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The Mediating Role of Basic Psychological Needs Satisfaction in the Relationship Between Metacognitive Beliefs and Learning Motivation in Adolescents

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A B S T R A C T

Purpose: The present study aimed to investigate the mediating role of basic psychological needs satisfaction in the relationship between metacognitive beliefs and learning motivation among adolescents.

Methods and Materials: This study employed a descriptive-correlational design using Structural Equation Modeling (SEM). The statistical population consisted of all high school students in Shiraz during the 2025–2026 academic year. A total of 321 students were selected through multi-stage cluster random sampling. Data were collected using the Metacognitive Beliefs Questionnaire, the Basic Psychological Needs Satisfaction Scale, and the Learning Motivation Questionnaire. Descriptive statistics, Pearson correlation coefficients, path analysis, Maximum Likelihood estimation, and bootstrapping with 5,000 samples were conducted using SPSS-26 and AMOS-24 software. The proposed model examined the direct and indirect relationships among positive and negative metacognitive beliefs, autonomy, competence, relatedness, and learning motivation.

Findings: The findings indicated that the proposed model demonstrated an acceptable fit with the data. Negative metacognitive beliefs had significant negative effects on autonomy, competence, and relatedness, whereas positive metacognitive beliefs significantly predicted autonomy and relatedness. Autonomy and relatedness significantly predicted learning motivation, but competence did not show a significant direct effect on motivation. Bootstrapping analyses revealed that autonomy and relatedness significantly mediated the relationship between negative metacognitive beliefs and learning motivation. Specifically, increases in negative metacognitive beliefs were associated with lower autonomy and relatedness, which subsequently reduced learning motivation. However, competence did not mediate the relationship between negative metacognitive beliefs and learning motivation. Furthermore, none of the indirect paths associated with positive metacognitive beliefs were statistically significant.

Conclusion: The findings suggest that maladaptive metacognitive beliefs undermine adolescents' learning motivation primarily through the frustration of autonomy and relatedness needs.

Keywords: *Metacognitive beliefs, Basic psychological needs satisfaction, Learning motivation, Students*

1. Introduction

Learning motivation is recognized as one of the most influential psychological determinants of academic achievement and educational success. Educational psychologists have consistently emphasized that motivated learners demonstrate greater persistence, cognitive engagement, and adaptability in the face of academic challenges, leading to enhanced academic performance and psychological well-being (Vu et al., 2022; Wang et al., 2026). Motivation is not merely a transient emotional state; rather, it is a dynamic psychological process that directs, energizes, and sustains goal-oriented learning behaviors over time. In contemporary educational systems, especially amid rapidly changing technological and social conditions, fostering students' motivation has become a central concern for educators, policymakers, and researchers (Chiu et al., 2021; Sun & Pan, 2021). Adolescence, as a developmental period characterized by substantial cognitive, emotional, and social changes, represents a particularly sensitive stage for the development or decline of learning motivation. During this period, motivational patterns can significantly shape academic trajectories, self-concept, and future educational aspirations (Grassinger et al., 2024; Rentzios et al., 2025).

Recent developments in educational psychology suggest that learning motivation is influenced by a broad range of cognitive, emotional, social, and contextual variables. Studies have shown that self-efficacy, emotional intelligence, classroom engagement, academic emotions, and self-regulation processes are among the strongest predictors of students' motivational functioning (Chang & Tsai, 2022; Liu & Sun, 2025). Furthermore, technological transformations in educational settings, particularly the expansion of online and hybrid learning environments, have altered the mechanisms through which motivation is maintained and regulated (Chiu et al., 2021; Zhou & Li, 2023). Researchers have therefore increasingly focused on identifying internal psychological mechanisms that enable students to sustain motivation despite environmental and emotional challenges. Among these mechanisms, metacognition and basic psychological needs satisfaction have emerged as two highly influential constructs in explaining motivational processes (Singh & Muis, 2024; Vansteenkiste et al., 2020).

Metacognition refers to the awareness, monitoring, and regulation of one's cognitive processes. It encompasses beliefs and judgments individuals hold about their thinking, memory, attention, and learning capacities (Hulbig, 2026; Yang & Luo, 2025). Metacognitive beliefs are particularly important because they shape how individuals interpret cognitive experiences, manage academic challenges, and regulate emotional responses during learning activities. Positive metacognitive beliefs generally involve confidence in the usefulness and controllability of cognitive strategies, whereas negative metacognitive beliefs are associated with perceptions of uncontrollability, cognitive inadequacy, and danger related to thoughts and emotions (Keen et al., 2022; Mansueto et al., 2022). These beliefs influence not only academic functioning but also emotional adjustment and psychological resilience across various contexts (Andersson et al., 2025; Palmieri et al., 2021).

A growing body of literature has emphasized the critical role of metacognition in academic settings. Students with stronger metacognitive capacities tend to exhibit better self-regulated learning, more adaptive learning strategies, greater persistence, and higher levels of intrinsic motivation (Katsantonis & McLellan, 2023; Sheffler et al., 2022). Metacognitive awareness enables learners to monitor their progress, evaluate the effectiveness of learning strategies, and make necessary adjustments to improve performance. Such processes contribute directly to enhanced academic engagement and sustained motivation (Urban & Urban, 2025; Wei et al., 2024). In contrast, maladaptive metacognitive beliefs can interfere with effective learning by promoting repetitive negative thinking, cognitive anxiety, avoidance behaviors, and emotional distress (Quan & Zettle, 2023; Rawat et al., 2023). Negative metacognitive beliefs have been associated with academic procrastination, test anxiety, emotional dysregulation, and burnout, all of which undermine motivational functioning (Hosseini-Adl & Khoshlahjeh Sedgh, 2023; Huntley et al., 2023; Pormousa Bozanjani et al., 2022).

