Iranian Educational Psychology Association

Iranian Journal of Learning and Memory

Print ISSN: 2645 - 5455
Online ISSN: 2645 - 5457

Homepage: https://journal.iepa.ir

The Effectiveness of Problem-solving Skills on Learning Self-Regulation and Achievement Motivation in Twelfth-Grade Female Students with Test Anxiety

Davod Ghaderi[1]

1. Department of Psychology, Sarab Branch, Islamic Azad University, Sarab, Iran. E-mail: d.ghaderipsy@gmail.com

Article Info

Article type:
Research Article

Article history:
Received June 25, 2024
Received in revised form September 13, 2024
Accepted September 22, 2024
Published online September 25, 2024

Keywords:
problem-solving, self-regulation of learning, achievement motivation, exam anxiety, students

ABSTRACT

Objective: This study investigated the effectiveness of problem-solving skills in learning self-regulation and achievement motivation in twelfth-grade female students with exam anxiety in Tabriz.

Method: The present study adopted a quasi-experimental method with pre-test-post-test-follow-up and a control group. From the population of 12th-grade female students with test anxiety in Tabriz, 30 were selected by multi-stage cluster sampling and random assignment. All the participants completed the self-regulated learning questionnaires of Lau and Jong (2022) and motivation to progress of Lang and Fries (2006) in the pre-test-post-test-follow-up phases. The experimental group was exposed to the problem-solving skills package of D'Zurilla and Nezu (2010) included in six 90-minute sessions over two months.

Results: Repeated measures analysis of covariance was used to analyze the data using SPSS 27 version. The results showed significant differences in learning self-regulation and achievement motivation of the experimental and control groups' pre-test/post-test and follow-up scores. After applying the intervention, the experimental group obtained higher scores in the criterion variables than the control group. This effect remained in the follow-up period.

Conclusions: This study's findings are significant, reassuring educators and psychologists that problem-solving skills can improve self-regulation and achievement motivation in students with anxiety.

Cite this article: Ghaderi, D. (2024). The Effectiveness of Problem-solving Skills on Learning Self-Regulation and Achievement Motivation in Twelfth-Grade Female Students with Test Anxiety. *Iranian Journal of Learning and Memory*, *7* (27), 23-38. DOI: https://doi.org/10.22034/iepa.2025.495082.1515

© The Author(s).
Publisher: Iranian Educational Research Association.
DOI: https://doi.org/10.22034/iepa.2025.495082.1515

Introduction

Test anxiety is a specific type of performance anxiety that occurs when a person is formally or informally assessed. Children often experience test anxiety when responding to exams, giving lectures, and participating in class (Huberty & Dick, 2006). Fear of negative evaluation is a common fear reported by children with test anxiety. Symptoms of test anxiety can be physiological (such as rapid heart rate, muscle tension, skin flushing, sleep problems, headaches), cognitive (such as memory problems, attention problems, concentration problems, worry, problem-solving problems, cognitive distortions), or behavioral (such as avoidance from work, withdrawal) (American Psychiatric Association, 2022). This anxiety creates significant barriers to learning and functioning (Grøtan et al., 2019). Test anxiety can affect a learner's social and emotional, and behavior, as well as his feelings about himself and the school adversely (Salend, 2012). Exam anxiety is prevalent among the student population in the world (Dalkıran et al., 2016). Howard (2020) stated that between 12 and 18 percent of the studies showed a high prevalence of test anxiety, indicating that, on average, five students out of a class of 30 are likely to have severe test anxiety.

Moreover, achievement motivation and learning are related to positive and negative emotional structures (emotions). One of these negative emotions that prevent optimal performance and learning of students is exam anxiety (Hannani et al., 2023). The structure of motivation for academic progress in school is the behaviors related to learning and improvement (Yancachajlla-Quispe, 2024). Eilam and Aharon (2003) believed that the motivation for academic progress is an all-around tendency to evaluate performance according to the highest standards, strive for success in performance, and enjoy the pleasure associated with success in performance. Most teachers are aware of the positive and universal consequences of academic motivation. However, they need to learn how and by what strategies and techniques to strengthen such motivation, and a small group of them, unknowingly and unknowingly using motivation methods, cause a decrease in motivation and poor academic performance (Nahid et al., 2023). According to Sardabi-Kia and Ghajarieh (2023), motivational strategies for learning are one of the main components that affect successful learning. If educators pay attention to this component, learning environments will be more attractive and lively for learners. On the other hand, a disorder in motivation can cause problems at the level of emotions and behavior and prepare the ground for anxiety (Cetin, 2015; Pekrun et al., 2016). One of the common types of anxiety among students is exam anxiety, or the perception of any academic evaluation is one of the most critical aspects of negative motivation and has adverse effects on students' classroom performance (Raufelder et al., 2017; Tan & Pang, 2023).

