



Impact of Virtual Instruction on Cognitive and Metacognitive Strategies in Alleviating Academic Procrastination among Medical Students



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ABSTRACT

Aims The prevalent academic procrastination among medical students, who will assume significant responsibilities in the future, can have irreversible consequences. One of the underlying factors is the weakness of cognitive and metacognitive strategies, which can be taught and learned by professors and students. The present research was conducted to investigate the effect of teaching cognitive and metacognitive strategies virtually on the academic procrastination of medical students at Iran University of Medical Sciences.

Materials & Methods This quasi-experimental research employed a two-group before-and-after design and was conducted at the Iran University of Medical Sciences in 2023. The study included 70 medical students from Iran University of Medical Sciences, who were divided into control and intervention groups. Cognitive and metacognitive skills were presented virtually in four one-hour sessions. Data were collected using Solomon and Rothblum's Academic Procrastination Questionnaire and analyzed using SPSS 16 software.

Findings Initially, no significant difference was found between the scores of the participants in the two groups before the cognitive and metacognitive strategies course ($p > 0.05$). However, a significant difference was observed between the scores of the two groups after the intervention ($p < 0.05$).

Conclusion The implementation of cognitive and metacognitive strategies training has a positive and significant influence on reducing academic procrastination among students.

Keywords Teaching; Metacognition; Academic Performance; Students, Medical

CITATION LINKS

[1] Gender-based differences among the students of Tabriz university of medical sciences in ... [2] Academic procrastination and academic performance: Do learning ... [3] Discrimination of students of medical sciences with high and low academic achievement based ... [4] Prevalence of academic procrastination among medical students and its ... [5] Investigating the correlation between academic procrastination with ... [6] The effectiveness of acceptance and commitment therapy on academic ... [7] The effects of medical students' self-oriented perfectionism on academic procrastination: The ... [8] The effectiveness of teaching self-regulated learning strategies on ... [9] The impact of motivation, learning strategies, and personality trait on medical ... [10] The effect of teaching cognitive strategies on the academic ... [11] The effectiveness of metacognitive skills training on students' academic ... [12] A study of metacognitive strategies use in students' experience and its relationship with ... [13] Academic interventions for academic procrastination: A review ... [14] Antecedents of academic procrastination and its relationship to academic ... [15] Comparison of the effectiveness of healthy lifestyle intervention and ... [16] The effect of virtual social networks on trust in interpersonal relationships ... [17] The effectiveness of self-regulated metacognitive strategies training on ... [18] The effectiveness of cognitive and meta-cognitive skills training on academic procrastination ... [19] Effect of cognitive and metacognitive learning strategies training ... [20] The prediction of academic procrastination based on cognitive strategies, ... [21] Structural model of the metacognitive beliefs and effect of self-esteem ... [22] The relationship of self regulation with academic procrastination ... [23] Relationship between self-regulated learning and ... [24] How to reduce test anxiety and academic procrastination through inquiry of ... [25] Comparison of students' attitudes about the effectiveness of algorithm-based education ... [26] A comparison of the effects of teaching through simulation and the traditional method on nursing students' self-efficacy ... [27] Comparing peer education with TBL workshop in ...

Introduction

One of the primary goals of universities is to educate students who are eager to learn. Despite all efforts to provide conditions for students' progress, there are always factors hindering their advancement. Academic procrastination by students is one such factor that disrupts the internal efficiency of the educational system [1]. Academic procrastination, a subtype of behavioral procrastination [2], is the most common type of procrastination among students. It refers to a detrimental behavioral habit characterized by learners' persistent desire to postpone academic activities, which many students encounter during their academic careers [1, 3, 4]. Results from the related literature indicated varying prevalence rates for this issue, ranging from 20% to 60% and 70% to 95% [1-4]. The prevalence of procrastination among students has become a concern, as it can impact health and career prospects [5]. According to findings from previous studies, high levels of procrastination hinder students from organizing their academic objectives and achieving them.