Research on metacognition has expanded significantly in recent years due to its relevance across educational and clinical domains. Meta-analytic and systematic review studies have demonstrated that interventions targeting maladaptive metacognitive beliefs can significantly improve psychological functioning, emotional regulation, and cognitive flexibility (Andersson et al., 2025; Zanini et al., 2025). Similarly, mindfulness-based cognitive interventions, which often involve metacognitive components, have shown positive effects on mental health and self-regulation capacities (Gkintoni et al., 2025). The neurological foundations of metacognition have also attracted scholarly attention. Contemporary neuroscientific evidence suggests that metacognitive processes are closely linked to prefrontal

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cortical functioning and executive control systems that regulate attention, planning, and decision-making (Hulbig, 2026). These findings indicate that metacognitive beliefs may exert substantial influence on motivational and learning processes during adolescence, a developmental stage characterized by ongoing maturation of executive cognitive systems.

Within educational contexts, several studies have specifically examined the relationship between metacognition and learning motivation. Teng and Yang demonstrated that metacognitive awareness positively predicts online learning achievement through self-efficacy and motivation mechanisms (Teng & Yang, 2023). Similarly, Feng Teng reported reciprocal longitudinal relationships among metacognition, self-efficacy beliefs, and language learning motivation in online educational environments (Feng Teng, 2025). Shin et al. also found that metacognitive scaffolding significantly improved learners' transfer performance and academic motivation in programming education (Shin et al., 2024). Rashidi et al. further showed that training cognitive and metacognitive self-regulated learning strategies enhanced students' academic motivation and mental health (Rashidi et al., 2023). Collectively, these studies suggest that metacognitive functioning plays an essential role in facilitating adaptive motivational processes in educational settings.

Nevertheless, the relationship between metacognitive beliefs and learning motivation cannot be fully understood without considering motivational theories that explain the underlying psychological mechanisms of human behavior. One of the most influential frameworks in this regard is Self-Determination Theory and its sub-theory, Basic Psychological Needs Theory (Vansteenkiste et al., 2020). According to this framework, all individuals possess three innate and universal psychological needs: autonomy, competence, and relatedness. The satisfaction of these needs promotes intrinsic motivation, psychological growth, well-being, and adaptive functioning, whereas frustration of these needs contributes to maladjustment and motivational decline (Sohrabi et al., 2021; Tang et al., 2020).

Autonomy refers to the experience of volition, self-direction, and personal agency in one's behaviors and decisions. Competence reflects the need to feel effective, capable, and successful in interacting with environmental demands. Relatedness involves feelings of belonging, social connection, and emotional support from significant others (Vansteenkiste et al., 2020). Educational research consistently demonstrates that students whose psychological needs are satisfied exhibit greater intrinsic motivation, stronger academic engagement, and higher educational achievement (Askari & Sodoghi, 2020; Bouten et al., 2025). Conversely, environments characterized by excessive control, social isolation, or feelings of incompetence tend to reduce students' academic motivation and emotional well-being (Grassinger et al., 2024; Xu et al., 2023).

The importance of basic psychological needs satisfaction in academic settings has been widely documented. Askari and Sodoghi found that intrinsic motivation mediated the relationship between psychological needs satisfaction and academic engagement among university students (Askari & Sodoghi, 2020). Miralles-Armenteros et al. reported that mindfulness and compassion enhanced academic engagement by promoting satisfaction of psychological needs (Miralles-Armenteros et al., 2021). Similarly, Elphinstone et al. demonstrated that mindful awareness and nonattachment were associated with greater autonomous motivation and psychological needs satisfaction (Elphinstone et al., 2021). Grassinger et al. further highlighted the reciprocal relationship between intrinsic motivation and well-being at school, emphasizing the central role of supportive educational environments (Grassinger et al., 2024). These findings collectively suggest that psychological needs satisfaction functions as a core motivational mechanism within academic contexts.

Recent studies have increasingly explored the interactions among metacognition, psychological needs, and motivational processes. Evidence suggests that positive metacognitive beliefs are associated with higher levels of autonomy and competence because students who perceive themselves as capable of regulating thoughts and learning strategies tend to experience greater self-control and effectiveness (Lee et al., 2024; Urban & Urban, 2025). Furthermore, adaptive metacognitive functioning may enhance social confidence and relatedness by reducing fear of evaluation and interpersonal anxiety (Gkintoni et al., 2025). In contrast, maladaptive metacognitive beliefs may frustrate psychological needs through persistent worry, cognitive self-doubt, and emotional dysregulation (Andersson et al., 2025; Quan & Zettle, 2023). Negative beliefs regarding the uncontrollability or danger of thoughts can lead to avoidance, decreased autonomy, diminished competence perceptions, and weakened social belongingness (Rakitzi, 2023; Rawat et al., 2023).

Theoretical perspectives also support the possibility that psychological needs satisfaction mediates the relationship between metacognitive beliefs and learning motivation.

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Students who hold adaptive metacognitive beliefs may experience greater control over their learning processes, which enhances autonomy and competence and subsequently increases intrinsic motivation (Singh & Muis, 2024). Likewise, students with lower cognitive anxiety and more adaptive self-regulatory beliefs may experience stronger social connectedness and engagement in educational environments (Bouten et al., 2025). On the other hand, students with dysfunctional metacognitive beliefs may experience motivational difficulties because their unmet psychological needs reduce emotional security, persistence, and academic involvement (Keen et al., 2022; Mansueto et al., 2022).

