

An Academic Achievement Model for Students with Post-Traumatic Stress Disorder (Kermanshah Earthquake) based on Cognitive Ability and Difficulty in Emotion Regulation

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Abstract

INTRODUCTION: Academic achievement is one of the main concerns of the educational system of any country, and as a result, any factor that is effective in reducing or increasing its quantity and quality is considered and emphasized by researchers. Psychological damage and stressful accidents have effects on academic achievement. This study aimed to develop a model of structural equations for academic achievement of students with Post-Traumatic Stress Disorder (PTSD) (Kermanshah earthquake) based on cognitive ability; moreover, it was attempted to investigate the mediating role of difficulty in emotion regulation in this regard.

METHODS: This descriptive-correlational study was conducted based on a quantitative and applied research method. The statistical population of the present study includes all students with PTSD in Sarpol Zahab, Kermanshah Province, Iran, in the academic year of 2018-19. In total, 48 cases were selected using the available sampling method. The data were collected using the Capita's Log software, Emotion Regulation Questionnaire, and final grades of Persian literature and mathematics courses. Data analysis was performed employing the Structural Equation Modeling (SEM) and Smart PLS software.

FINDINGS: The results of this study in the form of a structural model showed that all t-coefficients among the three main constructs were higher than 1.96, which indicates the existence of significant relationships among research variables. In other words, cognitive ability has a direct and significant relationship with the academic achievement of students with PTSD. Moreover, there is a negative relationship between cognitive ability and difficulty in emotion regulation.

CONCLUSION: The results of the present study revealed the direct and significant effect of cognitive ability on the academic achievement of students with PTSD. In addition, an indirect effect of cognitive ability was observed on the academic achievement of these students with a mediating role of difficulty in emotion regulation. The findings of the present study indicate that the improvement of the cognitive ability, as well as the enhancement of the skills related to emotion regulation in students with PTSD, leads to improved academic achievement.

Keywords: Academic Achievement; Cognitive Competence; Difficulty in Emotion Regulation; Post-traumatic Stress Disorder.

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Introduction

Success in school involves gaining appropriate experiences in all aspects of cognitive, emotional, social, behavioral, and biological development; moreover, the

attainment of these experiences in school can affect students' present and future lives (1). One of the important criteria in assessing the success rate of the educational system is the academic

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achievement of students. Over the past century, psychologists have been extensively trying to identify the factors affecting it (2). Academic achievement can be measured by measuring learners' performance and comparing pre-determined learning outcomes and goals in order to decide which teacher's educational activities and learning efforts have led to desirable goals. This definition presents the importance of academic achievement in the education system and society since the progress of any society depends on the educational ability of that society, and the efficiency of the educational system is estimated by measuring the achievement of the graduates of that system to educational goals.

Therefore, the improvement of the educational status of students has become one of the basic goals of contemporary education systems (3). Numerous factors can affect students' academic achievement. Among the most important of these factors, one can refer to the mental health of students throughout life (4). Mental health is of significant importance, especially in adolescence, and plays a prominent role in socio-psychological development and attainment of academic achievement among adolescents (5). However, exposure to unpleasant events can severely affect the lives of adolescents, cause many mental and physical disorders (6), and disrupt their academic life (7). Post-traumatic Stress Disorder (PTSD) is one of the most common disorders reported in injured or traumatized individuals. This disorder is included in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, in the category of trauma (disorders) related to stressors.

Furthermore, it is regarded as one of the most debilitating psychiatric disorders accounting for 5% to 6% and 10% to 12% of suffering among males and females, respectively (8). The results of several studies have shown that PTSD is associated with decreased academic performance and low academic achievement in students (9). This can affect a person's academic and professional life in the future, followed by adverse consequences for the person. Moreover, impaired attention, memory, and disruption of the underlying neural circuits are among the cognitive weaknesses of this group of people (10). It is worth mentioning that these factors are among the most important cognitive functions for learning tasks, as well as logical and verbal reasoning that play a very significant role in learning and academic achievement (11). Therefore, any

