

THE EFFECT OF SELF-REGULATED LEARNING STRATEGIES ON DEVELOPING CREATIVE PROBLEM SOLVING AND ACADEMIC SELF-EFFICACY AMONG INTELLECTUALLY SUPERIOR HIGH SCHOOL STUDENTS

Abstract: This study aims to investigate the effect of a self-regulated learning strategies on developing creative problem solving and academic self-efficacy among intellectually superior high school students. The sample was selected from students in the high school in the Sultanate of Oman. The participants in this study were 80 students. Experimental group (EG) consisted of 40 students while the control group (CG) consisted of 40 students. An experimental pretest and posttest control-group design was used in this study. The self-regulated learning strategies was conducted to the whole class by their actual teacher during the actual lesson period for 12 weeks with 50-minute sessions conducted three times a week. The program was designed based on the three basic fundamentals of self-regulated learning strategies, namely 'cognitive, metacognitive and resource management strategies. The results of this study indicated great gains for students in the experimental group in creative problem solving and academic self-efficacy. The study shows that students in the experimental group, compared to those in the control group, develop robust creative problem solving and academic self-efficacy. Recommendation: As self-regulated learning strategies exhibit a substantial effect on students' creative problem solving and academic self-efficacy, it is recommended that teachers should learn how to implement these strategies in their lessons to increase their students' performance.

Keywords: self-regulated learning strategies, creative problem solving, academic self-efficacy

Adel M. ElAdl, PhD
Full Professor
Zagazeg University
Sultane Qaboos Universities
Egypt, Oman
Contact:
E-mail: eladladel5@gmail.com
ORCID: 0000-0002-9246-3744

Yousra S. Polpol
Zagazeg University
Egypt
Contact:
E-mail: yousra_shaban@yahoo.com
ORCID: 0000-0002-8597-8600

INTRODUCTION

Novel and adaptive thinking requires creativity, as it involves proficiency at thinking and coming up with solutions and responses beyond that which is rote or rule-based (Davies, Fidler and Gorbis, 2011:9). As such creativity is a crucial graduate attribute relevant for problem-solving, generating novel solutions, innovation (Baker and Baker, 2012) and leading teams. Well-known creativity scholar Amabile (1996) views creativity is a multi-dimensional concept and an innate ability that everyone is born with, yet can be enhanced through educational interventions. While individual creativity provides the basis for team and enterprise innovation (Hirst et al., 2009); developing creativity in teams can be challenging (Walton, 2003). Too often business education tends to overemphasis individual linear, rational skills embedded in the scientific paradigm (Hoover et al., 2010) at the expense of intuition and team creative skills. It was found that students with high academic performance are usually self-regulated learners (Schunk & Zimmerman, 1995), since findings show that compared to students with low academic performance, they set more specific learning goals, use more learning strategies, self-monitor their own learning and assess their progress toward a goal in a more systematic manner (Pint rich & Sushi, 2002).

STATEMENT OF THE PROBLEM

Educators face the problem of creating a cognitive add metacognitive classroom where all students are engaged and active. Though overwhelming amount of considerations have emerged from current cognitive add metacognitive research, not all educators all over the world in general, and in our Arab world in particular, are aware of the findings of these studies. In such a case, an unbalanced prospect for teachers to provide maximal learning opportunities for all students prevails and is created. Accordingly, there will be an urgent need to create positive emotional connections to learning so that long-term learning can be transferred easily and successfully to the real-world. If students feel unsafe, stressed, or are experiencing a low-cycle of activity learning becomes impossible and they may hate the

learning process as a whole and drop out. Conventional methods might be problematic and no longer is beneficial to students. Students, as Schunk& Zimmerman (1995). claims, on average, retain only five percent of information delivered through lecture twenty-four hours later. Teachers try to do the teaching without considering whether the learners are motivated or not. Hence, employing methods that are more cognitive add metacognitive may be a way to increase the effectiveness of teaching and learning.

Further research is necessary to build on the vast amount of research into cognitive add metacognitive based learning specially with Omanis students. This will allow researchers to determine how cognitive add metacognitive based learning can be best used as an intervention with those students as there is a dearth of research with this population. Thus the present study addresses the following questions.

- 1- Are there differences in post-test scores mean between control and experimental groups on Creative problem solving scale?
- 2- Are there differences in post-test scores mean between control and experimental groups on Academic self-efficacy scale?
- 3- Are there differences in pre- post-test scores mean of the experimental group on Creative problem solving scale?
- 4- Are there differences in pre- post-test scores mean of the experimental group on Academic self-efficacy scale?