Despite the increasing attention devoted to these variables, several important gaps remain in the literature. First, many previous studies have examined metacognition, psychological needs, or learning motivation independently rather than within an integrated explanatory model (Supriadi & Suherman, 2024; Vu et al., 2022). Second, existing studies have predominantly focused on university populations, whereas relatively limited research has investigated these relationships among adolescents in secondary educational settings (Khamedi et al., 2020; Naeimi, 2023). Adolescence is a critical developmental period in which cognitive regulation, identity formation, emotional functioning, and motivational orientations undergo substantial transformation; therefore, understanding motivational determinants during this stage is particularly important (Wang et al., 2026). Third, although studies have demonstrated associations among metacognition, self-regulation, motivation, and emotional functioning, few investigations have specifically explored the mediating role of basic psychological needs satisfaction in the relationship between metacognitive beliefs and learning motivation (Codina et al., 2024; Sheikhiani Khah & Bakhshi Sooreshjani, 2025).

Moreover, contemporary educational contexts characterized by technological changes, increasing academic pressure, and emotional challenges have intensified the need to identify protective psychological mechanisms that support students' motivation and well-being (Tsai et al., 2024; Zhou & Li, 2023). Understanding how metacognitive beliefs influence learning motivation through satisfaction or frustration of psychological needs may provide valuable implications for educational interventions, counseling programs, and motivational enhancement strategies. Educational systems that foster adaptive metacognitive functioning while simultaneously supporting students' autonomy, competence, and relatedness may be more effective in promoting long-term academic engagement and psychological resilience (Flunger et al., 2024; Kong, 2021).

Given these theoretical and empirical considerations, the present study aimed to investigate the mediating role of basic psychological needs satisfaction in the relationship between metacognitive beliefs and learning motivation among adolescents.

2. Methods and Materials

2.1. Study Design and Participants

The present study was applied in terms of purpose and descriptive-correlational in terms of methodology, utilizing Structural Equation Modeling (SEM). The primary objective of the research was to investigate the mediating role of basic psychological needs satisfaction in the effect of metacognitive beliefs on learning motivation. The statistical population of this study comprised all high school students in Shiraz during the academic year 2025–2026. To select the sample, a multi-stage cluster sampling method was employed. Given the large size of the statistical population and using Morgan's table (1970), 330 students were selected as the sample. The sampling procedure was conducted as follows: initially, districts 2 and 4 of Shiraz's Department of Education were selected from the four districts of the city; subsequently, all high schools in these two districts were listed separately; ten schools were selected from these lists, and then four classes were chosen from each school. Finally, paper-and-pencil questionnaires were distributed to the participants. Nine questionnaires were excluded due to illegibility, and ultimately, 321 questionnaires were subjected to analysis.

Every study has specific inclusion and exclusion criteria for its statistical sample. The primary inclusion criterion for this study was the full consent of participants to complete the questionnaires. Exclusion criteria included unwillingness to complete the questionnaires, illegible or incomplete responses, and the participation of students from other universities.

In the first stage, the researchers prepared the questionnaires and arranged them in a specific order. Specifically, the Metacognitive Beliefs Questionnaire, which contained fewer items, was presented first. This was followed by the Learning Motivation Questionnaire, which was longer, and finally, the Basic Psychological Needs Satisfaction Questionnaire, which was the shortest

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instrument. This arrangement was designed to minimize student fatigue during the response process and to enhance the accuracy and quality of the collected data.

Subsequently, the researchers contacted the administrators of the selected schools and fully explained the objectives of the study to them. After highlighting the importance and necessity of conducting the research, the administrators agreed to the study and permitted the distribution of the questionnaires. The questionnaires were designed with clear and precise instructions to ensure that students could answer the items without ambiguity. Additionally, these instructions were verbally explained to the students prior to starting the questionnaire. On the scheduled day, the researchers visited the schools, provided necessary explanations regarding the study's objectives and the method of completing the questionnaires, and distributed them among the students. A response time of 45 minutes was allocated for all participants to ensure uniform testing conditions.

The researchers ensured that all students participated in the study with full awareness and voluntary consent. It was emphasized that participation was entirely optional, and students who wished to do so could withdraw at any time. Furthermore, if participants chose to withdraw during the questionnaire completion process, they were permitted to return their questionnaires without any concerns. In adherence to ethical research principles, participants were informed that providing identifying information was unnecessary, and all collected data would be kept strictly confidential. Throughout the response process, the researchers were present on-site to provide necessary guidance in case of any questions or ambiguities. To maintain scientific integrity and transparency in the execution, school administrators and officials ensured that the questionnaires were solely intended to investigate topics related to the study's objectives. Finally, the completed questionnaires were collected and stored with full confidentiality.

In this research, the Metacognitive Beliefs Questionnaire by Wells (1997), the Basic Psychological Needs Satisfaction Scale by Deci & Ryan (2000), and the Learning Motivation Questionnaire by Tuan et al. (2006) were used to measure the research variables. These questionnaires consisted of two sections: the first section covered demographic variables such as gender and age, while the second section comprised the main items of the questionnaires. Details regarding each of the questionnaires are provided below.