Procrastinating students are at a higher risk of academic underperformance compared to their peers. Procrastination often leads to negative emotional, mental, psychological, and behavioral outcomes, including unstable health, poor self-image, negative social perceptions, increased stress, and professional incompatibility. Specifically, academic procrastination is strongly associated with ineffective learning outcomes in many students, including poor academic performance, low-quality academic work, knowledge gaps, time pressure, dropout rates, and prolonged academic periods [2, 4-6]. Although the negative consequences of academic procrastination may not be immediately apparent in everyday life, its prevalence among medical students, who will assume significant responsibilities in the future, can have irreversible consequences [4]. Hayat *et al.* conducted a study on the association between academic achievement and procrastination among medical students. According to their findings, 29.25% of students stated that they always or almost always procrastinate their academic tasks [7]. Therefore, procrastination is not an issue that can be easily overlooked. Rather, it should be given serious attention because it is highly prevalent in society, especially among students [4]. Several studies have highlighted the association between learning strategies and procrastination, showing that the lack of organization and limited use of cognitive and metacognitive strategies are significantly related to procrastination, and there is an inverse relationship between cognitive and metacognitive learning strategies and procrastination [4, 8, 9]. Cognitive strategies are tools that help people prepare new information to combine with previously learned information, store it in long-term memory, and provide the desire to increase interpretation,

understanding, and acquisition of information [10]. Metacognitive strategies include techniques that teach learners to guide their mental processes in thinking, learning, and remembering while monitoring the learning process [11]. According to Safari and Mohamad Jani, some studies indicate the weakness of students in using metacognitive skills. For instance, Cohen believes that many students have difficulty building meaningful theories about their knowledge and awareness, which require the use of metacognitive skills [12]. Not only are these methods highly effective for learning and academic advancement, but they can also be taught and acquired by both educators and students [11]. Considering the cognitive nature of such factors, it is believed that psychological interventions may assist educators in designing suitable learning environments that can significantly reduce academic procrastination and, consequently, students' academic failure [6, 13]. Academic procrastination is a significant issue for both students and society that requires urgent attention [14]. Surprisingly few studies have been conducted in Asian countries, particularly in Iran, focusing on medical students [4]. Therefore, the present research aimed to investigate the impact of virtually teaching cognitive and metacognitive strategies on the academic procrastination of medical students at Iran University of Medical Sciences.

Materials and Methods

Study design

The study employed a quasi-experimental design with two groups assessed before and after the intervention. The study population consisted of medical students, with the research sample comprising fourth-year medical students at Iran University of Medical Sciences in 2023.

Sampling method

Using volunteer sampling and based on the educational policies of the medical school at Iran University of Medical Sciences, medical students were divided into two groups, A and B. One group was designated as the intervention group, while the other served as the control group. Subsequently, 35 volunteers from each group were enrolled in the study, which was determined considering a 95% confidence interval, test power of 90%, and using the sample size formula. Two participants from the intervention group were excluded due to incomplete participation in the training course, and two participants from the control group were excluded because they did not complete the pre-test and post-test. The inclusion criteria for this research were the student's willingness to participate and not having previously taken educational courses on cognitive and metacognitive learning strategies. Exclusion criteria included prior participation in such courses (to eliminate the influence of previous knowledge),

unwillingness to continue with the research, and experiencing unfortunate events during meetings and tests. Upon obtaining ethical approval, eligible students were enrolled in the study. Researchers initially conducted a preliminary pre-test using the academic procrastination questionnaire in both the intervention and control groups. Fourth-year students were chosen as the sample because lower-year students may lack the maturity to engage in research activities.

Intervention

To conduct the educational intervention for the intervention group, the time was coordinated with the class representative using the Big Blue Button software platform. Before the training began, students were informed that it was part of a research project, and they were asked not to share educational content with other students. They were also assured that the content would be made available to others after the research concluded. Expert educators in cognitive and metacognitive skills provided the educational content. The training consisted of four weekly sessions, each lasting one hour. At the start of each session, key messages from the previous session were reiterated to reinforce the content. Four weeks after the intervention, the post-test, using the same Solomon and Rothblum Academic Procrastination Questionnaire was administered to both the intervention and control group students.