Self-regulation is a promising conceptual approach that may reduce the adverse effects of anxiety (Albulescu et al., 2024). Self-regulation was defined by Brown (1998) as the ability to plan,

direct, and flexibly control one's behavior to adapt to changing circumstances (Billore et al., 2023). The concept has traditionally been applied to many contexts, including work, health care, and the organizational world (Allahverdiani et al., 2024; Karoly et al., 2005). Self-regulation, when used in education, is defined as the activity aimed at planning and managing time and effort to achieve educational goals (Berweger et al., 2023; Pichardo et al., 2014). Recently, personal self-regulation has been critical in health care, academic achievement, and avoiding behaviors such as procrastination (Garzón-Umerenkova et al., 2018; Pichardo et al., 2014). Acquiring psychological competencies that allow students to pass exams successfully has a lot to do with the development of conscious self-regulation of educational activities, that is, the student's ability to independently and responsibly pursue educational and life goals and manage their achievements (Morosanova et al., 2015). Research results show that conscious self-regulation is the most critical psychological mechanism for mobilizing and actualizing people's cognitive and personality resources in maximizing individual resources (Morosanova et al., 2015).

According to the meta-analysis of Amani et al. (2021), behavioral, cognitive, metacognitive, and cognitive-behavioral treatments have been the most effective in reducing test anxiety symptoms, respectively. Also, several interventions were carried out up to now to improve self-regulation of learning (Alazemi et al., 2023; Soltanizadeh et al., 2014) and motivation to progress (Khojasteh, 2019) for students with exam anxiety. However, despite the relationship between self-regulation of learning (Albulescu et al., 2024; Morosanova et al., 2015) and achievement motivation (Raufelder et al., 2017; Tan & Pang, 2023) with test anxiety, a study that uses explicitly a therapeutic approach to investigate the effectiveness on self-regulation and motivation to progress with the problem-solving approach has not been done so far. Problem-solving strategies in psychology refer to finding solutions to problems encountered in life (Malekzade et al., 2023). Solutions to these problems usually depend on the specific situation or context. This process starts with problem formulation, where the problem is discovered and simplified. The next step is to create possible solutions and evaluate them. Finally, a solution is selected for implementation and approval. Problems have a final goal to be achieved, achieving of which depends on problem orientation (problem-solving coping style and skills) and systematic analysis (Graça & Brandão, 2024).

Materials and Methods

Design of the Study

The current research adopted a quasi-experimental method with pre-test, post-test, and follow-up (3 months) and a control group. The design included an experimental group and a control group, with participants randomly assigned to the groups. Questionnaires measuring self-regulation of

learning and progress motivation were administered as pre-/post-test and follow-up (3 months) for both groups, with careful control of disturbing variables through random participant placement.

Participants

The statistical population of the present study included all female students in the 12th grade of the senior high schools in Tabriz in the academic year 2012-13 who were studying at the time of the intervention. The sample selection method in the present study was multi-stage cluster sampling in the first stage, then simple randomization, and finally random replacement was assigned in the experimental and control groups. First, a region was randomly selected from the areas of Tabriz municipality, five high schools were randomly selected from the selected region, and then the Sarason test anxiety questionnaire was administered to female students in the 12th grade of the senior high school in the selected high schools. From among the students whose scores were higher than the cutoff point of 12, 30 were selected and then randomly placed in the two experimental and control groups. It should be noted that in experimental and quasi-experimental designs, at least 15 people should be present in each group to increase internal validity (Handley et al., 2018). The criteria for the selection of the sample were:

- being in the 12th grade of the senior secondary school of girls in Tabriz;
- having a cutoff score above 12 based on the Sarason Anxiety Questionnaire (1975);
- filling out an informed consent;
- confirming the mental and physical health of the participants through a medical record review;
- not receiving any other interventional approach simultaneously; and
- the exit criteria included the participants' unwillingness to continue cooperation and the absence in two or more intervention sessions.

Instruments

Online Learning Self-Regulation Questionnaire (OSLQ): This scale created by Lau and Jong (2022) was adapted from the English version of Barnard et al. (2008). This questionnaire has 30 items on a five-point Likert scale, where higher scores indicate a more robust use of self-regulation strategies. This questionnaire has seven subscales: goal setting (items 1 to 5), time management (items 2 to 7), environment structuring (items 9 to 12), effort setting (items 13 to 15), cognitive-supervisory strategies (items 16 to 21), help to seek (items 22 to 25) and self-evaluation (items 26 to 30) (Lau & Jong, 2022). Lau and Jong (2022) examined several factor analysis models, among which the seven-factor structure of this questionnaire had a good fit. The internal consistency estimates show that all COSLQ subscales show high internal consistency in the study, ranging from .76 to .88. The item/total correlation coefficient for each subscale is more significant than .40, which shows that the reliability of the questionnaires is satisfactory. CFA findings indicate that the

second-order measurement model of the COSLQ provides an excellent fit to the data. Amirian et al. (2022) have investigated the psychometric properties of this questionnaire on Iranian students and evaluated it as valid. They reported a Cronbach's alpha coefficient of .92 for the entire test. The construct and criterion validity were also reported as acceptable by the questionnaire creators.

