Original Article

IEEPJ Vol. 5, No. 2, 2023, 261-272

http://ieepj.hormozgan.ac.ir/

Iranian Evolutionary and Educational Psychology Journal

IEEPJ

Predicting Academic Performance based on Self-Regulated Learning Strategies: Mediating Role of High-Level Motivational and Cognitive Strategies

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Abstract: The present study aimed to predict academic performance based on self-regulated learning strategies with the mediating role of high-level motivational and cognitive strategies. The research method was descriptive-correlation using structural equation modeling. The statistical population included all first grade high school students in Marvdasht (Iran) in 2020. Participants were 319 people whom selected via multi-stage cluster sampling method. Academic performance measured by Academic Performance Questionnaire (Pham & Taylor, 1999), self-regulated learning strategies assessed by Pintrich and de Groot (1990) Motivated Strategies for Learning Questionnaire (MSLQ), and high-level motivational and cognitive strategies evaluated by MSLQ and Biggs et al. (2001) Revised two-factor Study Process Questionnaire. The structural equation analysis has been used to evaluate the hypothetical model. The results indicated the model benefited from the appropriate fit indices. Therefore, it can be concluded that self-regulated learning strategies indirectly and with the mediating role of high-level motivational and cognitive strategies, predict academic performance. The findings can be useful in the academic counseling and teachers' classroom affairs.

Keywords: Academic Performance, Self-Regulated Learning Strategies, High Level Motivational and Cognitive Strategies, High School Students

Introduction

One of the concerns of educational systems in different countries is to pay attention to the flourishing of students' talents, preparing them for social interaction, effective communication with others, and equipping them to handle important life tasks and responsibilities in their future. Consequently, a significant portion of research in the fields of educational sciences and psychology has been dedicated to the topic of academic success and failure. The school years, including both schools and universities, provide the best opportunity to increase knowledge and equip individuals with the necessary skills for academic and professional success, allowing them to confidently enter society. Academic performance is considered one of the essential indicators in evaluating and assessing educational systems in a country (Zhang et al., 2023). Typically, academic performance is measured through various methods, including individual progress in separate educational courses, overall progress throughout educational courses, annual grade point average, program-specific grade point average, and so on (Saheb Alzamani & Zirak, 2011). Academic performance refers to an individual's acquired or learned ability in academic subjects

Article information: Received: 2021/12/27 | Accepted: 2022/03/3 | Published: 2023/06/1. https://doi.org/10.52547/ieepj.5.2.261

and is measured through standardized achievement tests or teacher-made exams (Samavi et al., 2020). In recent years, educational experts and educational psychologists have conducted significant research in the area of academic performance and related variables. Learners' learning is usually assessed based on their academic performance, and to evaluate the effectiveness of each activity and program, they examine its final outcome or consequence. In the education system, this is done through the evaluation of students' academic performance. For this reason, numerous studies have been conducted in the field of factors influencing students' academic performance, especially in educational psychology (Abu Saa et al., 2019; Mushtaq & Khan, 2012; Samavi et al., 2022; Samavi, 2022; Wu et al., 2020).

Some studies have found that poor academic performance is attributed to weak learning strategies (Diseth & Kobbeltvedt, 2010; Tait & Entwistle, 1996). In response to this importance, psychologists and educational experts turned to new learning theories, especially self-regulated learning theory. The theory and scientific research on self-regulated learning emerged in the mid-1980s in response to the question of how students become proficient in their learning processes. In fact, from the 1980s onwards, self-regulated learning emerged as a new strategy to help students master their learning processes and, more generally, improve the quality of learning, garnering attention from psychologists, counselors, and educational experts (Zimmerman & Schunk, 2011).

Numerous research studies investigating human behavior's origins have consistently highlighted those diverse behaviors stem from both individual differences and the influence of varying environments. This phenomenon also applies to human learning behaviors and the attainment of different learning outcomes. In simpler terms, learners in different educational settings acquire high-level motivational and cognitive strategies, often being unaware of their cognitive processes. The ability to think effectively and apply acquired knowledge appropriately is termed metacognition. In essence, recognizing what a student knows, comprehending the correct learning task, possessing the necessary knowledge and skills to execute it, and resourcefully utilizing their knowledge in specific situations all contribute to the learner having enhanced control over their objectives, orientations, and focus during the learning journey (Bai et al., 2021).