2.2. Measures

Metacognitive Beliefs Questionnaire (Wells, 1997): The Metacognitive Beliefs Questionnaire by Wells (1997, as cited in Wells & Cartwright-Hatton, 2004) is a 30-item self-report instrument designed to assess individuals' beliefs about their thoughts and mental worries. The initial version of this questionnaire consisted of 65 items, which were reduced to 30 items after multiple revisions. Its primary purpose is to examine worries and intrusive thoughts within the framework of Wells and Matthews' Self-Regulatory Executive Function model (Bahmanfar, 2019). Responses are scored on a four-point Likert scale ranging from "strongly disagree" to "strongly agree." This tool comprises five subscales: positive beliefs about worry, negative beliefs about the uncontrollability and danger of thoughts, beliefs regarding cognitive confidence, global negative beliefs (such as excessive responsibility and superstitions), and cognitive self-awareness. However, in some analyses, these subscales are reduced to two main components: positive beliefs (items 1, 7, 10, 19, 23, 28) and negative beliefs (items 2, 4, 9, 11, 15, 21, 8, 14, 17, 24, 26, 29, 6, 13, 20, 22, 25, 27, 3, 5, 10, 12, 16, 18, and 30). The Persian version of this questionnaire was translated and validated by Shirinzadeh et al. (2008), reporting a Cronbach's alpha coefficient of 0.91 for the total scale in the Iranian sample, and between 0.71 and 0.87 for the subscales. Furthermore, its construct validity was confirmed through factor analysis, showing significant correlations with instruments measuring anxiety, worry, and obsessive-compulsive tendencies (Bahmanfar, 2019; Hosseini-Adl & Khoshlahjeh Sedgh, 2023). The reliability of the test in the study by Hosseini-Adl & Khoshlahjeh Sedgh (2023) yielded a Cronbach's alpha of 0.80 for the total scale score. In the present study, the reliability of the questionnaire was found to be 0.81 using Cronbach's alpha.

Basic Psychological Needs Satisfaction Questionnaire (Deci & Ryan, 2000): This scale, designed based on Self-Determination Theory by Deci and Ryan (2000), consists of 21 items and assesses the satisfaction of basic psychological needs using a 7-point Likert scale (ranging from "strongly disagree" = 1 to "strongly agree" = 7). The instrument comprises three main components: autonomy (items 1, 4, 8, 11, 14, 17, and 20), competence (items 3, 5, 10, 13, and 19), and relatedness (items 2, 6, 7, 9, 12, 16, 18, and 21). Deci and Ryan (2000) reported a mean reliability coefficient of 0.89 for all three subscales, with Cronbach's alpha coefficients of 0.61 for autonomy, 0.71 for competence, and

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0.86 for relatedness. In the study by Besharat (2013), the construct validity of this scale was examined using exploratory factor analysis and the principal component analysis method. The results indicated that the questionnaire items could explain 53.60% of the variance in basic psychological needs. Furthermore, in the same study, the internal consistency of the general basic needs satisfaction scale was calculated using Cronbach's alpha, yielding correlation coefficients between 0.83 and 0.91, indicating the desirable validity of this instrument. In the research by Sheikhiani Khah & Bakhshi Sooreshjani (2025), reliability was assessed using Cronbach's alpha, resulting in coefficients of 0.73 for autonomy, 0.86 for competence, 0.79 for relatedness, and 0.78 for the total score. In the present study, the reliability of the questionnaire for the components of autonomy, competence, relatedness, and the total score was found to be 0.79, 0.70, 0.71, and 0.85, respectively, using Cronbach's alpha.

Learning Motivation Questionnaire (Tuan et al., 2006): The Science Learning Motivation Assessment Scale was designed by Tuan et al. in 2006 to evaluate the level of students' motivation for learning. This instrument comprises 35 items covering six psychological subscales: self-efficacy (items 1–7), active learning strategies (items 8–15), value of learning science (items 16–20), performance goals (items 21–24), achievement goals (items 25–29), and learning environment stimulation (items 30–35). The scale is scored using a five-point Likert scale ranging from "strongly disagree" (score 1) to "strongly agree" (score 5). Higher scores on each component or the total scale indicate a higher level of learning motivation in the participant. The validity and reliability of this tool have been confirmed in numerous domestic and international studies. Tuan et al. (2006) reported a Cronbach's alpha coefficient of 0.89 for the reliability of this questionnaire. Furthermore, Zare & Bakhshesh (2013) translated and standardized this questionnaire in Iran. In their study involving two sample groups of Payame Noor University students, they reported Cronbach's alpha and Guttman split-half coefficients of 0.83 and 0.87, respectively. A test-retest correlation coefficient of 0.66 was obtained after a two-week interval. Additionally, Naeimi (2023) reported a reliability coefficient of 0.93 in their study, indicating the high validity of this tool for assessing learning motivation in Iranian students. In the present study, the reliability of the questionnaire for the components of self-efficacy, active learning strategies, value of learning science, performance goals, achievement goals, learning environment stimulation, and the total score was found to be 0.79, 0.85, 0.78, 0.70, 0.70, 0.73, and 0.84, respectively, using Cronbach's alpha.

2.3. Data Analysis

The collected data were analyzed using both descriptive and inferential statistics. In the descriptive section, mean, standard deviation, minimum and maximum scores, skewness, and kurtosis of the study variables were examined. In the inferential section, the data obtained from the questionnaires were analyzed using path analysis, Maximum Likelihood estimation, and bootstrapping with 5,000 samples, employing SPSS-26 and AMOS-24 software, to test the research hypotheses.

