

Original Article: The Effectiveness of Creative Thinking Training on Self-regulated Learning Strategies and Students' Academic Achievement Motivation



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ABSTRACT

The aim of this study was to investigate the effectiveness of creative thinking training on self-regulated learning strategies and students' academic achievement motivation. The statistical population included all eighth-grade female students in the first secondary schools of Jahrom. The sample subjects were selected by multi-stage cluster sampling method. So, two schools were selected from the first secondary schools and one eighth grade class was selected from each school and after the students answered the research questionnaires, 15 students from each school who scored low on self-regulated learning strategies and achievement motivation questionnaires were randomly assigned to two groups, i.e., experimental and control. The experimental group was trained 8 sessions and post-test sessions were performed for both groups. The data obtained from the research were analyzed using one-way analysis of covariance with pre-test control. The results showed that teaching creative thinking has a significant effect on self-regulated learning strategies of students in the experimental group. Also, the results showed that teaching creative thinking has a significant effect on improving the motivation of students in the experimental group.

Introduction

One of the most important goals of educational centers in the 21st century is to train learners how to face the changing society and the complexities of the information explosion era [1-3]. Accordingly, the promotion of thinking, thinking in educational centers is of great importance, so in recent decades, education experts have paid more

attention to the categories of cognition and motivation and their role in learning.

Cognition encompasses some of the abilities and mental actions such as knowledge, comprehension, recognition, and thinking, and motivation is related to issues such as emotion, attitude, and evaluation. Self-regulatory learning is considered as an intertwined and related set [4-6].

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Self-regulatory learning is a type of learning in which learners initiate and direct their own efforts instead of relying on teachers, parents, and other educational agents to acquire skills and knowledge [7-9].

These learners are skilled in metacognitive knowledge and know how to direct their mental processes toward individual progress and goals. They also engage in planning, self-monitoring, self-control, self-assessment, and personal reinforcement at different stages of learning. Self-regulatory strategies are also related to motivation in a way that contributes to having appropriate adaptive beliefs and attitudes in the field of education, especially the interest in doing homework and the necessary effort and perseverance in this field [10-13].

To consider oneself worthy, self-sufficient and independent, in addition, behaviorally, these learners are able to create, select, construct, and create environments for optimal learning. Motivation is one of the important structures that is important and effective in the educational environment and educational environment [14-16].

On the other hand, the low motivation for progress in students has made this one of the concerns of teachers, educators and parents, and experts and educators have always sought to identify the factors affecting this structure so that they can be motivated [17].

Unfortunately, in many educational systems, exploration and creative thinking are not given much attention. Textbooks are usually written in such a way that they convey only a multitude of scientific events to students and take the opportunity for students to think and be creative.

Today, in schools, universities and all educational centers of developed countries, attention to creativity education, innovation and training of creative people is at the top of the curriculum. This is possible when there is a change in content and teaching methods instead of purely educational programs to creative thinking training programs [18-20].

Therefore, the aim of this study was to investigate the effectiveness of creative thinking training on self-regulated learning strategies and students' academic achievement motivation. In the Iranian educational system, the preservation and

repetition of scientific facts in the dominant method has always been considered and this has caused a spirit of passivity in the education system and as a result, thought and curiosity easily give way to passivity and imitation of others.

This is while the development of thinking skills is often considered as the most important function of any educational system (Hassani, 2014). Studies have also shown that the gradual development and development of thinking skills and the use of thinking strategies can increase students' motivation to learn and control them, since self-regulatory learning strategies are highly influenced by motivation and highly motivated students benefit more from self-regulatory learning strategies [21-23].

It can be said that thinking skills, especially creative thinking, are effective in students' self-regulatory learning strategies and motivation. Torrance (2019) also refers to motivational and motor creativity in classifying types of creativity (Aghaei, 2006). The theory of self-regulated learning is based on how students organize their learning metacognitively, motivationally and behaviorally [24-26].

It has been argued that high school students are often unable to use their knowledge to explain and predict phenomena and are unable to solve new problems. This problem is due to the fact that classroom teaching lacks the quality strategies needed to reason and solve a successful problem. This means that students face learning disabilities, which can be due to teaching methods and their inability to think creatively [27-30].

However, reviewing research on creativity and creative thinking, also one of the most interesting results of this research, which is generalizable, is the finding of problem-solving ability. According to many experts, almost all creative people are capable of understanding the relationship between the elements of a situation. Creative people in the face of ambiguous and challenging situations, use their insight and awareness and knowledge, while avoiding the result. Raw solutions reach a reasonable solution and have high decision-making power [31].