Chen (2002), in a study titled "The Influence of Self-Regulated Learning Strategies and Learning Environment on Students' Academic Progress," concludes that self-regulated learning strategies significantly impact students' academic advancement. Cano and Cardelle-Elawar (2008) demonstrate that the belief in rapid learning (effortless learning) is negatively correlated with deep processing and metacognition strategies, and positively related to surface processing strategy. It also acts as a mediator in the relationship with academic performance. Furthermore, the results indicate that deep and surface processing strategies have a negative association with academic performance, whereas metacognitive

strategies have a positive correlation with academic success. Ward and Butler (2019) aimed to extend the findings to college freshmen students and investigate the link between metacognitive awareness and their academic performance. Additionally, the researchers aimed to explore the potential benefits of metacognitive awareness training for college freshmen students, with the goal of enhancing their retention in higher academic environments. The study's outcomes demonstrated a noteworthy positive correlation between metacognitive awareness and the academic performance of college freshmen students, as measured by their cumulative grade point average (GPA). This implies that students with a higher level of metacognitive awareness tend to achieve better academically compared to those with lower levels of metacognitive awareness. Furthermore, these results validate the association between academic performance and metacognitive awareness within the college freshmen student population. Considering that metacognitive awareness can be enhanced through instruction, these findings offer a potential avenue to support at-risk freshmen in succeeding in their academic pursuits. Núñez et al. (2022), in a study titled "The Effect of Intervention on Self-Regulation Strategies on Elementary Students' Academic Progress: Investigating the Mediating Effect of Self-Regulatory Activity," conclude that reinforcing self-regulation strategies leads to enhanced academic progress. Habibi-Kaleybar (2020) in a study titled "The Role of Perceptions of the Classroom Environment and Academic Progress Motivation in Predicting Students' Academic Satisfaction" indicates a positive and significant relationship between perceptions of the classroom environment and its components with academic satisfaction. Considering the above findings, the present research aims to propose a model for students' academic performance based on self-regulated and high-level motivational and cognitive strategies.

Material and Methods

The present study utilized a descriptive-correlational research design and a structural equation modeling approach. The statistical population of this research included all first-year high school students in Marvdasht city (Iran) in 2020. A multi-stage cluster sampling method was used to select the participants, where 7 schools were randomly chosen, and then 2 classes were selected from each school, resulting in a total of 14 classes. As there were 11 observable variables in the main proposed model, with 30 participants considered for each variable, the sample size was determined to be 330 individuals. Out of the distributed 330 questionnaires, 11 incomplete questionnaires were excluded from the sample, leaving 319 complete questionnaires, resulting in a response rate of 96.67%.

Instruments

Academic Performance Questionnaire: To measure academic performance, an adapted version of the Academic Performance Questionnaire (Pham & Taylor, 1999) was used. This questionnaire, specifically

designed for the Iranian population, consists of 48 items and assesses academic performance in various domains, including self-efficacy, emotional effects, planning, lack of outcome control, and motivation. The scoring of the questionnaire is based on a 5-point Likert scale. The validity of each factor of the questionnaire was established by Saffarieh et al. (2022) as follows: Factor 1: 0.91, Factor 2: 0.92, Factor 3: 0.73, Factor 4: 0.63, Factor 5: 0.72. The reliability of the questionnaire was also calculated using Cronbach's alpha coefficient, resulting in 0.92 for self-efficacy, 0.73 for motivation, and 0.74 for the overall scale.

Furthermore, Saffarieh et al. (2022) estimated the test-retest reliability of the questionnaire as 0.74 using a retest method. In this research, to assess the reliability of the questionnaire, a retest method was used. After conducting the initial test on a sample, the questionnaire was administered again to 40 participants who had participated in the first phase two weeks later, and the correlation coefficient between the participants' scores in the two tests was 0.89.

The Motivated Strategies for Learning Questionnaire: To measure self-regulated learning strategies, the Pintrich and De Groot (1990) questionnaire was used. This questionnaire consists of 47 items divided into two sections: motivational beliefs and self-regulated learning strategies (cognitive and metacognitive strategies). The sub-scale for self-regulated learning strategies includes 22 items and measures three dimensions of academic self-regulation: cognitive strategies, metacognitive strategies, and resource management. The cognitive strategies sub-scale includes 13 items. Pintrich and De Groot (1990) established the validity of this questionnaire using factor analysis, resulting in three factors for the motivational beliefs scale (self-efficacy, intrinsic value, and test anxiety) and two factors for the self-regulated learning strategies scale (cognitive strategies and metacognitive strategies and resource management). The reliability coefficients for the sub-scales of self-efficacy, intrinsic value, test anxiety, cognitive strategies, and metacognitive strategies were determined to be 0.89, 0.87, 0.75, 0.83, and 0.74, respectively, using Cronbach's alpha coefficient. Moreover, Afsharian and Dortaj (2016) used content validity and factor analysis methods to examine the validity of this questionnaire. For determining the reliability of low-level cognitive strategies, high-level cognitive strategies, and metacognitive organization, reliability coefficients of 0.98, 0.79, and 0.84 were extracted, respectively. In the present study, Cronbach's alpha coefficient for the overall questionnaire was calculated to be 0.86.