3. Findings and Results

The total number of participants in this study was 321, with ages ranging from 14 to 18 years. The age distribution was as follows: 14-year-olds (n=14, 1.2%), 15-year-olds (n=95, 29.6%), 16-year-olds (n=95, 29.6%), 17-year-olds (n=88, 27.4%), and 18-year-olds (n=39, 12.1%). Regarding gender, 154 participants (47.97%) were female, and 167 participants (52.02%) were male. Prior to the main analyses, several preliminary analyses were conducted to gain initial insights into the data. The descriptive findings, including means, standard deviations, minimum and maximum scores, skewness, and kurtosis, are presented in Table 1.

Table 1

Descriptive Indices of the Research Variables

Variables	Mean	SD	Minimum	Maximum	Skewness	Kurtosis
Negative beliefs	9.35	3.34	5	19	0.34	-0.55
Positive beliefs	13.85	3.10	4	14	-0.08	-0.19
Autonomy	21.56	2.97	3	10	-0.32	0.63
Competence	13.22	2.12	3	12	-0.56	0.06
Relatedness	20.99	3.56	5	16	-0.42	0.32
Learning motivation	134.19	13.07	14	50	0.07	-0.03

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Based on the data in Table 1, the skewness and kurtosis values for all variables fall within the range of -2 to +2, indicating that the distribution of scores does not significantly deviate from a normal distribution. Further checks of assumptions revealed that the tolerance values for the variables ranged from 0.67 to 0.82, and the Variance Inflation Factor (VIF) ranged from 1.21 to 1.46. Consequently, none of the tolerance values were below the acceptable threshold of 0.10, and none of the VIF values exceeded the acceptable limit of 10. Given that multiple collinearity was not observed among the predictor variables, parametric tests such as Pearson correlation coefficients and Structural Equation Modeling (SEM) can be appropriately employed, and their results are considered reliable. Furthermore, the Durbin-Watson statistic was calculated at 1.72, which falls within the acceptable range of 1.5 to 2.5, indicating the independence of errors and supporting the use of SEM.

One of the key assumptions in structural equation modeling is the existence of significant correlations between variables, the results of which are presented in Table 2.

Table 2

Correlation Matrix of the Research Variables

Variables	1	2	3	4	5	6
1.Negative beliefs	1					
2.Positive beliefs	-0.08	1				
3.Autonomy	0.16**	-0.33**	1			
4.Competence	0.10	-0.42**	0.51**	1		
5.Relatedness	0.12*	-0.35**	0.58**	0.46**	1	
6.Learning motivation	0.07	-0.53**	0.46**	0.62**	0.45**	1

**p < 0.01 , *p<0.05

As shown in Table 2, positive metacognitive beliefs had a significant positive relationship with autonomy (r = 0.16, p < 0.01) and relatedness (r = 0.12, p < 0.05). Furthermore, negative metacognitive beliefs had a significant negative relationship with autonomy (r = -0.33, p < 0.01), competence (r = -0.42, p < 0.01), and relatedness (r = -0.35, p < 0.01). Additionally, learning motivation showed a significant positive relationship with autonomy (r = 0.46, p < 0.01), competence (r = 0.62, p < 0.01), and relatedness (r = 0.62, p < 0.01), and a significant negative relationship with negative metacognitive beliefs (r = -0.53, p < 0.01). No significant relationships were observed among the other research variables.

To evaluate the proposed model, Structural Equation Modeling (SEM) was employed. All analyses were conducted using AMOS-24 software. To test the fit of the proposed model to the data, the following indices were used: Chi-square (χ^2), Normalized Chi-square (χ^2/df), Goodness-of-Fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), Normed Fit Index (NFI), Comparative Fit Index (CFI), Incremental Fit Index (IFI), and Root Mean Square Error of Approximation (RMSEA). The proposed model in this study includes the variables of positive beliefs, negative beliefs, autonomy, competence, relatedness, and learning motivation. Prior to examining the structural coefficients, the fit of the main model was assessed. Figure 1 illustrates the proposed model in its standardized form. In this research, some items from all questionnaires were excluded from the analysis due to low factor loadings. The remaining items included in the proposed model are presented below.

