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Predicting Academic Performance Based on Perception of the Constructive Learning Environment with the Mediating Role of High-Level Motivational and Cognitive Strategies

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ABSTRACT

Objective: The current investigation endeavored to forecast academic achievement by examining the Perception of the constructive learning environment with the mediating role of high-level motivational and cognitive strategies.

Methods: Utilizing a descriptive-correlational approach and structural equation modeling, this study was conducted. The statistical population under scrutiny encompassed all first-year high school students in Marvdasht during the academic year 2019-2020. A multi-stage cluster sampling technique was employed for participant selection, with a total sample size of 319 individuals. Academic performance was evaluated using the Academic Performance Questionnaire, based on Pham and Taylor's (1999) work, while Perception of the constructive learning environment was assessed using the Taylor and Fraser Questionnaire (1991). High-level motivational and cognitive strategies were gauged using the subscales of two questionnaires by Pintrich et al. (1991) and Biggs et al. (2001). Structural equation analysis was applied in this study to scrutinize the theoretical model.

Results: The outcomes of the analysis demonstrated the significance and validation of the hypothesized pathway at a 0.01 significance level. Consequently, it can be inferred that self-regulated learning strategies can predict academic performance indirectly, with high-level motivational and cognitive strategies acting as mediators.

Conclusions: This discovery holds practical implications for academic guidance provided by psychologists and educators in classroom settings.

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Introduction

One of the most significant concerns for families and stakeholders in education today is the issue of academic underachievement and the low academic performance of students. According to statistics released by the Center for Statistics and Technology of the Ministry of Education, student failure rates vary across educational levels: 1.1% in primary school, 4.6% in middle school, and 8.0% in the first grade of high school (Sheikh-al-Islami & Esmaeili, 2021). The end of the academic year represents a critical moment for students experiencing academic failure, as such setbacks not only alter their self-concept but also change the way others perceive them. These changes, occurring during a sensitive and formative period of personality development, can leave lasting negative effects. Conversely, positive academic experiences foster a healthy self-image, while negative experiences may lead to a diminished self-concept. Success in school, regardless of one's life background, significantly increases the likelihood of future life success. In contrast, failure at any stage of education—primary, middle, high school, or university—can substantially reduce such prospects. Research has indicated that school dropouts are five times more likely to have experienced academic failure compared to their peers. Consequently, poor academic performance remains one of the most pressing issues facing educational systems worldwide, as it not only wastes substantial human and economic resources but also leaves damaging social, familial, and personal consequences (Ghadampour, Mirzaeian, & Sabzian, 2014).

Academic performance is generally defined as the acquired competence of an individual in educational subjects, typically measured through standardized achievement tests or teacher-made assessments. In recent years, educational specialists and educational psychologists have conducted extensive research on academic performance and its related variables. Student learning outcomes are often assessed through their academic performance, which also serves as the main indicator for evaluating the effectiveness of educational programs and interventions. Accordingly, numerous studies—particularly in educational psychology—have examined factors influencing students' academic performance (Shams-eddini Lori & Dadvar, 2021).

Continuous evaluation of students' academic status and investigation of related factors are therefore essential pillars for improving the quality of education systems. Such evaluation contributes to better curriculum design, higher instructional quality, and ultimately, more effective decision-making by educational authorities. Globally, monitoring and improving student performance is a priority within educational development programs. Success in academic performance reflects the capacity of an educational system to meet individual needs and achieve its broader goals. At all levels, education aims to shape learners' behavior, thoughts, attitudes, and skills—outcomes that are ultimately measured through their academic achievement (Baseri et al., 2019).

From a psychological perspective, learning is influenced by a complex ecosystem composed of multiple factors. One central element within this ecosystem is the learning environment, or more specifically, students' perception of the constructivist learning environment, which plays a decisive role in the learning process (Obiagbonaiah, Kolofel, & Brook, 2019). Constructivist theory, rooted in the works of Piaget and Vygotsky, emphasizes the learner's active role in constructing and interpreting knowledge (Adib-Azhari, Jasemi, Abdohab, Joufri, Li, & Chiuaming, 2020). From this perspective, learning involves meaning-making through active engagement (Levins, Ricouz, & Schmidt, 2008).