Achievement Motivation Scale-Revised (AMS-R): This questionnaire is a 10-item scale developed by Lang and Fries (2006). The grading of this scale is on a 4-point Likert scale, and the higher the score, the higher the hope for success and, in general, the motivation to progress. The studies of Lang and Fries (2006) confirmed the two-factor model (hope of success - fear of failure) of this questionnaire and provided good empirical support. The modified 10-item version (AMS-R) adequately fits the theoretical two-factor model. Adequate fit can be confirmed in cross-validation methods. In addition, the revised scales provided adequate reliability, lower inter-scale correlations, and criterion-related validity concerning conventional measures of achievement-related behavior. Regarding the reliability of the scales, it was found that the two scales for HS and FF show acceptable internal consistency (Cronbach's alpha: .71 to .83 for HS and .81 to .89 for FF). Previous studies found moderate correlations between the two scales from -.17 to -.36 in adolescent samples and college students (Lang & Fries, 2006). The total Cronbach's alpha for this questionnaire in the present study was .88. Furthermore, the revised scales provided adequate reliability, lower inter-scale correlations, and criterion-related validity with respect to typical criteria of achievement-related behavior.

Test Anxiety Questionnaire (STA) of Sarason (1975): This questionnaire was created by Sarason in 1975 to measure the reaction to the exam consisting of 37 questions that are scored as yes (score 1) and no (score zero). The total test anxiety score is obtained by adding up the individual's scores. The range of scores is between 0 and 25, and receiving a high score in this questionnaire indicates high exam anxiety. If getting scores lower than 8 indicate weak anxiety, scores lower than 12 indicate moderate anxiety, and scores higher than 12 indicate high test anxiety. In his study, Sarason (1975) obtained the self-reliability of the questionnaire using Cronbach's alpha coefficient as .88, internal consistency of .95, and criterion validity of .72. Cheraghian et al. (2007) reported the reliability of the internal consistency of this questionnaire using the binomial method as .91 and its retest coefficient as .82 after 6 weeks. Cronbach's alpha coefficient of the entire exam anxiety questionnaire is .74.

D'Zurilla and Nezu's (2010) Problem-Solving Skills Package: All sessions of the training course are based on the six stages of the D'Zurilla and Nezu (2010) model including the following steps: general orientation, problem definition and formulation, generation of practical solutions, decision making, implementation of the solution, and review of how it was designed and implemented. Necessary preparations were made before the intervention sessions began. The sessions were conducted with the presence of the experimental group in the same time and place.

All sample members were fully satisfied with the time and place of the intervention. The D'Zurilla and Nezu problem-solving skill package is summarized in the Table below.

Table 1. D'Zurilla and Nezu Problem-Solving Protocol (2010)

Sessions	Content
1	The members were introduced the principles of problem-solving, and they were required to pay attention to the problem-solving framework when dealing with, think about, and then try to solve the problem.
2	Group discussion regarding the benefits of planning to solve the problem, define it, collect information, break down the problem into simpler components, and specify the real goals.
3	Alternative and possible solutions and the possibility of choosing the most effective answer among the answers were examined.
4	Fluidization and mental precipitation methods and using them to solve problems were taught.
5	Decisions were made and possible consequences of participants' each choice were predicted, the usefulness of these consequences was considered and the solutions provided by the participants were evaluated and prioritized.
6	More practice was done based on the pre-prepared scenarios, and the selected method was implemented.
7	The results of implementation were reviewed.
8	Evaluation of whether the problem can be solved in another way? What part of the solution can be replaced by a better option? Is it possible to combine two steps of the same solution? What other things can be done in this case, and how can the existing solutions be improved? What modifications to the solution would improve the results, and can we change the solutions to make them more efficient? What other methods can be used? What will happen if this solution is removed? How can the current situation be changed to create a better result?
9	The participants reported the implementation steps and the result of the problem-solving method for solving their problems.
10	A group discussion was held regarding the steps and the results obtained.

Results

In this section, the demographic characteristics of the participants as well as the descriptive statistics of the variables examined in the participants are presented in the descriptive statistics section, and finally, after presenting the necessary assumptions for the statistical test of repeated measures analysis of covariance measurements, in the inferential statistics section, we provide inferential analysis of the research hypotheses. Repeated measures analysis of covariance was used to consider the pre-test effect as well as the three measurement times of the variables. The findings from the demographic data indicated that all the sample participants were female, and the mean and standard deviation of their age was 16.80±2.96. Table 2 presents the descriptive statistics of the studied groups in all research variables in the pre-test, post-test, and follow-up stages.

Table 2. Descriptive Statistics of Research Variables in Pre-Test, Post-Test, and Follow-Up Stages

Variables		Groups	M			SD			minimum	maximum
			pre-test	post-test	follow-up	pre-test	post-test	follow-up		
Learning Self-Regulation	Goal Setting	Experimental	16.73	23.46	23.06	4.06	1.30	1.22	8	24
		Control	17.53	17.26	17.40	4.67	4.46	4.48	9	23
	Time Managemen	Experimental	8.13	13	13.13	2.13	1.30	1.35	5	13
		Control	8.33	8.34	8.26	2.19	1.91	2.28	6	12
	Environment Structuring	Experimental	10.93	17.20	17.21	2.93	2.14	1.97	5	15
		Control	11.13	11.40	11.41	2.87	3.24	3.64	12	19
	Effort Setting	Experimental	8.20	12.73	12.75	2.24	1.79	1.62	5	13
		Control	8.53	8.26	8.53	2.12	2.23	2.18	5	12
	Cognitive-Supervisory Strategies	Experimental	17.73	26	26.13	3.89	2.47	2.32	9	23
		Control	17.66	18	18.20	3.81	3.68	3.87	9	22
	Help to seek	Experimental	10.46	16.01	16	3.22	2.59	2.23	5	16
		Control	10.93	10.46	10.66	3.36	2.97	3.28	5	17
	Self-evaluation	Experimental	14.26	20.80	20.81	4.84	2.36	2	7	23
		Control	14.73	14.46	14. 60	4.83	4.84	4.99	7	22
	Total Score	Experimental	86.46	129.20	129.06	13.98	7.27	7.18	44	101
		Control	88.40	88.46	88.93	13.92	12.10	13.25	53	106
Achievement Motivation		Experimental	23.86	24	33.86	7.48	3.83	3.58	14	36
		Control	24.26	24	23.86	7.35	7.28	7.33	15	35