On the other hand, considering that motivation for progress is one of the key components of self-regulatory model and people with motivation for

progress consider it important and honorable to succeed in challenging tasks, it seems that students who think creatively, have higher self-regulatory learning and motivation [32].

Creative thinking is a kind of mental skill that by educating that person can create unusual new ideas by depicting issues and phenomena and analyzing them. Also, teaching creative thinking based on information divides, analyzes and applies information, and accordingly, by discovering scientific laws and offering new solutions, enhances the process of learning and production of knowledge, and self-regulated learning of knowledge [33].

Traditional methods create a boring learning environment due to the lack of controversial topics. To fill this gap, the dominance of this superficial approach can be prevented with creative teaching methods. In the Iranian education system, students usually do not have a passive role in learning and questioning and creative methods, and teaching methods can not affect their thinking, especially their creative thinking, which is directly related to their learning methods. Methods and the gradual development of knowledge about how thinking can increase students' motivation to learn and control it.

This shows that teaching correct thinking and especially creative thinking can play an important role in the rate of learning and motivation of students and thus their optimal performance [34].

Although many studies have emphasized the role of creative thinking on self-regulated learning strategies and motivation for progress, few studies, especially in Iran, can be found that have addressed simultaneously the effectiveness of creative thinking on self-regulated learning strategies and students' academic achievement motivation, so it seemed necessary to conduct a study in this domain in order to use the results to improve students' motivation for achievement and learning self-regulation, and the present study addressed such gaps.

Jahani (2008) showed that teaching creative thinking to adolescents could affect their creative skills and increase their performance. Ghavam (2008) reported that teaching creative thinking is effective in strengthening students' ideas in learning humanities. Nadi, Gardan Shekan and Golparvar (2011) studied the effect of teaching the

components of critical thinking, problem solving and metacognition, which was based on creativity training, on students' self-directed learning, and found the significant effect of problem solving and metacognition training, based on creative thinking.

The rate of learning has been self-directed to the whole and its components (self-management, desire to learn, self-control). To some extent, problem-solving and metacognition training has increased the amount of self-directed learning of the whole and the amount of its components (self-management, desire to learn and self-control).

Examining the effect of brainstorming training as a type of creativity training and creative thinking on the level of creativity and achievement motivation of fourth grade elementary school students in Tehran, Lari (2011) showed that the effect of education on increasing achievement motivation was significant. Hassani et al. (2014) studied the effectiveness of the combined training of critical thinking and creative thinking in which the training sessions were based on creative thinking, in self-directed learning (synonymous with self-regulated learning) of the second experimental female students in Qom. They determined that skills training creative thinking skills had a significant effect on self-directed learning and all its components, i.e., desire to learn, self-management and self-control [36-38].

Moradi and Aghdasi (2015) reviewed the effectiveness of problem-solving skills training considered as creative thinking and problem solving based on four sessions of creative thinking training in the self-regulatory strategies of high school students in Tabriz. They identified that education could increase self-regulation strategies in female high school students [39-41].

Also, Efenthaler (2012) examined the effectiveness of various interventions for learning self-regulation with different problem-solving scenarios including creative thinking training sessions, and they found that these scenarios could affect motivation, planning, organization and monitoring and problem-solving scenarios were an important aid in improving cognitive structures.

Haunga, Brad, and Mentz (2013) focused on metacognition and problem-solving skills using teacher-centered programming training on students' self-directed learning strategies. They found that

teacher metacognition and problem-solving skills training could help students apply self-directed strategies for effective learning [42-44].

In a study of cognitive internship using an effective educational model on open and flexible learning used as a creative thinking training, Khan (2014) identified the role of different concepts, processes, strategies and methods related to thinking skills, leading to the development of cognitive and metacognitive abilities through expression, reflection and exploration to self-regulated learning [45-47].

Studying the interaction of creativity training course with e-learning, Yae and Lane (2015) found that creativity training with this method was effective in students' self-regulation. Therefore, the question is whether the teaching of creative thinking can be effective in promoting self-regulated learning strategies and motivating students' academic achievement [48-50].

Self-regulated learning strategies questionnaire to measure self-regulatory learning strategies by Pintrich and DeGroot (1990) with 22 items was used. This two-component questionnaire includes the use of cognitive strategies with 13 items and self-regulatory strategy with 9 items. Subjects were asked to rate their views on each item based on a 5-point Likert scale, from strongly agree equal to 5 to strongly disagree equal to 1 [51-53].