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Figure 1

Proposed model of the study

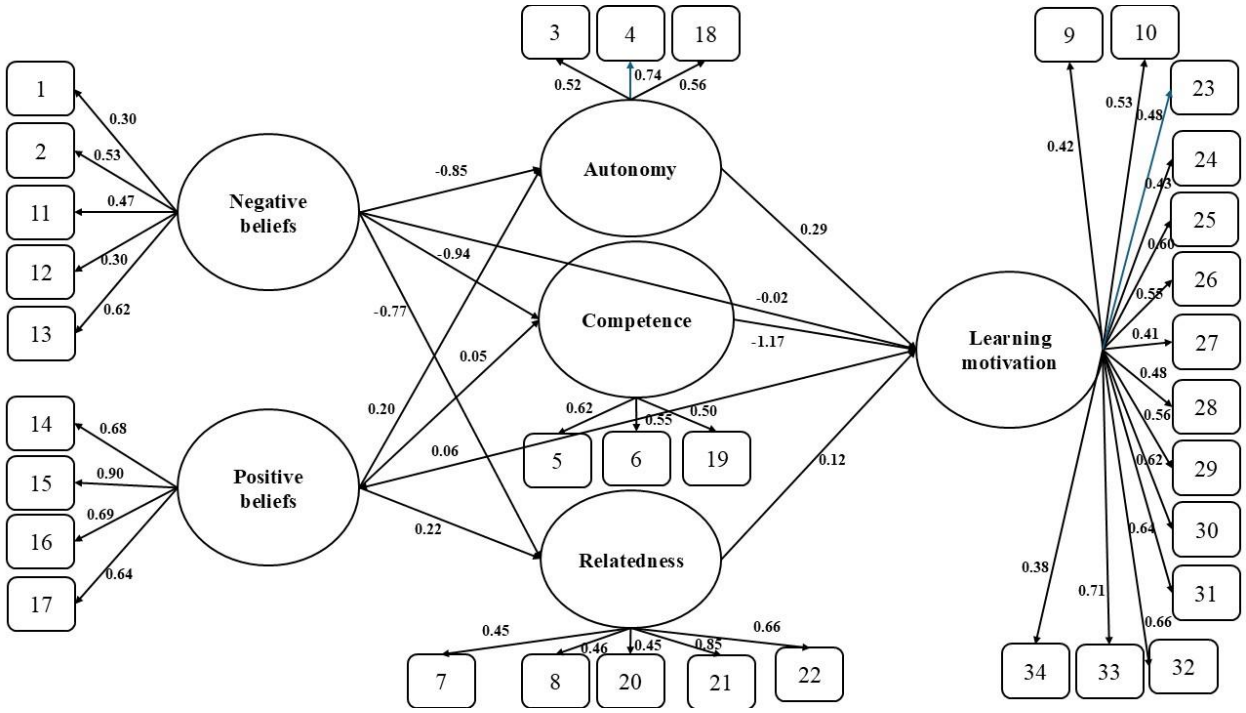

Table 3 shows the fit of the proposed model to the data based on the fit indices.

Table 3

Fit of the Proposed Model to the Data Based on Fit Indices

Indices	X^2	df	X^2/df	GFI	AGFI	NFI	CFI	IFI	RMSEA
Proposed Model	1242.14	442	2.81	0.83	0.78	0.76	0.82	0.83	0.07

As shown in Table 3, all fit indices fall within the acceptable ranges; therefore, it can be concluded that the proposed model demonstrates a good fit. Subsequently, the direct paths of the research model were examined, and the findings are presented in Table 4.

Table 4

Standardized Coefficients of the Direct Paths in the Proposed Research Model

Path			Estimate	SD	Critical Ratio	P
Negative Belief	→	Autonomy	-0.85	0.35	-4.35	0.000
Positive Belief	→	Autonomy	0.20	0.07	4.06	0.000
Positive Belief	→	Competence	0.05	0.04	1.80	0.06
Positive Belief	→	Relatedness	0.22	0.06	4.54	0.000
Negative Belief	→	Competence	-0.94	0.27	-4.25	0.000
Negative Belief	→	Relatedness	-0.77	0.28	-4.18	0.000
Autonomy	→	Learning Motivation	0.29	0.18	3.35	0.000
Negative Belief	→	Learning Motivation	-0.02	33.08	-0.25	0.79
Competence	→	Learning Motivation	-1.17	27.94	-0.29	0.77
Positive Belief	→	Learning Motivation	0.06	2.33	0.24	0.80
Relatedness	→	Learning Motivation	0.12	0.20	3.30	0.000

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As shown in Table 4, the paths from negative beliefs to autonomy (β=−0.85,p<0.001), positive beliefs to autonomy (β=0.20,p<0.001), positive beliefs to relatedness (β=0.22,p<0.001), negative beliefs to competence (β=−0.94,p<0.001), autonomy to learning motivation (β=0.26,p<0.001), negative beliefs to relatedness (β=−0.77,p<0.001), and relatedness to learning motivation (β=0.12,p<0.001) were statistically significant. However, the paths from positive beliefs to competence (β=0.05,p=0.06), negative beliefs to learning motivation (β=−0.02,p=0.79), competence to learning motivation (β=−0.17,p=0.77), and positive beliefs to learning motivation (β=0.06,p=0.80) were not statistically significant. Subsequently, the indirect paths of the proposed model were examined using bootstrapping.

Table 5

Bootstrapping Results

Path					Data	Upper Limit	Lower Limit	P
Positive Belief	→	Autonomy	→	Learning Motivation	0.05	0.07	-0.02	0.36
Positive Belief	→	Competence	→	Learning Motivation	0.05	0.06	-0.05	0.87
Positive Belief	→	Relatedness	→	Learning Motivation	0.02	0.07	-0.02	0.4
Negative Belief	→	Autonomy	→	Learning Motivation	-0.24	0.52	0.23	0.000
Negative Belief	→	Competence	→	Learning Motivation	-0.11	0.22	-0.14	0.43
Negative Belief	→	Relatedness	→	Learning Motivation	-0.33	0.50	0.21	0.000

As shown in Table 5, the indirect effect of negative beliefs on learning motivation, mediated by autonomy, was -0.24, and the indirect effect of negative beliefs on learning motivation, mediated by relatedness, was -0.33. This indicates that negative metacognitive beliefs indirectly lead to a decrease in learning motivation through the mediating variables (autonomy and relatedness). This negative effect suggests that as negative metacognitive beliefs increase, autonomy, relatedness, and learning motivation decrease. Furthermore, since the confidence intervals (upper and lower bounds) for these indirect paths do not include zero, these indirect paths are statistically significant.

However, given that the significance levels for the indirect effects of positive beliefs on learning motivation mediated by autonomy, positive beliefs on learning motivation mediated by competence, positive beliefs on learning motivation mediated by relatedness, and negative beliefs on learning motivation mediated by competence are greater than 0.05, the aforementioned paths are not statistically significant.