Based on the findings of Table 2, it is clear that the average variables in the experimental group increased in the post-test and follow-up compared to the pre-test.

Before implementing the analysis of the covariance test with repeated measures, the Shapiro-Wilk test was used to check the normality of the distribution of scores in the three stages of measurement, which indicated the normality of the distribution of scores ($p \geq 0.05$). Levine's test also measured the assumption of homogeneity of variance, the results of which were insignificant, which showed that the assumption of homogeneity of variances was met ($p \geq 0.05$). Also, the results of Mochli's test indicated that the assumption of sphericity of the data in the variables was not met ($p \leq 0.05$). These results suggest that the assumption above was unmet, and the Greenhouse-Grieser statistic was considered in the further analysis.

Table 3 presents the results of a multivariate analysis of variance with repeated measurements to investigate the research's main hypothesis.

Table 3. Results of Multivariate Tests (Wilks' Lambda)

Effect	Values	F	Sig.
Time	.032	18.377	.001
Group	.275	5.868	.001
Group*Time	.030	20.034	.001

Based on Table 3 and the Sig level, the null hypothesis (i.e., the equality of the mean) can be rejected because the value of Sig is smaller than the minimum probability of type 1 error (.05). As a result, a significant difference is observed in the dependent variables affected by the independent variable in the studied groups.

Considering the rejection of the hypothesis, the Greenhouse-Geisser statistic was used to test the within-group effects and the influence of the independent variable on the dependent variables. The results are presented in Table 4.

Table 4. The Results of the Greenhouse-Geisser Test to Investigate Intragroup Effects

Variables	Source	TSS	DF	MS	F	*P*	η
Goal Setting	Time	473.956	1.155	236.987	34.688	.001	.553
	Group*time	540.800	1.155	468.078	39.580	.001	.586
Time Management	Time	200.822	1.161	172.913	36.492	.001	.566
	Group*time	227.756	1.161	196.103	41.386	.001	.59
Environment Structuring	Time	120.067	1.232	97.450	56.239	.001	.668
	Group*time	123.489	1.232	100.227	57.842	.001	.674
Effort Setting	Time	213.422	1.200	177.869	123.016	.001	.815
	Group*time	180	1.200	150.014	103.751	.001	.787
Cognitive-Supervisory Strategies	Time	109.156	1.565	69.757	58.278	.001	.675
	Group*time	97.067	1.565	62.032	51.824	.001	.649
Help to seek	Time	384.689	1.581	243.261	103.659	.001	.787
	Group*time	312.067	1.581	197.338	84.090	.001	.750
Self-evaluation	Time	133.622	1.543	86.582	93.122	.001	.769
	Group*time	174.200	1.543	112.874	121.400	.001	.813
Total Score	Time	200.622	1.320	151.951	24.715	.001	.469
	Group*time	226.756	1.320	171.744	27.934	.001	.499
Achievement Motivation	Time	9231.089	1.257	7344.438	234.499	.001	.893
	Group*time	8976.022	1.257	7141.512	228.020	.001	.891

Based on the results of Table 4, it was found that problem-solving skills in the two experimental and control groups affect all dimensions of the learning self-regulation variable. In the experimental group, the dimensions after the intervention showed better problem-solving skills than in the control group (P=0.001).

Moreover, Benferoni's follow-up test was used to check two by two in the pre-test, post-test, and follow-up stages, as shown in Table 5.