Instrument

The data collection instrument in this research was the Solomon and Rothblum Academic Procrastination Questionnaire, which was first prepared by Solomon and Rothblum in 1984. This instrument comprises three sections: preparing for exams (questions 1 to 6), preparing assignments (questions 9 to 17), and preparing articles (questions 20 to 25); however, six questions (questions 7, 8, 18, 19, 26, and 27) were included to assess the traits of "discomfort with procrastination" and "willingness to change procrastination habits," totaling 27 items. Notably, for Iranian students, the questions related to the third section were considered akin to research assignments and class research. Each item in the scale is rated on a five-point scale: "never" (score of 1), "rarely" (score of 2), "occasionally" (score of 3), "most of the time" (score of 4), and "always" (score of 5). Questions 4, 6, 11, 13, 15, 16, 21, 23, and 25 are reverse-scored. Solomon *et al.* (1984) reported internal consistency with a coefficient of 0.84 and reliability using Cronbach's alpha of 0.91 for the entire scale [15]. The questionnaire was translated into Persian by Jokar and Delavarpour, with reliability and validity coefficients of 0.61 and 0.88, respectively [16]. To address internal validity threats arising from non-random sample allocation, covariance analysis was employed during the result analysis. Measures were taken to mitigate factors such as dissemination of experimental content, compensatory competition, and morale weakening in

the control group, including explicit instructions in the consent form. Control group participants would receive all educational content at the research's conclusion. To address external validity concerns, various measures were taken during the study design, implementation, and publication of findings.

Data analysis

Data analysis was conducted using SPSS 16 software, employing descriptive statistics (mean and standard deviation) and inferential statistics. The Kolmogorov-Smirnov test assessed the normality of the statistical sample, while the t-test of two groups was applied to analyze the research questions.

Findings

Both the control and intervention groups comprised 33 students each. Table 1 presents the demographic characteristics of the groups. The majority of participants were within the age range of 22 years and the independent t-test revealed no statistically significant difference between the groups' average ages ($p=0.053$). Based on the Chi-square test results, both groups were homogeneous in terms of gender ($p=0.599$). Concerning habitat status, the Chi-square test revealed no statistically significant difference in habitat between the groups ($p=0.506$). In terms of the research sample's GPA in both groups, the majority fell within the 16 range. The independent t-test revealed no statistically significant difference in GPA between the control and intervention groups ($p=0.038$).

Table 1. Frequency and mean values of demographic characteristics of the participants

Groups	Control group	Intervention group	p-Value
Age	21.75±70.844	22.36±96.236	0.053*
Gender	Female 21(64)	19(58)	0.599**
	Male 12(36)	14(42)	
Habitat status	Native 25(76)	26(79)	0.506**
	Non-native 8(24)	7(21)	
GPA	16.20±1.59	16.18±1.470	0.847*

*Independent t-test.

**Chi-square test.

The mean post-test academic procrastination scores of students in the two groups exhibited a significant difference ($p=0.0000$). However, there was no statistically significant difference between the two groups at the pre-test stage, with their averages being almost identical ($p=0.7880$; Table 2).

Table 2. Paired t-test results to check the difference in mean pre- and post-test scores of academic procrastination in the two groups

Parameter	Group	Mean	T	p-Value
Pre-test	Intervention	66.90±10.10	3.76	0.788
	Control	65.81±12.24		
Post-test	Intervention	50.60±4.66	9.24	0.000
	Control	65.54±11.64		

Based on the results obtained from Levene's test, the obtained significance level (0.528) was greater than

the critical value at the 0.95 level (0.05), thereby affirming the assumption of homogeneity of variance. The results of the analysis of covariance in Table 2 indicate a significant difference in academic procrastination between the intervention and control groups ($p < 0.01$; $F = 20.83$). The coefficient of determination (R^2), equals 0.41, implying that 41% of

the variance in academic procrastination can be attributed to the utilization of educational methods involving cognitive and metacognitive strategies. In other words, education through cognitive and metacognitive strategies can significantly influence the reduction of academic procrastination among students (Table 3).