High-level motivational and cognitive strategies scale: To measure high-level motivational and cognitive strategies, two sub-scales from different questionnaires were used. High-level cognitive strategies encompassed metacognitive regulation, deep information processing, and critical thinking. A questionnaire was developed, containing three sub-scales to assess these three strategies. Two sub-scales (metacognitive regulation and critical thinking) were adapted from the MSLQ questionnaire ((Pintrich

& De Groot, 1990), and the other sub-scale (deep information processing) was derived from the revised Study Process Questionnaire (Biggs et al., 2001). The metacognitive regulation sub-scale consists of 12 items, with one item being "I go back and review if I don't understand something while studying." The critical thinking sub-scale comprises 5 items, with one item being "I often question myself about the materials I read or hear in class to determine whether they are convincing." The deep information processing sub-scale includes 10 items, with one item being "I make the maximum effort on important topics to understand them." Participants responded to these three sub-scales using a 5-point Likert scale ranging from "strongly disagree" to "strongly agree." In scoring this questionnaire, except for items 9 and 23, the remaining items were directly scored. According to this scoring method, the higher the score a student obtained in each sub-scale, the higher the level of their learning strategies. The Cronbach's alpha reliability coefficient for this scale was 0.73.

In this study, descriptive statistical methods such as mean, standard deviation, minimum, and maximum, as well as inferential statistical methods like structural equation modeling, were used to evaluate the proposed model.

Results

By considering the grade level, the average age of seventh-grade students was 12.50 ± 0.12 years, with a minimum age of 12 years and a maximum age of 13 years. For eighth-grade students, the average age was 12.72 ± 0.13 years, with a minimum age of 12 years and a maximum age of 15 years. Additionally, for ninth-grade students, the average age was 12.48 ± 0.14 years, with a minimum age of 14 years and a maximum age of 15 years. Out of the total 319 participants, 94 students were in seventh grade (29.47%), 165 students were in eighth grade (41.72%), and 60 students were in ninth grade (18.81%). Table 1 presents the descriptive indices related to the research variables and their components at the subscale and total score levels.

Table 1. Descriptive statistics of variables

Variable	Subscale	Statistic indices					
		Mean	SD	Skewness	Kurtosis	Min.	Max.
Self-regulated learning strategies	Cognitive	54.60	6.20	-1.03	0.28	39	62
	Metacognitive and resource management	32.57	3.96	0.31	-0.24	23	41
	Motivational	94.17	10.41	-0.17	0.21	72	121
	Total	181.34	16.98	-0.72	0.73	134	321
High-Level 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		81.64	13.59	-0.45	-0.01	42	105
Academic performance		165.16	15.43	-0.45	1.35	101	199

In Table 1, descriptive indices of self-regulated learning strategies (cognitive, metacognitive, and resource management), high-level motivational strategies (metacognitive self-regulation, critical thinking, deep processing, and total score), and academic performance are reported. Since the skewness and kurtosis values for all three scales, both at the total score level and subscale level, fall within the normal range (between +2 and -2), we are allowed to use parametric tests. To examine the research hypothesis, the bootstrap method was used. In this method, if both the lower and upper bounds of the bootstrap are either positive or negative, and zero is not within this range, then the indirect path is considered significant, and the hypothesis is accepted. Moreover, if the significance level is less than 0.05, the indirect effect is considered significant. Table 2 displays the significance or insignificance of the indirect path between the mentioned variables, as determined by the bootstrap method.

Table 2. Indirect path between the variables

Predictor	Mediator	Criterion	Error	Low limit	High limit	p
Self-regulated learning strategies	High-Level Motivational and Cognitive Strategies	Academic performance	0.029	0.071	0.167	0.001

As observed in Table 2, the results of the analysis indicate significance and confirmation of the studied path. According to the mentioned table, the significance level is less than 0.01, and the confidence interval does not include zero. Therefore, the research hypothesis is accepted. This means that there is an indirect relationship between self-regulated learning strategies and academic performance, mediated by high-level motivational and cognitive strategies.