Table 5. Bonferroni Post Hoc Test Results for Pairwise Comparisons

Variables	Times	Mean Difference	Std. Error	Sig	95% Confidence Interval	
					Lower Bound	Upper Bound
Goal Setting	Pre-test post-test	-4.933	.807	.001	-6.988	-2.879
	Pre-test Follow-up	-4.800	.806	.001	-6.852	-2.748
	post-test Follow-up	.133	.257	1.000	-.521	.788
Time Management	Pre-test post-test	-3.233	.485	.001	-4.469	-1.997
	Pre-test Follow-up	-3.100	.533	.001	-4.458	-1.742
	post-test Follow-up	.133	.174	1.000	-.309	.576
Environment Structuring	Pre-test post-test	-2.433	.319	.001	-3.247	-1.620
	Pre-test Follow-up	-2.467	.310	.001	-3.257	-1.676
	post-test Follow-up	-.03	.123	1.000	-.346	.729
Effort Setting	Pre-test post-test	-3.267	.267	.001	-3.946	-2.587
	Pre-test Follow-up	-3.267	.301	.001	-4.032	-2.501
	post-test Follow-up	.001	.139	1.000	-.278	.278
Cognitive-Supervisory Strategies	Pre-test post-test	-2.400	.286	.001	-3.128	-1.672
	Pre-test Follow-up	-2.267	.275	.001	-2.968	-1.565
	post-test Follow-up	.133	.172	1.000	-.305	.572
Help to Seek	Pre-test post-test	-4.300	.375	.001	-5.255	-3.345
	Pre-test Follow-up	-4.467	.410	.001	-5.511	-3.422
	post-test Follow-up	-.167	.249	1.000	-.801	.468
Self-Evaluation	Pre-test post-test	-2.533	.243	.001	-3.151	-1.915
	Pre-test Follow-up	-2.633	.250	.001	-3.271	-1.996
	post-test Follow-up	-.100	.148	1.000	-.477	.277
Total Score	Pre-test post-test	-3.133	.559	.001	-4.557	-1.709
	Pre-test Follow-up	-3.200	.643	.001	-3.271	-1.996
	post-test Follow-up	-.067	.293	1.000	-.811	.377
Achievement Motivation	Pre-test post-test	-21.400	1.312	.001	-24.741	-18.059
	Pre-test Follow-up	-21.567	1.381	.001	-25.083	-18.051
	post-test Follow-up	-.167	.556	1.000	-1.582	1.249

Based on the results of Table 5, it is clear that in all aspects of self-regulation and motivation to progress, there is a significant difference between the experimental and control groups in the pre-test/post-test and follow-up. The experimental group obtained higher scores in the criterion variables than the control group compared after applying the independent variable and this effect remains in the follow-up period.

Discussion

This study aimed to investigate the effectiveness of problem-solving skills in self-regulation of learning and motivation to progress in twelfth-grade female students with exam anxiety in Tabriz.

The results showed that all dimensions of the learning self-regulation variable (criterion variable) affected by problem-solving skill (independent variable) differ in the experimental and control groups, As after the intervention, the problem-solving skill is the experimental group was better than that in the control group. It was also found that all dimensions of self-regulation of learning in the two experimental and control groups had significant differences in the pre-test/post-test and follow-up, and the experimental group had higher scores than the control group after applying the intervention than the control group and continued in the follow-up period. Although a study utterly similar to the present study was not found in the research background, the results of the present study were consistent with those of Amani et al. (2021), Gharibi and Baharizar (2014), Soltanizadeh et al. (2021) and Alazemi et al. (2023).

In explaining these findings, it is necessary to mention some crucial points. Problem-solving skills are an active approach to searching and identifying problems and opportunities, using logic and judgment skills in collecting and analyzing information, searching, creating, and comparing different solutions, and choosing the best way to face a problem (Škėrienė & Jucevičienė, 2020). On the other hand, *self-regulation* was defined by Brown (1998) as the ability to plan, guide, and flexibly control one's behavior to adapt to changing conditions (Billore et al., 2023). Accuracy in self-regulation of learning indicates that development in this category in students with test anxiety strongly requires continuous and purposeful learner activity. Teaching problem-solving skills makes the learner face learning categories actively and continuously and deal with them dynamically. The development of self-regulation requires facing problems actively and trying to resolve them. Teaching the problem-solving approach makes the students act actively in the face of the challenges and problems ahead and try to successfully face the problems by planning, guiding, and controlling the conditions, which are the requirements of self-regulation development. In confirmation of this category, it has been determined that the amount of active learning and cooperation in the interest of students trained with the problem-solving method is more than those not trained with it.

Another explanatory point is that self-regulation requires adapting to changing environmental conditions (Karoly et al., 2005). In the face of challenges in the field of learning, existing issues and challenges are constantly growing and changing, which can intensify exam anxiety in students (Ocak et al., 2022). Teaching problem-solving skills creates a dynamic space where the learner can face problems and test solutions to diverse and changing problems and challenges (Škėrienė & Jucevičienė, 2020). This space makes the learners face the problems of the learning with the

mentality that they can face the learning problems with complete flexibility and dynamism and try to solve them instead of running away from the upcoming situations and existing challenges.

The last explanatory point is that teaching problem-solving skills determines the best way for students to face problems (Škėrienė & Jucevičienė, 2020). Learning is a multifaceted and complex category; in the face of it, repetitive and sometimes fixed solutions cannot always be the answer. For this reason, *self-regulation* of learning, which is a much more complex category, as the ability to plan, guide, and flexibly control one's behavior to adapt to changing conditions (Billore et al, 2023), can teach the best ways to face and finally solve problems while students deal with situations which are constantly changing and metamorphosing.

Conclusion

The results showed that the progress motivation (dependent variable) was affected by the problem-solving skill (independent variable) in the two experimental and control groups, and the progress motivation in the experimental group was significantly higher than that in the control group (P=.001) after problem-solving skill intervention. It was also found that there was a significant difference in the motivation to progress in the two experimental and control groups in the pre-test/post-test and follow-up, and the experimental group had higher motivation scores than the control group after applying the intervention. Progress has been made, and this effect remained in the follow-up period.