4. Discussion and Conclusion

The present study aimed to investigate the mediating role of basic psychological needs satisfaction in the relationship between metacognitive beliefs and learning motivation among adolescents. The findings demonstrated that negative metacognitive beliefs had significant negative direct effects on autonomy, competence, and relatedness, while autonomy and relatedness significantly predicted learning motivation. Furthermore, the indirect paths from negative metacognitive beliefs to learning motivation through autonomy and relatedness were statistically significant. However, competence did not mediate the relationship between negative metacognitive beliefs and learning motivation, and none of the indirect paths associated with positive metacognitive beliefs reached statistical significance. Overall, the findings suggest that maladaptive metacognitive beliefs undermine learning motivation primarily through the frustration of students' autonomy and relatedness needs.

One of the major findings of the present study was that autonomy mediated the relationship between negative metacognitive beliefs and learning motivation. This finding is consistent with the principles of Self-Determination Theory, which emphasizes autonomy as a core psychological prerequisite for intrinsic motivation and adaptive educational functioning (Tang et al., 2020; Vansteenkiste et al., 2020). Negative metacognitive beliefs involve perceptions that thoughts are uncontrollable, dangerous, or cognitively overwhelming, leading individuals to feel powerless in managing internal experiences (Keen et al., 2022; Mansueto et al., 2022). Such cognitive experiences reduce individuals' sense of personal agency and volitional control, thereby weakening autonomy. When students believe they cannot effectively regulate their thoughts or learning-related anxieties, they are less likely to experience ownership over academic tasks and educational decisions. This diminished sense of autonomy subsequently reduces learning motivation because students no longer

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perceive themselves as active and competent participants in the learning process (Flunger et al., 2024).

These findings align with previous research indicating that maladaptive metacognitive beliefs are associated with reduced psychological well-being and motivational functioning (Andersson et al., 2025; Quan & Zettle, 2023). Gkintoni et al. argued that dysfunctional metacognitive patterns interfere with emotional regulation and cognitive flexibility, thereby impairing adaptive motivational processes (Gkintoni et al., 2025). Similarly, Yang and Luo highlighted the close relationship between metacognitive functioning and cognitive self-regulation in educational settings (Yang & Luo, 2025). The present findings also support research demonstrating that autonomy-supportive environments promote intrinsic motivation, persistence, and academic engagement (Askari & Sodoghi, 2020; Elphinstone et al., 2021). Therefore, students with high levels of negative metacognitive beliefs may experience reduced learning motivation because they perceive themselves as lacking control over both their cognition and educational experiences.

From a cognitive perspective, autonomy reflects not only behavioral freedom but also psychological ownership over learning activities. Students with maladaptive metacognitive beliefs may become excessively preoccupied with cognitive errors, intrusive thoughts, or fears of academic failure, which weakens self-directed learning behaviors (Huntley et al., 2023). This process may limit students' willingness to engage in challenging tasks or independently regulate their learning strategies. Furthermore, recent neuroscientific evidence suggests that dysfunctional metacognitive processes disrupt executive control mechanisms and prefrontal functioning associated with self-regulation and motivational persistence (Hulbig, 2026). Consequently, reduced autonomy may represent one of the key pathways through which maladaptive metacognitive beliefs impair academic motivation during adolescence.

Another important finding revealed that relatedness mediated the relationship between negative metacognitive beliefs and learning motivation. This result supports the assumptions of Basic Psychological Needs Theory, which identifies relatedness as a central component of healthy motivational development (Vansteenkiste et al., 2020). Relatedness refers to feelings of belongingness, emotional support, and social acceptance within interpersonal relationships. Students who feel connected to peers, teachers, and educational environments generally display stronger engagement, persistence, and academic enthusiasm (Bouten et al., 2025; Grassinger et al., 2024). However, negative metacognitive beliefs may weaken relatedness by increasing social anxiety, self-consciousness, and fear of negative evaluation.

The findings are consistent with studies suggesting that maladaptive metacognitive beliefs contribute to emotional distress and interpersonal withdrawal (Rakitzi, 2023; Rawat et al., 2023). Individuals who perceive their thoughts as dangerous or uncontrollable often avoid social interactions because they fear criticism, embarrassment, or rejection. This process can diminish feelings of belongingness and emotional connection within educational settings. Quan and Zettle argued that negative metacognitive processes intensify emotional distress and psychological inflexibility, which may limit adaptive social engagement (Quan & Zettle, 2023). Similarly, Andersson et al. demonstrated that interventions targeting dysfunctional metacognitive beliefs improve emotional well-being and social functioning (Andersson et al., 2025). The present findings therefore suggest that negative metacognitive beliefs indirectly reduce learning motivation by disrupting students' social and emotional integration into the educational environment.

The relationship between relatedness and motivation has been widely documented in educational psychology research. Students who perceive supportive peer and teacher relationships are more likely to experience positive academic emotions, intrinsic interest, and sustained effort toward learning goals (Miralles-Armenteros et al., 2021; Rentzios et al., 2025). Codina et al. also found that psychological need satisfaction moderates maladaptive educational outcomes such as procrastination and disengagement (Codina et al., 2024). Furthermore, Xu et al. demonstrated that sense of school belonging enhances self-regulated learning and intrinsic motivation among students (Xu et al., 2023). In light of these findings, the present study suggests that negative metacognitive beliefs weaken students' sense of belonging and connectedness, thereby undermining motivational engagement in academic contexts.

The present findings additionally revealed that competence did not mediate the relationship between negative metacognitive beliefs and learning motivation. Although negative metacognitive beliefs significantly predicted competence, competence itself did not significantly predict learning motivation within the structural model. This finding contrasts with some previous studies emphasizing the importance of competence in motivational functioning (Askari & Sodoghi, 2020; Tang et

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al., 2020). However, it is possible that competence operates differently from autonomy and relatedness in adolescent educational settings. During adolescence, social belongingness and perceived autonomy may exert stronger influences on motivational engagement than competence alone, especially in collectivistic educational contexts where interpersonal relationships and emotional support play central roles.