In order to evaluate the structural validity of the internal correlation questionnaire, the scores of the components and the whole questionnaire were calculated by Alborzi and Seif (2002). The results showed that the correlation of the components of the questionnaire with each other and the total score was positive and significant. Alborzi and Seif (2002) showed that the correlation of the scores of each component with the component and its related section is more than the correlation with other components and sections, indicating the structural validity of the scores obtained from this questionnaire [54].

Cronbach's alpha method was used by Alborzi and Seif (2002) to determine the reliability of the components of this questionnaire. The internal

consistency coefficients of the components of the questionnaire were reported to be 0.72 and 0.59, respectively, which shows considerable reliability of scores. It has been obtained from the mentioned components. In this study, subcomponents were not considered and only the overall score was considered as an indicator of self-regulatory learning strategies [55-58].

Harter Academic Achievement Motivation Questionnaire Numerous motivational scales have been developed to date, but are generally credited for measuring motivation in high school and college. The Harter Motivation Questionnaire (1981) is one of the scales designed to measure motivation in adolescence and early middle school. This questionnaire consists of 33 items and the subject's answer is determined in a 5-point Likert scale, from strongly agree value equal to 5 to strongly disagree value equal to 1. Harter (1981) measured the reliability coefficients of the questionnaire using Richard Sean's Kuder formula between 0.54 and 0.84 and the retest coefficients in one sample over a period of 9 months from 0.48 to 0.63 and in another sample for a period of 5 months reported between 0.58 and 0.76 [59-61].

Harter (1981) reported the construct validity of this questionnaire based on the perceived adequacy scale from 0.33 to 0.58. In Iran, the validity and reliability of the Harter Progress Motivation Questionnaire have been reported optimally by Bahrani (2009). The validity of the questionnaire was also reported to be 0.36 by correlating the scores with students' academic achievement. The reliability of the questionnaire by retesting method and alpha-Cronbach was reported from 0.61 to 0.86.

Creative Thinking Training Package

According to Lippmann (1995), who can cultivate creativity in learners by designing a program or a set of educational content, many creative thinking training packages have been developed. Creative presented by Gwain, which was used for the first time in Iran by Hassani (2014) which is summarized below.

Table 1. Summary of Creative Thinking Training Sessions (Gwain, 1978)

Training Method	The Level	Meeting
Introduction	getting to know	1
Defining the principles and barriers of creative thinking	Identify the problem	2
Creative exercise technique and group homework	Gathering information and hypothesizing	3
Brain stimulation, freeing the mind	Ideation	4
Creative visualization, reverse brain stimulation and group homework, Imagination, intellectual portfolio and group assignment	Ideation	5
10-minute decision and group assignment	Solution	6
		7

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The results of descriptive data are presented in the following Tables. Mean and standard deviation

of scores of groups' self - regulated learning strategies Pre-test and post-test are presented.

Table 2. Mean and standard deviation of scores of groups' self - regulated learning strategies Pre-test and post-test

Post-test		Pre-test		Group	Variable
Deviotion Standard	Average	Deviotion Standard	Average		
178.	08.74	26.3	62	the experiment	Self-regulatory learning strategies
66.2	87.67	60.3	80.63	Control	

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As can be seen in Table 2, in the pre-test stage, the students in the experimental group have a mean of 62.00 and a standard deviation of 3.26 (62 3 3.26) in self-regulated learning strategies, and in the control, group considering the same strategies. The mean of self-regulatory learning is 63.80 and the standard deviation is 3.60 (63.80 60 3.60). In the

post-test of the experimental group, the students in the self-regulated learning strategies had an average of 74.08 and a standard deviation of 8.17 (74.08 17 8.17) and in the control group, average of 67.87 and a standard deviation of 2.66 (66/2.66 ± 2.66) were obtained [62-65].

Table 3. Mean and standard deviation of motivation scores of groups' progress in pre-test and post-test.

Post-test		Pre-test		Group	Variable
Average	Average	Deviotion Standard	Average		
07.7	93.79	70.3	47.69	the experiment	Motivation for Progress
55.4	80.74	44.4	60.71	Control	

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As can be seen, in the pre-test stage, the students in the experimental group have a mean of 69.47 and a standard deviation of 3.70 (69.47 70 3.70) and in the control group a mean of 60.60 in the motivation for progress. 71 and the standard deviation is 4.44 (71.60 44 4.44).

of 7.07 (79.93 7 07.07) in the motivation group and a mean of 74.80 and a standard deviation of 4.55 (55) in the control group. / 4 ± 80/74).