In constructivist classrooms, teachers act as facilitators, encouraging intellectual growth by prompting students to build on their prior knowledge and critically engage with the ideas of their peers. More recently, social constructivist perspectives have gained prominence in studies on learning environments. This approach acknowledges that scientific knowledge emerges through inquiry, but it gains its highest validity within cultural and social contexts. Drawing on constructivist and critical social theories, Taylor et al. (1997) developed a questionnaire to assess students' perceptions of constructivist learning environments across five dimensions: personal relevance (the extent to which school experiences relate to life outside school), student negotiation (students' opportunities to express, share, and validate their ideas), shared control/participation (students' involvement in planning and managing activities, assessments, and classroom norms), uncertainty (opportunities for students to explore and socially/culturally evaluate scientific knowledge), and critical voice (the extent to which classroom contexts allow students to critique teaching practices and express learning barriers) (Barzegar-Bafrouei et al., 2013).

Accordingly, students exposed to diverse and supportive learning environments tend to become more effective learners than those who lack such opportunities (Ozgul et al., 2018). Conversely, research by McDonald and Walidiosu has shown that inappropriate learning environments fail to provide opportunities for growth, emotional support, motivation, and strategic development, thereby jeopardizing students' academic performance (Rashidi et al., 2015). Notable constructivist learning environment models include Johnson's (1999) constructivist framework, Hannafin and Oliver's (1999) open learning environment, and Taylor's (1997) constructivist model (Shafiei, 2017).

The literature also indicates that multiple models have been developed to explain students' academic performance. For example, Sharma et al. (1990) proposed a model that outlines the diverse factors influencing meaningful learning. This model suggests that higher-order motivational and cognitive strategies mediate the effects of prior knowledge and classroom context on academic outcomes. Santrock (2008) identifies these strategies as comprising critical thinking, metacognitive self-regulation, and deep processing approaches (Barzegar-Bafrouei, 2011).

Research on human behavior further supports the notion that learning outcomes result from the interaction between individual differences and environmental factors. In this respect, learners acquire higher-order motivational and cognitive strategies differently depending on the learning environments in which they engage. This process relates closely to metacognition, defined as awareness of one's own cognitive processes. The ability to think critically, apply knowledge effectively, and regulate one's learning requires recognizing what one knows, understanding the nature of a task, identifying necessary skills, and strategically applying knowledge in specific contexts. Thus, students with stronger metacognitive awareness are better able to control their goals, motivations, and attention (Bai & Wang, 2021).

Given the above, the present study aims to develop a model of students' academic performance based on their perception of the constructivist learning environment and the application of higher-order motivational and cognitive strategies.

Material and Methods

This study employed a descriptive–correlational design within the framework of structural equation modeling (SEM). The statistical population comprised all lower secondary school students in Marvdasht during the academic year 2019–2020. A multistage cluster sampling method was applied. First, seven schools were randomly selected from the city's schools. Then, two classes from each school were randomly chosen, yielding a total of 14 classes. Given that the proposed model included 11 observed variables, and following the rule of 30 participants per variable, the required sample size was determined to be 330 students. Out of 330 distributed questionnaires, 11 were excluded due to incomplete responses. Thus, the final dataset consisted of 319 valid questionnaires, resulting in a completion rate of 96.67%.

Instruments

Academic Performance Questionnaire: Academic performance was measured using a scale adapted from Pham and Taylor (1999), developed for the Iranian context (Pham & Taylor, 1999; cited in Dortaj, 2004). This questionnaire contains 48 items assessing five domains: self-efficacy, emotional influences, planning, lack of outcome control, and motivation. Responses were rated on a 5-point Likert scale. Validity indices reported by Nourmohammadian (2006) for the five factors ranged from 0.63 to 0.92. Reliability was established using Cronbach's alpha, with coefficients of 0.92 (self-efficacy), 0.73 (motivation), and 0.74 (overall scale) (Dartaj, 2004). Nourmohammadian also reported a reliability coefficient of 0.74. In this study, test–retest reliability was examined by administering the questionnaire twice within a two-week interval to 40 students, yielding a correlation of 0.89.