Table 3. Results of analysis of covariance of the intervention and control groups regarding academic procrastination

Academic procrastination	Sum of squares	Degree of freedom	Mean square	F value	p-Value	Coefficient of determination	Statistical power
Post-test (intervention group)	14.62	1	38.46	20.83	0.001	0.41	0.05
Post-test (control group)	14.09	63	14.81	8.66	0.01	0.004	-
Group	8.316	1	10.520	34.24	0.000	-	0.01
Error	26.92	46	37.11	-	-	-	-
Total	255.99	82	-	-	-	-	-

Discussion

Academic procrastination is a prevalent issue across various educational levels, encompassing a range of behavioral challenges influenced by several factors. This study aimed to explore the impact of virtually teaching cognitive and metacognitive strategies on the academic procrastination tendencies of medical students at Iran University of Medical Sciences. The results indicated that implementing training in cognitive and metacognitive strategies significantly and positively reduced academic procrastination among students. Rashidzade *et al.* concluded in their research that training in metacognitive self-management strategies enhances academic resilience and decreases academic procrastination. Furthermore, they suggested that programs focusing on teaching metacognitive self-directed strategies enhance resilience and decrease academic procrastination [17], consistent with the findings of this study. Similarly, Kafipour *et al.* found that students' utilization and familiarity with language learning strategies are moderate, while their level of academic procrastination is high [9]. Sam Khaniani's research demonstrated the effectiveness of teaching cognitive and metacognitive skills in reducing academic procrastination, suggesting that such training can offer effective approaches to combat procrastination tendencies [18]. Ghadampour *et al.* discovered that teaching cognitive and metacognitive learning strategies significantly reduces academic procrastination and enhances self-efficacy among students in the intervention group compared to the control group, with this effect persisting during the follow-up period [19]. Additionally, Sheykholeslami's research showed that there is a significant negative correlation between cognitive strategies and their components, as well as metacognitive strategies and their components, with students' academic procrastination. Their analysis also revealed that cognitive and metacognitive strategies positively predict academic procrastination tendencies among students [20].

Furthermore, Ghadampour *et al.*'s study showed that there is a negative and significant relationship

between self-esteem indicators and academic procrastination, while metacognitive beliefs have a positive and significant association with procrastination. The research emphasizes the direct role of metacognitive variables in explaining student procrastination tendencies [21]. In a study, Saputri *et al.* found that self-regulation has a significant negative relationship with academic procrastination of learners [22]. Also, San *et al.* showed that internal goal orientation, task values, practice, development, metacognitive self-regulation, resource management strategies, organization, and critical thinking are components of self-regulated learning and have a significant negative correlation with academic procrastination. They proposed that the majority of self-regulated learning components exhibit a robust correlation with academic procrastination, indicating areas that can be enhanced to assist those in need of improvement. Educators can plan strategies to tackle academic procrastination and increase academic performance [23]. Krispenz *et al.* showed that teaching techniques and strategies for cognitive re-evaluation of problems by strengthening academic self-efficacy reduce stress and academic procrastination [24]. Metacognition plays an essential role in successful learning, and the higher the cognitive abilities of the learner, the more successful the learning process will be. In other words, the learner ought to be actively involved in their learning process and evaluate their methods, and if their learning strategies prove ineffective, they should be willing to adopt new approaches [25]. The primary objective of metacognitive education is to foster self-regulation and self-directed learning, enabling students to evolve into autonomous learners capable of steering, supervising, and adjusting their cognitive and learning strategies toward their defined objectives [26, 27].

According to our findings, greater emphasis should be placed on instructing and enhancing cognitive and metacognitive abilities concurrently with educational initiatives. It is advisable to incorporate these aspects into educational planning and upcoming curriculum updates. Further investigation

is encouraged to explore the implementation of this subject matter within medical curricula. Numerous challenges related to learning and the transfer of knowledge stem from insufficient metacognitive capabilities and strategies. These strategies and skills empower individuals to choose, regulate, monitor, oversee, and ultimately refine their cognitive processes. Consequently, learners should undergo essential training in various skills such as organization, self-assessment, planning, and goal establishment to proficiently adopt cognitive strategies, thereby paving the way for acquiring new knowledge. Without this preparation, tackling unfamiliar challenges could prove to be a daunting task for them.

Among the limitations of the present study, we mention the small number of samples and the involvement of disturbing variables during the research. In addition, using the questionnaire also has inherent limitations.

Conclusion

The implementation of cognitive and metacognitive strategies training has a positive and significant influence on reducing academic procrastination among students.

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