Normal Distribution of Data

In the post-test, the students in the experimental group had a mean of 79.93 and a standard deviation

Kolmogorov-Smirnov test was used to check the normality of the distribution of scores, the results of which are presented in Table 4.

Table 4. Kolmogorov-Smirnov test used to check the normality of the distribution of scores

Result	Meaning	The level	Group	Component
Normal	0.95	Pre-exam	Test	Self-regulatory learning strategies
	0.43	Post-test		
Normal	0.89	Pre-exam	Control	
	0.58	Post-test		

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Table 4 shows that the distribution of scores of self-regulated learning strategies in the pre-test stage is 0.95 ($p = 0.95$) and post-test is 0.43 ($p =$

0.43), so it is concluded that the distribution of learning strategies scores of self-regulations is normal in both pre-test and post-test stages [66-68].

Table 5. Evaluation of normality of achievement motivation scores by Kolmogorov-Smirnov test

Result	Meaning	The level	Group	Component
Normal	0.87	Pre-exam	Test	Motivation for progress
	0.77	Post-test		
Normal	0.42	Pre-exam	Control	
	0.40	Post-test		

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Homogeneity of Variances

The results of homogeneity of variances are presented in Table 6.

Table 6. Levin test to determine homogeneity of variances

Significance level	Degree of freedom 2	Degree of freedom 1	F	Variables
0.08	28	1	3.33	Self-regulatory learning strategies
0.19	28	1	1.81	Motivation for progress

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Table 6 shows that Levin test is not significant in the post-test of self-regulatory learning strategies ($p = 0.08$) and achievement motivation ($p = 0.19$). Due to the lack of significance, we can say that the variances are equal. This is important because it confirms the reliability of subsequent results.

Homogeneity of Regression Slope

The following is the default test for the existence of regression slope homogeneity for using analysis of covariance in the table [68-70].

Table 7. The default test for the existence of regression slope homogeneity for using analysis of covariance

Significance level	F	Average of squares	Degree of freedom	Average of squares	Source of change	Variable
07.0	956.2	011.111	2	022.222	Group * Pre-test	Self-regulatory learning strategies
07.0	975.2	34.107	2	672.214	Group * Pre-test	Motivation for progress

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Table 7 shows that the calculated F is not significant for the group interaction and the pretest, meaning that the relationship between the dependent variable and the configuration is the same for the entire experimental group as the

regression line is all parallel. Therefore, the assumption of homogeneity of regression slope is confirmed. Therefore, the analysis of covariance can be continued [71-73].

Results of one-way analysis of covariance

The results of one-way analysis of covariance are presented Table 8.

Table 8. Covariance analysis test for the effect of creative thinking training on self-regulated learning strategies and achievement motivation

Squared	Significance level	F	Average of squares	Degree of freedom	Average of squares	Source of change	Variable
023.0	4340.	631.0	58.23	1	58.23	Pre-exam	Self-regulatory learning strategies
18.0	02.0	883.5	94.219	1	94.219	Group	Motivation for progress
0320.	355.0	885.0	47.31	1	47.31	Pre-exam	
0.19	0.018	6.358	266.05	1	266.05	Group	

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According to Table 8, self-regulated learning strategies are significant according to the type of group ($F = 5.883$, $P < 0.05$), so that the experimental group has increased the amount of self-regulated learning strategies compared with the control group.

The effect of independent variable intervention (creative thinking training) was 0.18, i.e., 18% of the variance variation of post-test scores of the variable of students' self-regulated learning strategies was related to the effect of creative thinking training. This means that teaching creative thinking has a significant effect on students' self-regulated learning strategies [7].

Also, the results of post-test of motivation for progress were significant according to the type of group ($F = 6.358$, $P < 0.05$), so that the experimental group increased the level of motivation for progress compared with the control group. The effect of independent variable intervention (creative thinking training) was 0.19, i.e., 19% of variance changes in post-test scores of students' achievement motivation variable were related to the effect of creative thinking training. This means that teaching creative thinking has a significant effect on students' achievement motivation

Discussion

The first hypothesis is confirmed, meaning that teaching creative thinking has an effect on students' self-regulated learning strategies. The result of this hypothesis is consistent with other studies, like that of Ebrahimi (2008), in which the results indicated that teaching creative thinking has been effective in strengthening students' ideas in learning

humanities. Nadi (2011) reported that problem-solving and metacognition training (based on creative thinking) had a significant effect on total self-directed learning and its components.