Another possible explanation is that competence may influence learning motivation indirectly through other variables not examined in the current model. For example, competence perceptions may affect academic self-efficacy, emotional resilience, or goal orientation rather than directly influencing motivation (Chang & Tsai, 2022; Liu & Sun, 2025). Hilz et al. suggested that competence-related beliefs are strongly linked to self-concept and academic anxiety, which may complicate their direct relationship with motivation (Hilz et al., 2023). Similarly, Supriadi and Suherman demonstrated that mathematical reasoning and problem-solving mediate the relationship between anxiety and learning motivation (Supriadi & Suherman, 2024). Therefore, competence may interact with additional emotional or cognitive mechanisms that were not included in the present study.

The findings also indicated that positive metacognitive beliefs did not significantly predict learning motivation through autonomy, competence, or relatedness. Although positive metacognitive beliefs significantly predicted autonomy and relatedness, their indirect effects on learning motivation were not statistically significant. This finding may suggest that positive metacognitive beliefs influence motivation through more direct cognitive mechanisms rather than through psychological needs satisfaction. Previous studies have shown that adaptive metacognitive functioning enhances self-regulation, learning strategies, self-efficacy, and cognitive flexibility (Tsai et al., 2024; Urban & Urban, 2025). Consequently, positive metacognitive beliefs may directly strengthen academic confidence and strategic learning behaviors without necessarily requiring mediation through basic psychological needs.

This finding is partially consistent with research emphasizing the direct role of metacognition in academic achievement and motivational regulation (Katsantonis & McLellan, 2023; Teng & Yang, 2023). For instance, Teng and Yang reported that metacognitive awareness directly contributes to self-efficacy and online learning achievement (Teng & Yang, 2023). Similarly, Lee et al. found that positive psychological capital mediated the relationship between metacognition and self-directed learning ability (Lee et al., 2024). These findings imply that positive metacognitive beliefs may activate motivational processes through cognitive confidence, strategic planning, and self-regulatory competence rather than through autonomy or relatedness alone.

Another important implication of the present findings concerns the role of metacognitive beliefs in contemporary educational environments. Educational systems today increasingly require students to independently regulate learning, manage information overload, and adapt to technologically mediated instructional settings (Chiu et al., 2021; Zhou & Li, 2023). In such contexts, maladaptive metacognitive beliefs may intensify academic stress, emotional exhaustion, and motivational decline. Conversely, adaptive metacognitive functioning may support resilience, self-regulation, and sustained engagement (Sheffler et al., 2022; Singh & Muis, 2024). The findings therefore highlight the importance of integrating metacognitive training and psychological needs support within educational interventions designed for adolescents.

The present study also contributes to the growing literature on motivational development during adolescence. Adolescence represents a critical developmental stage characterized by heightened emotional sensitivity, identity exploration, and increasing academic demands. During this period, students become particularly vulnerable to cognitive distortions, emotional dysregulation, and motivational instability (Wang et al., 2026). The current findings suggest that maladaptive metacognitive beliefs may undermine educational adjustment by frustrating fundamental psychological needs. Consequently, addressing cognitive self-regulation and psychological need satisfaction simultaneously may represent an effective strategy for enhancing adolescents' academic functioning and emotional well-being.

Overall, the findings support an integrative conceptualization of learning motivation in which cognitive beliefs and motivational needs interact dynamically. Metacognitive beliefs appear to shape how students interpret academic experiences, regulate emotions, and perceive themselves within educational environments. At the same time, autonomy and relatedness function as motivational mechanisms that either facilitate or inhibit engagement in learning activities. These findings underscore the importance of adopting multidimensional psychological models to better understand academic motivation among adolescents.

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One limitation of the present study concerns the use of self-report questionnaires, which may increase the possibility of response bias, social desirability effects, and inaccurate self-perceptions among participants. In addition, the study employed a cross-sectional correlational design, which limits causal interpretation of the observed relationships. The sample was also restricted to high school students in Shiraz, which may reduce the generalizability of the findings to students from different cultural, educational, or socioeconomic backgrounds. Furthermore, several potentially influential variables, including academic stress, family functioning, teacher support, personality traits, and emotional disorders, were not examined in the proposed model.

Future research is recommended to employ longitudinal and experimental designs to better clarify the causal relationships among metacognitive beliefs, psychological needs satisfaction, and learning motivation. Researchers may also investigate additional mediating and moderating variables such as self-efficacy, academic resilience, emotional regulation, school climate, and parental support. Conducting comparative studies across different educational levels, cultures, and age groups could further enhance understanding of these relationships. Moreover, qualitative and mixed-methods approaches may provide deeper insight into adolescents' subjective experiences of metacognition and motivational functioning within educational settings.

From a practical perspective, the findings highlight the importance of developing educational interventions aimed at reducing maladaptive metacognitive beliefs and strengthening students' autonomy and relatedness. Schools and educators should create supportive classroom environments that encourage independent thinking, emotional safety, and positive peer interactions. Training programs focused on metacognitive awareness, emotional regulation, and self-regulated learning strategies may help students better manage cognitive challenges and maintain motivation. Furthermore, teachers and school counselors should pay greater attention to students who display excessive worry, cognitive self-doubt, or social withdrawal, as these characteristics may negatively affect both psychological well-being and academic motivation.

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 study and participated in the research with informed consent.

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