Furthermore, to confirm the above results and demonstrate the direct paths in the study, the modified model (Figure 1) along with the model fit indices (Table 3) is presented.

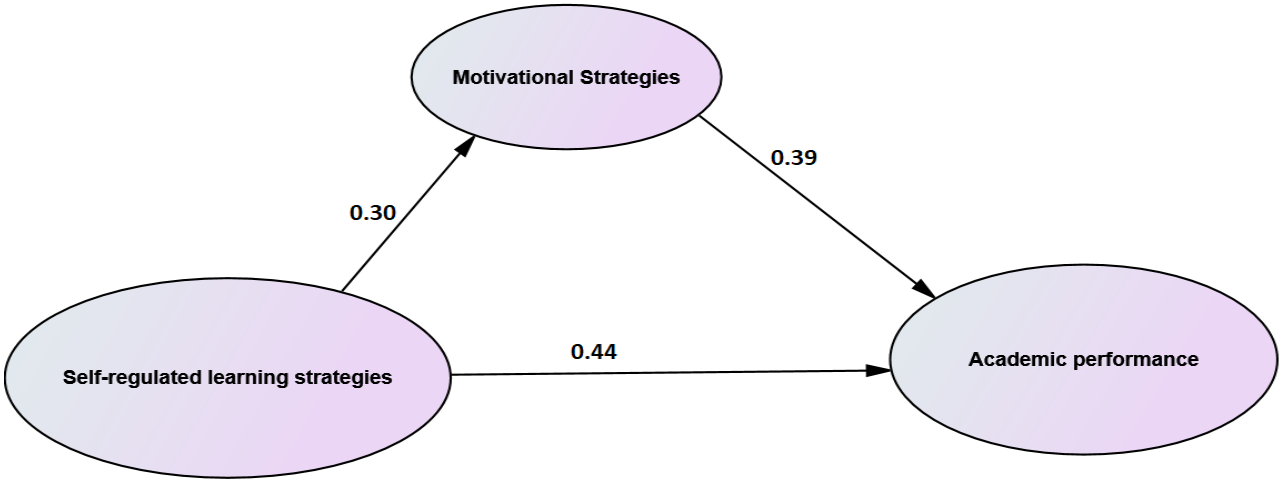

Figure 1. Modified Research Model

Table 3. Model Fit Indices

Fit indices	NFI	IFI	RFI	CFI	RMSEA
Primary model	0.85	0.87	0.93	0.86	0.11
Corrected model	0.95	0.91	0.95	0.93	0.069

As can be seen in Table 3, all fit indices are at an acceptable level, confirming the proposed model and the research hypothesis.

Discussion

The results of analyzing this hypothesis using the bootstrap method indicate that there is an indirect relationship between self-regulated learning strategies and academic performance through high-level motivational and cognitive strategies. This research finding aligns with the results of studies conducted by previous studies (Cano & Cardelle-Elawar, 2008; Chen, 2002; Samavi et al., 2020; Zhang et al., 2023).

In explaining the indirect relationship between self-regulated learning strategies and academic performance through high-level motivational and cognitive strategies, it can be stated that according to Pintrich (2000) model of self-regulated learning, learning is an active and organized process in which learners choose learning goals and then try to regulate, control, and monitor their cognition, motivation, and behavior. The use of self-regulated learning strategies helps learners to control and monitor their learning outcomes, and by selecting specific goals and appropriate actions, they can achieve their objectives and believe that the results depend on their performance.

Achieving better academic results for students whose learning is dependent on external resources can also be motivating. Therefore, although external events cannot create internal motivation in individuals, they can contribute to increasing their internal motivation by using external events, such as teaching self-regulated learning strategies, in addition to improving their external motivation. Zimmerman and Schunk (2004) believe that self-regulated learners start and guide the learning process from a metacognitive, motivational, and behavioral perspective. In terms of motivation, these learners perceive themselves as competent, self-efficient, and capable of understanding. They also mentioned that there is a significant positive correlation between the use of self-regulated learning strategies and students' academic progress. Therefore, students who use self-regulated learning strategies have better self-efficacy and positively evaluate themselves, which results in higher motivation to learn.

Cognitive regulation and the use of metacognitive strategies can lead to increased motivation and academic progress in students. However, educational systems that encompass teaching methods, course content volume, instructional types, and evaluation and grading methods do not encourage deep,

coherent, and creative learning. Instead, they push students towards performance outcomes, especially grades, and even regulate self-regulation and learning monitoring in line with these performance goals. According to the findings of Pintrich and De Groot (1990), learners adjust their motivation and cognitive management in the course using self-regulation strategies.