Hassani *et al.* (2014) also showed that the combined teaching of critical thinking and creative thinking, whose sessions were based on creative thinking training, could affect the learning of the leader (synonymous with self-regulated learning) students and all its components. Moradi and Aghdasi (2015) also showed that teaching problem solving skills, whose sessions were based on teaching creative thinking, increased students' self-regulatory strategies. Likewise, Haunga (2013) reported an increase in students' self-directed learning strategies by teaching metacognition and problem-solving skills related to creative thinking training sessions. Khan (2014) achieved the same results by implementing an educational model related to thinking skills. Yae and Lin (2015) showed that creativity education was effective in students' conceptualization and self-regulation. In explaining this finding, it is important to pay attention to self-regulatory learning and its strategies. One of the most important issues related to learning and motivation is the concept of self-regulation.

To explain failure, successful students use self-regulatory learning strategies and motivational patterns, such as striving for success and challenging activities and setting goals, in order to do their homework. In contrast, unsuccessful students have less effort and less interest in activities, are not able to set goals and use learning strategies (Bambuti, 2008). So, when such students are intervened when teaching creative thinking, by

paying attention to the content of the training sessions, which begin with identifying barriers to creative thinking, they will learn how to overcome some of the misconceptions associated with creativity, and with new thinking, using the ability to analyze and critique information at a higher level, try harder to learn.

More self-reflection in planning and organizing their learning is important. During the sessions, they learn how to build their own knowledge in learning situations, and to build this knowledge; they must set goals for themselves that ultimately improve and enhance their self-regulated learning.

In other words, by teaching creative thinking and engaging students with group techniques and assignments, students learn how to come up with new ideas by stimulating the brain, freeing the mind, as well as creative visualization, combining, modifying. Choosing them can lead to setting goals for students. Thus, the creation of new ideas and the ability to acquire knowledge and analyze information at a higher level will enable the student to engage competently, wisely and deliberately in deep learning strategies and put more effort into their own learning as well as more reflection on the program.

Conclusion

Students need to organize their learning, the result of which has probably been to increase their level of readiness in self-regulatory learning strategies. According to Desi and Ryan (2000), self-regulation depends not only on intrinsic motivation, but also on the basic features of educational programs that creative teaching methods can achieve the goals of self-regulation and thus promote self-regulated learning. Because creative thinking is a kind of mental skill that by educating that person can create unusual new ideas by depicting problems and phenomena and analyzing them, also according to Lacauses (2011), teaching thinking creativity has caused the individual to divide, analyze and apply information, and accordingly, by discovering scientific laws and offering new solutions, intensify the process of learning and production of knowledge and increase students' self-regulated learning.

Thus, it can be said that teaching creative thinking has caused students to set goals for

themselves in learning situations with increasing knowledge, which has ultimately improved and increased their self-regulation. This is consistent with Pintrich's (2003) view of the concept of self-regulated learning, in which he considers this type of learning to be an active and organized process in which learners select goals for their learning and then work to achieve their learning goals. They set up and maintain their knowledge. According to Shank and Zimmerman (1998), self-regulation is "a set of self-produced thoughts, feelings, and actions, designed by the individual and constantly adjusted to achieve the desired goals."

Hypothesis 2 Research: Creative thinking training has an effect on students' achievement motivation. In order to test hypothesis 2 of the study, one-way analysis of covariance with pre-test of achievement motivation was used, so that the results showed that 19% of variance changes in post-test variables of students' achievement motivation were related to the effect of creative thinking training. This means that teaching creative thinking has a significant effect on promoting students' achievement motivation.

Although in the study of experimental literature, it was found that few studies have examined the effect of creative thinking training on students' achievement motivation, in examining the alignment of this finding with the results of previous studies, it should be said that studies that motivate students' progress.

The results of intervention confirmed the promotion of students' achievement motivation, including Jahani (2008), showed that teaching creative thinking to adolescents could affect their creative skills and increased their performance. Larry (2011) also concluded that the effect of independent variable on students' achievement motivation was significant by teaching the effect of brainstorming training which was based on creative thinking.

According to Harter, this leads to the promotion of inner motivation for progress. During the sessions, students learn to succeed in creative visualization by using creative visualization, which leads to the creation of positive visual images and thoughts instead of negative thoughts and images. At this stage, students identify their goals and heart desire for it.

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