Constructivist Learning Environment Scale (CLES): Perceptions of the constructivist learning environment were assessed using the questionnaire developed by Taylor and Fraser (1991), which measures five subscales: personal relevance, shared control, critical voice, negotiation, and uncertainty (Taylor & Fraser, 1991; Taylor et al., 1997). The instrument consists of 30 items rated on a 5-point Likert scale (never to always). Example items include:

- "In this class, I learn things that are related to life outside of school" (personal relevance).
- "In this class, I learn that science cannot provide definite answers to all problems" (uncertainty).
- "In this class, I am allowed to ask why I need to learn certain topics" (critical voice).
- "In this class, I help my teacher in assessing my learning" (shared control).
- "In this class, I discuss with other students how to solve problems" (negotiation).

The reliability of the CLES has been confirmed in multiple studies (Tsai, 2000; Delslepz, 2002; Johnson & McClure, 2004; Yilmaz-Tuzun & Topcu, 2020; Yilmaz-Tuzun et al., 2006), with Cronbach's alphas ranging from 0.60 to 0.90 across different subscales. In the present study, Cronbach's alpha was 0.75.

Higher-Order Motivational and Cognitive Strategies: These strategies were measured using three subscales addressing metacognitive self-regulation, deep information processing, and critical thinking. Two subscales (self-regulation and critical thinking) were adapted from the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991), while the deep processing subscale was drawn from the revised Study Process Questionnaire (SPQ; Biggs et al., 2001).

- The metacognitive self-regulation subscale included 12 items (e.g., "When studying, if I do not understand something, I go back and read it again").
- The critical thinking subscale contained 5 items (e.g., "I often ask myself questions about what I read or hear in class to determine if it is convincing").
- The deep processing subscale consisted of 10 items (e.g., "I put maximum effort into understanding important topics").

Responses were given on a 5-point Likert scale (strongly disagree to strongly agree). All items were directly scored except for items 9 and 23, which were reverse-coded. Higher scores reflected greater use of higher-order learning strategies. The Cronbach's alpha coefficient for this scale in the present study was 0.73.

Data Analysis

Descriptive statistics (mean, standard deviation, minimum, maximum) were used alongside structural equation modeling (SEM) to test the proposed model.

Ethical Considerations

The following ethical principles were observed: Academic honesty and integrity were maintained, anonymity of respondents was ensured, with questionnaires administered without names and participant information was treated with full confidentiality.

Results

Descriptive Statistics

The mean age of seventh-grade students was 12.44 ± 0.50 years (range: 12–13 years). For eighth-grade students, the mean age was 13.61 ± 0.72 years (range: 12–15 years), while the mean age for ninth-grade students was 14.35 ± 0.48 years (range: 14–15 years). Of the total

319 participants, 94 students (29.47%) were in the seventh grade, 165 students (41.72%) in the eighth grade, and 60 students (18.81%) in the ninth grade.

Table 1 presents the descriptive indices (mean, standard deviation, skewness, kurtosis, minimum, and maximum) for the study variables and their subscales.

Table 1. Descriptive statistics of study variables at the subscale and total score level

Variable	Subscale	M	SD	Skewness	Kurtosis	Min	Max
Constructivist Learning Environment	Personal relevance	20.01	4.29	-0.31	-0.47	8	27
	Shared control	20.27	6.36	0.01	-1.30	6	30
	Critical voice	21.91	5.20	-0.47	-0.32	6	30
	Negotiation	21.11	5.57	-0.25	-0.69	6	30
	Uncertainty	19.82	4.11	0.01	-0.33	9	28
	Total score	103.11	17.89	-0.10	-0.87	54	135
Higher-Order Motivational and Cognitive Strategies	Metacognitive self-regulation	31.70	5.35	-0.38	-0.20	17	40
	Critical thinking	23.52	4.96	-0.86	0.49	9	30
	Deep processing	26.43	4.90	-0.21	-0.53	14	35
	Total score	81.64	13.59	-0.45	-0.01	42	105
Academic Performance	—	165.16	15.43	-0.45	1.35	101	199

As shown in Table 1, skewness and kurtosis values for all scales and subscales fell within the normality range (−2 to +2), justifying the use of parametric statistical tests.

Hypothesis Testing

The research hypothesis was examined using the bootstrap method. According to this method, if both the lower and upper bounds of the bootstrap confidence interval are either positive or negative and zero does not lie within the interval, then the indirect path is statistically significant. Moreover, if the significance level is less than 0.05, the indirect effect is supported.