defects can disrupt the learning process and academic achievement (12). Accordingly, it seems that cognitive deficits and weaknesses in higher cognitive functions are among the factors associated with academic failure and lack of academic achievement of students with PTSD. In addition to cognitive abilities, the way to manage and regulate emotions is also factors affecting the academic life of students that play an important role in their academic achievement (13). Difficulty in regulating and managing emotions is considered one of the main manifestations of PTSD (14). Several studies have shown that people with PTSD have problems with emotion regulation (15). Emotion regulation is defined as the ability to monitor, evaluate, and modulate emotional responses, especially in the context of goal-oriented behaviors. This includes four components, namely awareness of emotions and their perception, acceptance of emotions, ability to control impulsive behaviors and behave in accordance with the intended goals in case of encountering difficult emotional experiences, and ability to flexibly apply emotion-adjusting strategies appropriate to the situation (16). As a result, it can be stated that emotion regulation, in addition to emotional systems, also involves the individual's cognitive systems and affects students' academic performance.

With this background in mind, it can be concluded that PTSD is one of the most prevalent disorders after experiencing natural disasters, including earthquakes, which has devastating effects on mental health and cognitive abilities, especially among children and adolescents. This disorder can disrupt students' academic achievement and cause many problems for them in their academic life. However, more research has focused on using methods to minimize emotional problems and improve the mental health of these people. On the other hand, less attention has been paid to their cognitive achievement and academic performance.

In all educational systems, the rate of academic achievement of students is one of the indicators of success in scientific activities, and based on this, academic achievement rates and the factors affecting it are among the major issues that attracted the attention of various researchers. As a result, it is necessary to adopt a new and effective strategy to improve the cognitive abilities of these students and pave the way for their academic progress. The present study can be important and

necessary in several ways. First, Iran is an earthquake-prone country, and the earthquake that occurred in November 2017 in Sarpol Zahab and Azgele district in Kermanshah, Iran (7.3 on the Richter scale) was one of the most severe earthquakes in recent decades. Various studies have shown that PTSD (especially in adolescents) is one of the most important and major psychological consequences of earthquakes (17).

Accordingly, it seems necessary to investigate the cognitive and emotional dimensions related to the academic achievement of students affected by this event. It is worth mentioning that no studies have been conducted so far on the relationship between cognitive ability and academic achievement of students with PTSD considering the mediating role of difficulty in emotion regulation in the form of a model of structural equations. This reveals the dearth of research in the literature in this regard, and the present study can be an important step in paving the way for investigating this disorder among adolescents with PTSD in Kermanshah, Iran.

Accordingly, the present study aimed to investigate the relationship between cognitive ability and academic achievement of students with PTSD considering the mediating role of difficulty in emotion regulation, which is proposed as follows:

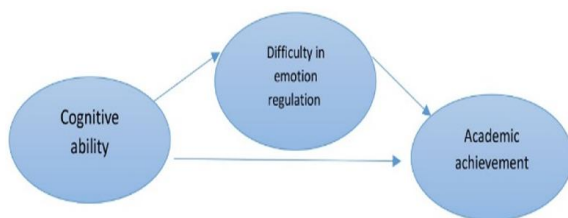


Figure 1. Proposed research model

Methods

The statistical population of the present study included 576 students studying in the first and second year of high school in the academic year 2018-19 in Sarpol Zahab, Kermanshah Province, Iran, who had been diagnosed with PTSD in an earthquake by the medical centers of the city. In total, 48 cases were selected using the available sampling method. After obtaining permission from the university, by referring to the PTSD treatment centers in Sarpol Zahab, making the necessary coordination with the center officials, and obtaining information about students with PTSD, high school students referring to the

centers were asked to complete the emotion regulation questionnaire. Based on their scores and the cut-off point of this questionnaire, the students were divided into groups of 12 cases regarding the high and low emotion regulation. The inclusion criteria were willingness to participate in the study and diagnosis of PTSD after the Kermanshah earthquake. The required data were collected by selecting a research sample and requesting the students and their parents to participate in the research process. It should be noted that the research objectives and process were explained to all of them, and in case of willingness, they were included in the study.