The results of the present study are aligned with those of Habibi (2019), Khojasteh and Ghoodarzi (2019), and Yaghoobi et al. (2013). The results of the present study showed that teaching problem-solving skills has a positive and improving effect on motivation. This means the students receiving problem-solving skills training improved their progress motivation. Students who have learned problem-solving skills are expected to be highly successful learners and have a solid motivation to progress, especially in the academic field. By applying problem-solving skills to achieve academic success, they adjust their goals and actions and maintain their motivation despite the difficulty of the homework. Problem-solving is also a cognitive activity, and teaching this skill helps improve students' academic motivation (Mazzucchi, 2008).

In explaining the effect of teaching problem-solving skills on increasing students' progress motivation, it can also be stated that when people use problem-solving skills, their sense of competence and mastery over courses is strengthened. Also, using problem-solving strategies increases a person's belief in their abilities, increasing their motivation to progress and making them believe they can achieve the results they expect. In addition, teaching problem-solving skills gives students the ability to follow the flow of teaching and learning with higher self-confidence; since they get to know their strengths and weaknesses and how to deal with obstacles during learning instead of feeling weak which make them unable to work harder for their goals with

perseverance. These skills will encourage students to consider their academic assignments and tasks valuable, and for this reason, pay more attention and care and proceed with their academic affairs using appropriate orientations, which, in addition to increasing their academic progress, significantly affects their motivation to progress.

Eilam and Aharon (2003) believe that the motivation for academic progress is an all-around tendency to evaluate performance according to the highest standards, strive for success in performance, and enjoy the pleasure associated with success in performance. One of the essential symbols of such an effort is solving the problem. It is impossible to achieve high standards in education and strive for educational perfection without equipping them with problem-solving strategies and trying to develop them. Students equipped with problem-solving strategies in the face of educational issues and challenges are constantly trying to improve their performance according to the criterion of excellence, which is the motivation of education.

Limitations and Suggestions

The results of the present study are limited to 12th-grade female students in Tabriz. The control variable in the present study was test anxiety, and it should be noted that the results can only be generalized to students with test anxiety. In the present study, only aspects of the variables of self-regulation criterion of learning and motivation for progress were examined.

According to the results of the present study, it is suggested that all counselors, psychotherapists, and especially school counselors should use problem-solving strategies and motivation to improve students' self-regulation.

Acknowledgements

We now thank and appreciate all the dear ones who helped us conduct this research.

Conflict of interest

There are no conflicts of interest.

References

Alazemi, A.F.T., Jember, B., & Al-Rashidi, A.H. (2023). How to decrease Test Anxiety: a focus on academic emotion regulation, l2 grit, resilience, and self-assessment. *Lang Test Asia*, *13*, 28. https://doi.org/10.1186/s40468-023-00241-5

Albulescu, I., Labar, A. V., Manea, A. D., & Stan, C. (2024). The mediating role of cognitive test anxiety on the relationship between academic procrastination and subjective wellbeing and academic performance. *Frontiers in Public Health*, *12*, 1336002. https://doi.org/10.3389/fpubh.2024.1336002

Allahverdiani, K., Azemode, A., Hashemi, T., & Esmaelpour, K. (2024). The effectiveness of academic life skills and self-regulation of motivation training on academic motivation of senior high school female students. *Iranian Journal of Learning and Memory, 6*(24), 5-14. https://doi.org/10.22034/iepa.2024.435702.1468

Amani, H., Farid, A., & Sheykhalizadeh, S. (2021). Meta-Analysis of the effectiveness of interventions on test anxiety reduction. *Psychological Research, 1*(23), 136–156. 20.1001.1.10199616.1400.23.1.3.7. [Persian].

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders, fifth edition, text revision*. Washington: American Psychiatric Association.

Amirian, S. K., Rezaei, Z., Hatamikiya, S., & Kareshki, H. (2022). Psychometric properties of the Online Self-Regulated Learning Questionnaire. *Educational Psychology, 18*(64), 85-108. [In Persian]. doi: 10.22054/jep.2023.68167.3645

Barnard, L., Paton, V., & Lan, W. (2008). Online self-regulatory learning behaviors as a mediator in the relationship between online course perceptions with achievement. *The International Review of Research in Open and Distributed Learning*, *9*(2). https://doi.org/10.19173/irrodl.v9i2.516

Berweger, B., Kracke, B., & Dietrich, J. (2023). Preservice teachers' epistemic and achievement emotions when confronted with common misconceptions about education. *Journal of Educational Psychology, 115*(7), 951–968. https://doi.org/10.1037/edu0000792

Billore, S., Anisimova, T., & Vrontis, D. (2023). Self-regulation and goal-directed behavior: A systematic literature review, public policy recommendations, and research agenda. *Journal of Business Research, 156,* Article 113435. https://doi.org/10.1016/j.jbusres.2022.113435

Bruce, W. T., Dennis, A. A., & Dennis, R. S. (2007). *Learning and motivation strategies: Your Guide to success*. Pearson Education.

