement, school type, and previous academic experiences were not incorporated into the model. Finally, the study assessed the major constructs at a single point in time and therefore could not capture possible changes in regulatory behavior, resilience, or motivation across an academic year or during periods of heightened examination pressure.

Future research should examine the proposed relationships using longitudinal, prospective, and experimental designs in order to clarify temporal ordering and strengthen causal interpretation. Longitudinal studies could investigate whether improvements in self-regulated learning precede increases in academic resilience and whether such changes subsequently predict sustained academic motivation over semesters or school years. Future studies should also replicate the structural model in larger and more diverse samples from different geographical regions, school types, socioeconomic backgrounds, and educational levels. Including objective or multi-informant indicators, such as academic grades, teacher ratings, behavioral measures of study regulation, or digital learning traces, could reduce reliance on self-report data. Researchers may also extend the model by examining contextual variables such as teacher emotional support, parental involvement, peer support, classroom climate, academic stress, and perceived autonomy support. Comparative analyses across gender, grade level, and academic track may further determine whether the structural pathways operate similarly across student subgroups.

From a practical perspective, schools and educational counselors can use the findings to design programs that simultaneously strengthen students' self-regulated learning skills and their capacity to cope constructively with academic setbacks. Training can focus on goal setting, realistic academic planning, time management, monitoring comprehension, selection of effective cognitive and metacognitive strategies, regulation of effort, reflection on performance, and flexible modification of ineffective study methods. Resilience-oriented components can additionally teach students to interpret setbacks as manageable, identify alternative responses to academic problems, seek appropriate support, and maintain commitment to educational goals under pressure. Teachers can reinforce these skills by providing structured opportunities for reflection, encouraging strategic rather than purely outcome-based learning, and creating classroom environments in which temporary failure is treated as part of the learning process. School counselors can identify students who demonstrate weak self-regulation or difficulty recovering from academic setbacks and provide targeted individual or group-based support before persistent motivational disengagement develops.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent.

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