The data collection tools included:

Capita's Log software (2014 version):

Captain Log Sandford is one of the designers of the cognitive empowerment system (Navid, 2014). In the present study, Capita's Log software was used to evaluate the cognitive ability of students with PTSD. It is based on a basic information processing system, working memory, and central processing speed; moreover, it provides feedback on individual ability, competence, and self-efficacy. This set includes 50 training programs with 2000 exercises to improve various cognitive skills. In this study, participants' skills related to working memory, attention, and processing speed were evaluated using the assignments provided in Capita's Log software. The reliability of the results of this software has been confirmed in several studies (18). Moreover, in the introductory phase of the present study, the reliability values of working memory, attention, and processing speed using Cronbach's alpha were estimated at 0.79, 0.82, and 0.80, respectively. The values indicate that the reliability of the data is acceptable.

Emotion regulation scale (Gratz and Roemer)

The present study utilized the motion regulation scale (Gratz and Roemer) to evaluate the emotion regulation skills of the research participants. This is a 36-item scale developed by Gratz and Roemer (2004) with a general score and six specific scores of subscales related to different dimensions of emotion regulation rated on a 5-point Likert scale. These subscales include rejection of emotions, inability to use goal-oriented behaviors, impulse control problems, lack of emotional awareness, low access to emotion regulation strategies, and lack of

emotional clarity. The researchers also examined the reliability and validity of the scale in a sample of 479 undergraduate students. This scale also revealed good internal stability in the total score using Cronbach's alpha coefficient (0.93) and in all subscales with an alpha coefficient greater than 0.8. Moreover, the reliability values of the test-retest in a period of 4 to 8 weeks for the total score and the score of subscales were estimated at 0.88 and 0.57, respectively ($P < 0.01$).

Kermani, Mamazandi, and Talepsand (2018) examined the psychometric properties of this questionnaire and evaluated its validity as acceptable and desirable. Furthermore, using internal consistency and Cronbach's alpha coefficient, validity coefficients for each factor, such as non-acceptance of emotional responses, difficulty in using purposeful behaviors, difficulty in controlling impulse, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity, were estimated at 0.75, 0.74, 0.68, 0.66, 0.73, and 0.63, respectively. Furthermore, in the introductory phase of the present study, the reliability values related to each dimension of non-acceptance of emotional responses, difficulty in using purposeful behaviors, difficulty in controlling impulse, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity were obtained at 0.76, 0.72, 0.81, 0.70, 0.69 and 0.65, respectively, using Cronbach's alpha, which shows that the reliability of the data is acceptable.

Academic achievement

In the present study, the final grades of students in Persian literature and mathematics were also considered the scores related to academic achievement. It should be noted that in the introductory phase of the present study, the reliability values of the scores related to mathematics and Persian literature courses using Cronbach's alpha coefficient were 0.77 and 0.69, respectively, which are in the acceptable range. Cognitive empowerment training was conducted for 20 sessions (1-hour sessions, twice a week) after the school classroom at the medical center by a trained and skilled examiner. During this period, no training was provided for the control group who were present at the same treatment site; however, the same conditions were considered.

The obtained data were analyzed in SPSS

software (version 26) and SMART PLS2 software which is a useful tool for partial least squares structural equation modeling (PLS-SEM) designed by Ringel, Wende, and Will (2005). Regarding the choice of the PLS method in the present study, it can be stated that since in the studies related to covariance-based modeling, the presence of three indicators is required for each latent variable, this limitation does not exist in PLS-based modeling. Moreover, academic achievement in the present study is in the form of two indicators; accordingly, the choice of PLS-SEM is a suitable method. In addition, covariance-based structural modeling can be used when the sample size is large, and the data distribution is normal; however, in the present study, one of the main criteria for entering the study was the diagnosis of PTSD after the Kermanshah earthquake but the number of the students with this criterion was limited. Therefore, the researcher could select 48 cases, and PLS-SEM was a suitable alternative to covariance-based-SEM since this method can be applied to a small sample size (19).