Cetin, B. (2015). Academic motivation and approaches to learning in predicting college students' academic achievement: Findings from Turkish and US samples. *Journal of College Teaching & Learning (TLC), 12*(2), 141–150. https://doi.org/10.19030/tlc.v12i2.9200

Dalkıran, E., Şahin Baltacı, H., Karataş, Z., & Nacakcı, Z. (2016). Developing of individual instrument performance anxiety scale: Validity-Reliability Study. *International Journal of Assessment Tools in Education, 1*(1), 13-25. https://doi.org/10.21449/ijate.239569

D'Zurilla, T. J., & Nezu, A. M. (2010). Problem-solving therapy. *Handbook of cognitive-Behavioral Therapies*, *3*(1), 197-225.

Eilam, B., & Aharon, I. (2003). Students' planning in the process of self-regulated learning. *Contemporary Education Psychology, 28,* 304–334. doi: 10.1016/S0361-476X(02)00042-5. [Persian].

Garzón-Umerenkova, A., de la Fuente, J., Amate, J., Paoloni, P. V., Fadda, S., & Pérez, J. F. (2018). A linear empirical model of self-regulation on flourishing, health, procrastination, and achievement, among university students. *Frontiers in Psychology*, *9*, 536. https://doi.org/10.3389/fpsyg.2018.00536

Gharibi, H., & Baharizar, K. (2014). The effectiveness of teaching problem-solving skills on academic self-regulation and students' math anxiety. *Scientific Journal of Education and Evaluation (Quarterly)*, *8*(32), 61-78. doi: jinev780. [Persian].

Graça, L., & Brandão, T. (2024). Religious/spiritual coping, emotion regulation, psychological well-being, and life satisfaction among university students. *Journal of Psychology and Theology*, *52*(3), 342-358. https://doi.org/10.1177/00916471231223920

Grøtan, K., Sund, E. R., & Bjerkeset, O. (2019). Mental health, academic self-efficacy and study progress among college students: The shot study, Norway. *Frontiers in Psychology*, *10*, 45. https://doi.org/10.3389/fpsyg.2019.00045

Habibi, M. H. (2020). The effect of teaching problem-solving skill on the creativity and academic motivation of secondary school students. *Rooyesh*, *9*(1), 57-64. URL: http://frooyesh.ir/article-1-1648-en.html. [Persian].

Handley, M. A., Lyles, C. R., McCulloch, C., & Cattamanchi, A. (2018). Selecting and improving quasi-experimental designs in effectiveness and implementation research. *Annual Review of Public Health*, *39*, 5–25. https://doi.org/10.1146/annurev-publhealth-040617-014128

Hannani, S., Afshar Zarandi, A., Amiri, F., & Azadi, N.A. (2023). Relationship between academic emotions, academic motivation, and academic performance among operating room students during the COVID-19 Pandemic. *Current Psychosomatic Research*, *2*(1), 55-64. http://dx.doi.org/10.32598/cpr.2.1.165.1. [Persian].

Hoppmann, C. A., & Blanchard-Fields, F. (2010). Goals and everyday problem solving: Manipulating goal preferences in young and older adults. *Developmental Psychology*, *46*(6), 1433–1443. https://doi.org/10.1037/a0020676

Howard, E.L. (2020). *A review of the literature concerning anxiety for educational assessments*.

Huberty, T. J., & Dick, A. C. (2006). Performance and test anxiety. In G. G. Bear & K. M. Minke (Eds.), *Children's needs III: Development, prevention, and intervention* (pp. 281–291). Bethesda, MD: National Association of School Psychologists.

Karoly, P., Boekaerts, M., & Maes, S. (2005). Toward consensus in the psychology of self-regulation: How far have we come? How far do we have yet to travel? *Applied Psychology: An International Review*, *54*(2), 300–311. https://doi.org/10.1111/j.1464-0597.2005.00211.x

Khojasteh, S. (2020). The effectiveness of sand play therapy on anxiety and achievement motivation of primary school students. *Journal of Child Mental Health, 7* (1), 68-80. Doi: 10.29252/jcmh.7.1.7. [Persian].

Khojasteh, S., & Ghoodarzi, M. (2020). The effects of problem-solving skills training on students' achievement motivation and academic self-concept in students with low academic self-concept and achievement motivation. *MEJDS, 10* ,146-146. URL: http://jdisabilstud.org/article-1-2006-en.html. [Persian].

Lang, J. W. B., & Fries, S. (2006). A revised 10-item version of the Achievement Motives Scale: Psychometric properties in German-speaking samples. *European Journal of Psychological Assessment, 22*, 216-224. doi: 10.1027/1015-5759.22.3.216

Lau, K. L., & Jong, M. S. Y. (2022). Acceptance of and self-regulatory practices in online learning and their effects on the participation of Hong Kong secondary school students in online learning. *Education and Information Technologies*, 1–18. Advance online publication. https://doi.org/10.1007/s10639-022-11546-y

Malekzade, L., Hejazi, E., Aghababaei, S., & Zamani, N. (2023). Designing a package of scientific thinking training and its effect on problem-solving skill in preschool children. *Iranian Journal of Learning and Memory, 6*(23), 5-15. https://doi.org/10.22034/iepa.2023.394390.1420. [Persian].