On the other hand, students enhance their self-management skills, time regulation, and learning abilities by acquiring cognitive and metacognitive strategies. They gain proficiency and experience in overcoming obstacles that hinder their progress and learning. These strategies lead to a deeper comprehension of the subjects and enjoyment of learning, attracting them to engage more in the process and ultimately feel capable and efficient within themselves in achieving success.

Furthermore, as a result of the skills gained from cognitive and metacognitive strategies, in the metacognition stage, students assess their level of success. When these students are satisfied with their grades and consequently feel successful in their learning skills, they evaluate themselves as competent and accomplished individuals. Thus, it is likely that learning cognitive and metacognitive strategies can aid in optimal time management and, consequently, lead to improved academic performance. In fact, cognitive and metacognitive strategies are effective and beneficial methods for enhancing students' perception of their abilities and self-efficacy.

In general, students who use high-level cognitive and metacognitive strategies seem to enjoy learning more from the class and school environment and feel more capable of achieving educational goals. As a result, these students become more resourceful and self-efficient, leading to improved academic performance. Moreover, cognitive and metacognitive strategies play a vital role in academic progress and emotional and cognitive growth. Emotional aspects in metacognition are essential and influential in self-confidence and motivation. Additionally, students who acquire cognitive and metacognitive strategies and become proficient in study techniques may no longer fear challenging materials or books because they know they can overcome difficult content with the skills they possess. As a result, their reaction to a set of emotions, such as anxiety and worry, which arouses them, decreases with the acquisition of these strategies.

Additionally, through metacognitive training, students acquire competencies in identifying, monitoring, predicting, and evaluating their emotional regulation strategies. Assessing failures and successes in regulating emotions helps students become aware of their strengths and weaknesses and shape their lives accordingly. These students are likely to possess the flexibility to cope easily with challenging situations and manage conflicts efficiently. Cognitive and metacognitive awareness also enables students to identify their decision-making methods and avoid using ineffective decision-making styles.

In conclusion, students who embrace cognitive and metacognitive strategies appear to grasp study skills effectively and put them into practice in planning, such as allocating time for study, reviewing their notes, and setting aside time for guidance and studying for their desired exams. Thus, cognitive and metacognitive strategies lead to better planning and improved academic performance in students.

Suggestions for Further Research

1. Consider conducting a longitudinal study to investigate the enduring impacts and evolution of cognitive and metacognitive strategies on academic performance and self-efficacy over an extended period.
2. Implement intervention programs tailored to develop cognitive and metacognitive strategies among students. Evaluate the effectiveness of these programs by comparing the academic performance and self-efficacy of intervention and control groups.
3. Explore the cross-cultural aspects of cognitive and metacognitive strategies by conducting a study across diverse educational systems and cultural contexts. This research can shed light on the universality and potential cultural variations of these strategies.
4. Investigate the role of teacher training in promoting cognitive and metacognitive strategies within the classroom. Evaluate whether teachers equipped to support and foster these strategies can positively influence students' academic performance and self-efficacy.

Limitations of the Study

1. The reliance on self-report measures to assess cognitive and metacognitive strategies may introduce self-report bias, leading participants to overstate or understate their usage of these strategies, potentially influencing the results.
2. The generalizability of the research findings might be limited since the study was conducted in a specific school or educational setting. To establish broader applicability, replication across diverse educational institutions and student populations is necessary.
3. The cross-sectional design of the study may hinder the establishment of causal relationships between cognitive and metacognitive strategies and academic performance. To investigate causality more effectively, longitudinal or experimental designs should be considered.
4. External factors, such as socio-economic status, parental involvement, or other school-related influences, were not fully accounted for in the study. Including these factors in future research can provide a more comprehensive understanding of their impact on academic performance and self-efficacy.

5. Cognitive and metacognitive strategies can overlap with other psychological constructs, such as motivation and study habits, making it challenging to isolate their specific effects on academic performance and self-efficacy.

8. Ethical considerations, such as participant consent, privacy, and the potential effects of intervention programs on control groups, should be carefully addressed in future research.

Addressing these research suggestions and limitations can bolster the validity and applicability of the findings, providing valuable insights into the intricate relationship between cognitive and metacognitive strategies, academic performance, and self-efficacy.

Conflict of interest: There is no conflict of interest associated with this research.

Financial sponsor: This research was conducted without any financial support and with the researcher's personal funds.

Acknowledgments: The researcher would like to express their gratitude to all the participants, as well as the professors and friends who provided support throughout this research endeavor.

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