Findings

Measurement model

The measurement model test, which is the result of the algorithm output, includes checking the reliability (internal consistency) and validity of the model (20). The first criterion for examining the fit of measurement models is reliability, which is itself determined by examining factor load coefficients (internal consistency), examining Cronbach's alpha coefficients, and combined reliability. Prerequisites for factor load coefficients are 0.4, Cronbach's alpha coefficients of 0.7, and combined reliability of 0.7. The second criterion of the study of the fit of measurement models is the average variance extracted (AVE), which examines the degree of correlation of each structure with questions (indicators). The necessary condition for convergent validity is 0.5 (21). The results related to the study of each indicator of the measurement model regarding the data collection tools used in the present study are presented below:

Internal consistency evaluation:

Table 1 tabulates the factor load of each indicator on the relevant construct. The acceptable factor load for each variable is 0.7.

As can be observed in Table 1, the factor loads of each variable on the desired construct are higher

than 0.7%, and therefore, the internal consistency of the research variables is confirmed. To evaluate the reliability, the combined reliability index was used, the results of which are presented in Table 2. In structural equation modeling, combined

reliability is also used, and values higher than 0.7 indicate appropriate reliability.

According to the results in Table 2, the values obtained from the combined reliability of the research variables are accepted.

Table 1. Factor loads

Variable	Cognitive ability	Academic achievement	Difficulty in emotion regulation
Active memory	93.0		
Attention	95.0		
Processing speed	95.0		
Mathematics		93.0	
Persian literature lesson		76.0	
Not accepting emotions			96.0
Inability to use goal-oriented behaviors			94.0
Problem at impulse control			97.0
Lack of emotional awareness			93.0
Low access to emotion regulation strategies			93.0
Lack of emotional clarity			92.0

Diagnostic validity of AVE

In the structural equation model, one of the types of validity is diagnostic validity, which is calculated by SMSRT PLS software. Accordingly, the indicators (indicators of each construct) ultimately provide a suitable separation in terms of measurement, compared to other constructs in the model. In other words, each indicator should measure only its own construct, and its composition should be such that all constructs are well separated from each other. This process is characterized by AVE, according to the results presented in Table 3, the AVE values of the research constructs are higher than 0.5, and they are accepted.

Convergent validity

Convergent validity was used to examine the fact that each indicator has the highest correlation with its construct, compared to other constructs. When multiple indicators are used to measure each latent variable, the researcher must not only be satisfied with the individual scale of the marker but must also consider the degree of convergent validity of the constructs. To investigate this issue, a cross-factor load was used. To do this, the correlation of each indicator with all other constructs of the model was calculated; therefore,

the values should be higher for the selected construct of the researcher than other constructs. The results showed that convergent validity was also confirmed (Table 4)

Structural model

This section evaluated the relationships among variables using a structural model in the PLS, and the results were presented considering two modes of significance and standard estimation. Initially, the Bootstrapping command of Smart PLS software was used to investigate the effect of variables which revealed the output of t-coefficients (Figure 2). When the values of t are greater than 1.96, it indicates the significance of the parameter and subsequently confirms the relationships among the research variables. As can be observed in Figure 3 all t-coefficients among the three main constructs are higher than 1.96, which indicates significant relationships among research variables.

Subsequently, the causal relationships among the research constructs were evaluated using Smart PLS software. As shown in Figure 3 (implementation of the model in a standard mode), there is a significant relationship among the three main research constructs.

Table 2. Combined reliability estimation

Construct (latent variable)	Combined reliability	Cronbach's alpha
Cognitive ability	96.0	94.0
Difficulty in emotion regulation	98.0	97.0
Academic achievement	84.0	73.0

Table 3. Evaluation of the AVE values for diagnostic validity

Construct (latent variable)	AVE
Cognitive ability	89.0
Difficulty in emotion regulation	89.0
Academic achievement	72.0

Therefore, the relationship between cognitive competence and academic achievement is positive, the relationship between cognitive competence and difficulty in emotion regulation is negative, and the relationship between difficulty in emotion regulation and academic achievement is negative. According to the results, it can be said that cognitive ability has a negative effect on the difficulty in emotion regulation. This means that a high level of cognitive competence is inversely and significantly related to the difficulty in emotion regulation. In addition, cognitive competence has a positive effect on academic achievement and higher scores of cognitive competence have a positive and significant relationship with increasing academic achievement scores. On the other hand, the difficulty in emotion regulation has a negative effect on academic achievement and has led to a decrease in academic achievement scores. Furthermore, the causal

coefficients of the paths show that cognitive competence has an effect with a coefficient of 25% ($0.27 * 0.95$) through the mediating role of difficulty in emotion regulation.