Table 2. Bootstrap results for indirect effects

Predictor	Mediator	Outcome	SE	Lower bound	Upper bound	p-value
Constructivist learning environment	Higher-order motivational & cognitive strategies	Academic performance	0.022	0.049	0.122	0.001

As Table 2 indicates, the indirect path was statistically significant. The significance level was $p < .01$, and the confidence interval did not include zero, thereby supporting the study hypothesis. This finding confirms that the relationship between perception of the constructivist learning environment and academic performance is mediated by higher-order motivational and cognitive strategies.

Model Fit

To further confirm the results and examine direct paths, a modified model was estimated (Figure 1), and its fit indices are reported in Table 3.

Table 3. Model fit indices for the research hypothesis

Model	NFI	IFI	RFI	CFI	RMSEA
Initial model	0.85	0.87	0.93	0.86	0.111
Modified model	0.95	0.91	0.95	0.93	0.069

As shown in Table 3, all fit indices for the modified model reached acceptable levels, confirming the adequacy of the proposed model and supporting the research hypothesis.

Discussion

The results of this study, obtained through bootstrapping, indicate the presence of an indirect relationship between students' perceptions of a constructivist learning environment and their academic performance, mediated by higher-order motivational and cognitive strategies. This finding is consistent with previous research by Cano and Cardelle-Elawar (2008), Peng (2012), Sirirung (2015), Corley and Marcia (2016), Nooghabi (2016), Ubaid Azhar and colleagues (2019), Tous et al. (2020), Nakhostin Goldoost and Moeinikia (2009), Ataeifar (2010), Barzegar Befroei et al. (2013), Karshki and Ghalebash Qarablaghi Inalu (2016), Bayramnejad et al. (2020), Habibi Kalibar (2020), and Owzayi, Ahmadi, and Azimpour (2021). The indirect effect observed in the present study can be explained by the characteristics of constructivist learning environments, which encourage students to employ high-level strategies such as self-regulation, critical thinking, and deep processing. Within such environments, learners are likely to connect school-based learning experiences with external knowledge, engage in evaluating the credibility of information, integrate resources from multiple sources, and ultimately reach informed conclusions.

This perspective is reinforced by Biggs (2003), who argued that learning approaches are context-dependent rather than fixed learner traits. Similarly, Entwistle (1991) emphasized that learning approaches are shaped by both context and content, such that collaborative and interest-oriented classrooms encourage deep learning strategies. Seif (2015) also linked deep learning with constructivist approaches, while hauntological frameworks suggest that flexible, learner-centered environments stimulate deep learning through complex cognitive and neural interactions.

Furthermore, empirical studies have consistently demonstrated that perceptions of supportive classroom environments enhance students' academic motivation, adaptability, and psychological well-being. High-level cognitive and motivational strategies such as summarizing, critical questioning, and metacognitive regulation contribute to effective planning and prioritization, thereby supporting both academic achievement and the balance of personal responsibilities. As such, the interplay of constructivist environments and advanced learning strategies provides students with tools for deeper engagement, resilience in the face of challenging content, and greater confidence in their academic capacities.

Despite these contributions, this study has several limitations. The sample consisted exclusively of female students in lower secondary schools in Marvdasht, which limits the generalizability of the findings to broader populations, including male students and students in other regions or educational levels. Furthermore, the cross-sectional and correlational design precludes causal inferences about the observed relationships, emphasizing the need for replication in longitudinal or experimental studies. Another limitation concerns the reliance on self-report instruments, which may introduce response biases and affect the accuracy of results. Finally, the data collection process was constrained by limited direct access to students due to COVID-19 restrictions, which may have influenced participation and responses.

Future research could build on these findings in several ways. Employing diverse methods of data collection, such as interviews or classroom observations, may yield richer and more nuanced insights into students' perceptions and strategies. Expanding the study to include students from different cities, educational levels, and gender groups could enhance the external validity of the results and provide opportunities for comparative analysis. Furthermore, incorporating longitudinal designs would allow researchers to track changes in students' perceptions, strategies, and performance over time, thereby clarifying causal relationships. Finally, exploring the role of gender differences, particularly in the interaction between motivational strategies, academic achievement, and engagement, could offer valuable contributions to educational psychology and inform interventions tailored to diverse student populations.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving human participants were reviewed and approved by ethics committee of Islamic Azad University.

Author contributions

All authors contributed to the study conception and design, material preparation, data collection and analysis. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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