Mazzucchi, A. (2008). Cognitive and behavioral disorders following traumatic brain injury. In S. F. Cappa, J. Abutalebi, J.F. Démonet, P. C. Fletcher, and P. Garrard (Eds.), *Cognitive neurology: A clinical textbook* (pp. 349–365). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780198569275.003.0017

Morosanova, V. I., Fomina, T.G., & Bondarenko, I. N. (2015). Academic achievement: Intelligence, regulatory, and cognitive predictors. *Psychology in Russia: State of the Art, 8*(3), 136–156. https://doi.org/10.11621/pir.2015.0311

Nahid, S., Muzaffar, N., & Abbas, M. (2023). Impact of Teachers' Motivation on Students' Performance. *Global Educational Studies Review, VIII(II)*, 444-453. https://doi.org/10.31703/gesr.2023(VIII-II).40. [Persian].

Ocak , G., Karafil, B., & Akar, F. (2022). Exploring the relationship between self-regulation skill and test anxiety level of secondary school students. *Bulletin of Education and Research, 44*(3), 55.

Pekrun, R., Lichtenfeld, S., Marsh, H. W., Murayama, K., & Goetz, T. (2017). Achievement emotions and academic performance: Longitudinal models of reciprocal effects. *Child Development*, *88*(5), 1653–1670. https://doi.org/10.1111/cdev.12704

Pichardo, C., Justicia, F., Fuente, J., Martínez-Vicente, J. M., & Berbén, A. B. G. (2014). Factor structure of the Self-Regulation Questionnaire (SRQ) at Spanish Universities. *The Spanish Journal of Psychology*, *17*, E62. doi:10.1017/sjp.2014.63

Pritchard, M.E., & Wilson, G.S.S. (2003). Using emotional and social factors to predict student success. *Journal of College Student Development, 44*(1), 18-28. https://dx.doi.org/10.1353/csd.2003.0008

Rath, J. F., Langenbahn, D. M., Simon, D., Sherr, R. L., Fletcher, J., & Diller, L. (2004). The construct of problem solving in higher level neuropsychological assessment and rehabilitation. *Archives of Clinical Neuropsychology: The Official Journal of the National Academy of Neuropsychologists*, *19*(5), 613–635. https://doi.org/10.1016/j.acn.2003.08.006

Raufelder, D., Regner, N., & Wood, M. A. (2017). Test anxiety and learned helplessness is moderated by student perceptions of teacher motivational support. *Educational Psychology*, *38*(1), 54–74. https://doi.org/10.1080/01443410.2017.1304532

Rubin, M., Watt, S. E., & Ramelli, M. (2012). Immigrants' social integration as a function of approach–avoidance orientation and problem-solving style. *International Journal of Intercultural Relations, 36*(4), 498–505. https://doi.org/10.1016/j.ijintrel.2011.12.009

Salend, S. J. (2012). Teaching students not to sweat the test. *Phi Delta Kappan*, *93*(6), 20-25. https://doi.org/10.1177/003172171209300605

Sarason, I. G. (1975). Test anxiety and the self-disclosing coping model. *Journal of Consulting and Clinical Psychology, 43*(2), 148–153. https://doi.org/10.1037/h0076507

Sardabi-Kia, M., & Ghajarieh, A. (2023). The role of motivational strategies on young EFL learners' basic psychological needs: A self-determination theory perspective. *Journal of Modern Research in English Language Studies, 10*(1), 1-23. DOI: 10.30479/jmrels.2022.17055.2042

Škėrienė, S., & Jucevičienė, P. (2020). Problem solving through values: A challenge for thinking and capability development. *Thinking Skills and Creativity*, *37*, 100694. https://doi.org/10.1016/j.tsc.2020.100694

Soltanizadeh, M., Hosseini, F., & Kazemi Zahrani, H. (2021). The effectiveness of acceptance and commitment therapy on social adjustment and self-regulation learning in female students with test anxiety. *Journal of Educational Psychology Studies*, *18*(41), 29-17. [In Persian]. doi: 10.22111/jeps.2021.6048

Tan, S. H., & Pang, J. S. (2023). Test anxiety: An integration of the test anxiety and achievement motivation research traditions. *Educational Psychology Review*, *35*(1), Article 13. https://doi.org/10.1007/s10648-023-09737-1

Yaghoobi, A., Mohagheghi, H., Yousef Zade, M., Ganji, K., & Olfatii, N. (2014). The effect of time management training on test anxiety and academic achievement motivation among high school students. *Journal of School Psychology*, *3*(1), 131-144. doi: jsp-3-1-93-3-9. Doi: jsp-3-1-93-3-9. [Persian].

Yancachajlla-Quispe, L. I.., Rengifo-Ramírez, S. S.., Farfán-Latorre, M.., Estrada-Araoz, E. G.., Lavilla-Condori, W. G.., & Lavilla-Condori, M. L. (2024). Exploring the relationship between metacognition and motivation in Peruvian basic education students. *Salud, Ciencia Y Tecnología - Serie De Conferencias*, *3*, 658. https://doi.org/10.56294/sctconf2024658

Yang, X. (2025). Linguistically responsive formative assessment for emergent bilinguals: exploration of an elementary teacher's practice in a math classroom. *International Multilingual Research Journal*, *19*(1), 67-90. https://doi.org/10.1080/19313152.2024.2339757