The results of implementing two models regarding the two modes of significance and standard estimation are presented in Table 5.

Model Adequacy Checking

In the Smart PLS model to check the fit of the model, the sum of squared errors (SSE) on each latent variable block and $1 - \frac{SSE}{SSO}$ -show the content validity index or CV-COM, and if the index of CV-COM of the latent variables is positive, the measurement model is of good quality. As can be observed in Figure 4 CV-COM of the latent variables is positive for all constructs. Therefore, the developed model has good adequacy.

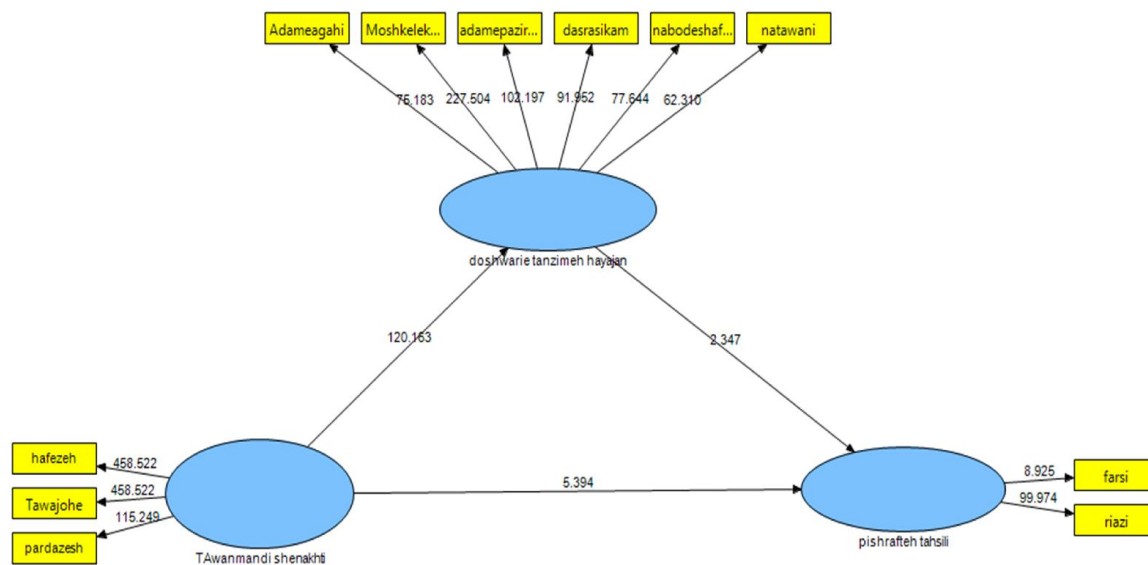
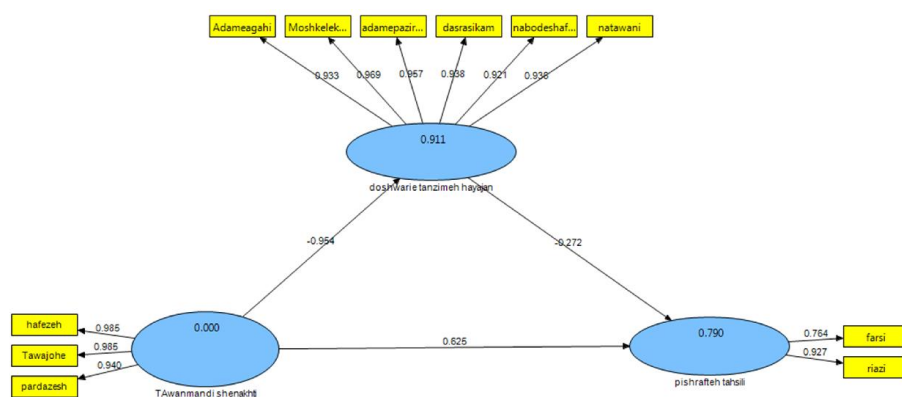
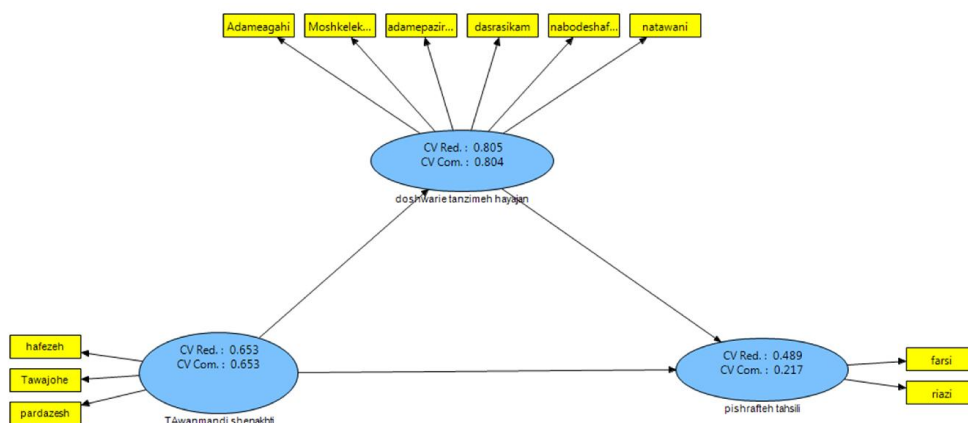
**Figure 2.** Implementation of the proposed model in a significant mode

Table 4. Convergent validity evaluation

Variable	Cognitive ability	Academic achievement	Difficulty in emotion regulation
Active memory	93.0	63.0	59.0
Attention	95.0	58.0	58.0
Processing speed	95.0	70.0	65.0
Mathematics	60.0	93.0	51.0
Persian literature lesson	58.0	76.0	73.0
Not accepting emotions	71.0	50.0	96.0
Inability to use goal-oriented behaviors	58.0	44.0	94.0
Problem at impulse control	63.0	60.0	97.0
Lack of emotional awareness	56.0	71.0	93.0
Low access to emotion regulation strategies	48.0	66.0	93.0
Lack of emotional clarity	49.0	50.0	92.0

Table 5. Results of direct and indirect relationships of research variables

Relationships	Standard coefficients	t-value	Result
Cognitive ability → Academic achievement	62.0	39.6	Confirmed
Cognitive ability → Difficulty in emotion regulation	95.0	163.120	Confirmed
Difficulty in emotion regulation → Academic achievement	27.0	35.2	Confirmed
Cognitive ability → Difficulty in emotion regulation → Academic achievement	25.0	-	Confirmed

**Figure 3.** Implementation of the model in a standard estimation mode**Figure 4.** Model adequacy

Discussion and Conclusion

This study aimed to investigate the relationship between cognitive ability and academic achievement of students with PTSD. In total, 48 students with PTSD in Sarpol Zahab, Kermanshah Province, Iran, were selected as the research sample. The data were collected using Capita's Log cognitive software (cognitive abilities of attention, working memory, and processing speed), and emotion regulation scale (Gratz and Roemer, 2004). Furthermore, the final scores of the research participants in mathematics and Persian literature courses were considered the data related to the academic achievement variable.

The collected data were then analyzed using the structural equation modeling by the PLS method in Smart PLS software. The results of data analysis show that the conceptual and proposed model is of appropriate quality. In addition, cognitive competence revealed a direct and significant relationship with the academic achievement of students with PTSD. This means that high levels of cognitive competence can significantly predict academic achievement. This finding is in line with the results of studies conducted by Rudak et al.

(2018), Samadi et al. (2018), Song et al. (2018), and Cramp et al. (2018). The results of these studies show that cognitive functions, such as working memory, ability to pay attention, and information processing, are among the important cognitive abilities in learning and play a critical role in the students' achievement and academic progress.

In explaining these results, it can be said that students with PTSD have major deficits in cognitive and executive functions, and several studies conducted in this regard confirm this issue. Valenciaa et al. (22) in a study examined the cognitive profile of children with PTSD using neurological tests. The results showed that this group had poor cognitive and executive functions; moreover, working memory, attention, and executive functions in these patients had serious problems. Furthermore, De Jong et al. (23) and Sahragard et al. (24) have confirmed the existence of deficits in cognitive skills and executive functions of individuals with PTSD. It is worth noting that the improvement of academic performance, especially academic achievement in mathematics is mainly dependent on cognitive

abilities and executive functions, and many experts emphasize the role of these abilities in learning mathematics (25). Another result of the present study was the negative relationship between cognitive ability and difficulty in emotion regulation. In other words, PTSD students with low scores in cognitive abilities face more difficulties in regulating and managing their emotions. On the other hand, these students with high scores in cognitive abilities have higher levels of emotion regulation skills. One of the main dimensions of emotion regulation and emotion management is the cognitive dimension of emotion regulation, which includes positive refocusing, refocusing on planning, re-evaluating, and focusing on thinking (26). All of these activities are based on the cognitive system, and this shows that high-level cognitive abilities affect the ability to regulate emotion, which is confirmed by some studies (27).

In the same line, the results of the present study revealed that the difficulty in emotion regulation has a negative and inverse relationship with academic achievement. This means that students with PTSD and difficulty in emotion regulation have low academic achievement; however, those with PTSD and low levels of difficulty in emotion regulation have higher academic achievement. This finding is consistent with the results of studies by Azar et al. (2015), Bat, and Hafez (2015). The proper use of emotion regulation strategies can play an essential role in the factors effective in academic achievement among the students, and therefore, paves the way for their academic achievement (28). Gross (29) believes that the ability of people to manage their emotions is one of the most important capabilities to reduce inappropriate levels of anxiety. In fact, it is suggested that emotion regulation can reduce students' anxiety, thereby increasing their academic achievement.

Similarly, the results of a study by Shirazi Tehrani et al. (30) show that emotion regulation skill training reduces test anxiety. Additionally, Gharibnavaz et al. (31) reveal the mediating role of emotion regulation strategies in the relationship between metacognitive beliefs and test anxiety. Finally, the most important finding of the present study was that the academic achievement of students with PTSD can be explained through cognitive competence with a mediating role of difficulty in emotion regulation. In fact, this finding suggests that difficulty in emotion

regulation mediates the relationship between cognitive competence and academic achievement. Since no research has been conducted so far to examine these three variables in the form of a structural equation, this finding cannot be compared with the results of similar studies. In explaining this finding, it can be stated that cognitive skills and emotional skills are the two main factors in learning and students' academic performance. However, according to the results of the studies reviewed in the present study, cognitive and emotional dysfunctions are among the main weaknesses of individuals with PTSD. Accordingly, it is possible to explain the academic failure and low levels of academic performance of students with PTSD based on weakness in cognitive abilities and skills related to emotion regulation.

A lot of efforts were made in conducting the present study; however, regarding the limitations, one can refer to the low access to the samples for research since the researcher intended to evaluate the students with PTSD after the Kermanshah earthquake. This limited the scope of access to a suitable sample to achieve the desired results. Furthermore, the information of the difficulty in emotion regulation was collected through self-report; accordingly, the results might be faced with personal bias. Accordingly, it is suggested that similar studies be performed on larger sample sizes, and the results be compared with the findings of the present study. Moreover, given that the proposed research model based on the relationship between cognitive competence and academic achievement with the mediating role of difficulty in emotion regulation has been approved in this study, it is suggested that appropriate strategies and measures be adopted to improve cognitive competencies and ability to manage and regulate emotions in students with PTSD so that these students can have great performance in their academic life.

Acknowledgments

None

Conflict of Interests

The authors declare that there is no conflict of interest in this study.

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