Academic self-efficacy scale

PURPOSE OF THE STUDY

This study aims to investigate the effect of a self-regulated learning strategies program on creative problem solving and academic self-efficacy among eleventh grade Omanis students. By gaining a better understanding of this process, teachers can apply the findings to create safe, stress-free classrooms that will engage the minds of students, improving their creative problem solving, and that will help to ameliorate their academic self-efficacy.

LITERATURE REVIEW

According to Zimmerman and Schunk (1997), the following characteristics should be considered so that learning can be considered as self-regulated: The use of different learning strategies, to be self-efficient when applying the strategies and to be committed to achieving goals. The primary goal of a self-regulation culture is to ensure that the entity involved in it is capable of improving and seeking its inherent quality and that such culture is born from the willing of individuals who are part of it. For that reason, self-regulated learning concept has been increasing the students actively participate in their learning process, monitoring and controlling the basic processes to achieve academic goals (Schunk, 2012).

Thus, learning is increasingly considered an activity accomplished by the students themselves and not a reactive response to teaching, for that reason, the students self-regulating their learning are proactive in their efforts to learn, since they are aware of their strengths and limitations.

The self-regulated learning construct is related to the ways of independent and effective academic learning including metacognition process, intrinsic motivation and strategic performance (Perry, 2002). It is also stated that the self-regulated learning influences the motivational and emotional aspect of individuals in a direct way. If a student has the necessary tools and methods to learn and study, their academic performance will be improved and consequently, their efforts will be reflected in their grades. According to the above-mentioned points, the student will be not only more motivated but also intrinsically motivated and will have positive emotions that will help to strength motivation. Lassen, Krawchuk and Rajani (2008) found that although self-variables are related to average scores per grade, self-efficacy for self-regulation is the best predictor of procrastination tendencies. Based on the findings from the two studies, the authors suggest that self-efficacy is a stronger predictor of the tendency to procrastinate than other motivation variables, such as self-regulation, academic self-efficacy and self-esteem. The costs of academic procrastination are evident: compared to neutral procrastinators, negative

procrastinators reported low GPAs per grade, they expected and received a lower class grade, spent more hours procrastinating each day, took longer to begin assignments and expressed less confidence that they were capable of regulating their own learning. Self-efficacy is proposed as the key to understanding procrastination in adult students who have knowledge of cognitive and metacognitive abilities and strategies but with low confidence to use them to organize their learning. Metacognitive strategy training will help students to know what to do and how to do it, but in order to increase self-efficacy for self-regulation, students will need repeated success experiences, encouragement and demonstrations of the benefits of using successful strategies.

Creative Problem Solving Scholars and researchers discussed the issue of creative problem solving of problems in general and especially in the field of gifted students. The creative problem solving can be defined within its three components as the solution, this means finding a way to solve the problem. The problem refers to obstacles that present a challenge to the individual to reach the goal. This challenge needs a solution or making a decision. Thus, creative solving is a frame or system including productive thinking tools that can be used to understand problems or generating different ideas that are not traditional then evaluating them to reach new solutions (Kaplan, 1996)). Doyle, C. (2016) mentioned many definitions for creative problem solving. Stated that it is taking a creative decision through thinking and reflecting and predicting ideas and solutions through deep awareness, argued that it is the natural and dynamic system and a way to handle a certain challenge. It is noted that through the steps of creative problem solving model brainstorming strategy has its own importance since the aim is to generate many idea that may be the solution of a problem (Abu Jado and Nawfl, 2007). The creative problem solving approach is the effort by the individual or the group's creative thinking to solve a problem, and can be used in many areas, and provide a framework regulating the use of tools and specific strategies to help generate and develop products that are characterized by novelty and utility, it is a framework of processes with a regulatory

function, a system used by the product of the thinking tools in order to understand the problems and opportunities and the generation of many diverse ideas is familiar as well as evaluating, developing and implementing the proposed solutions (Al-asar, 2000). (Renzulli, Gentry, & Reis, 2014).

Academic Self-Efficacy, Self-efficacy is a personal belief in one's capability to organize and execute a course of action required to attain mastery and succeed in specific tasks and it has been a key component in theories of motivation and learning in varied contexts.

This concept emerged from the seminal work of Bandura (1997), who posited that self-efficacy affects an individual's choice of activities, effort, and persistence. People who have low self-efficacy for accomplishing a specific task may avoid it, while those who believe they are capable are more likely to participate.

Artino (2012) claims that self-efficacy emerges from four primary sources: (a) enactive mastery experiences (actual performances); (b) observation of others (vicarious experiences); (c) forms of persuasion, both verbal and otherwise; and (d) physiological and affective states from which people partly judge their capableness, strength, and vulnerability to dysfunction. In this work, we focus in academic self-efficacy as the portion of the self-concept construct related specifically to learning. Academic self-efficacy corresponds with pupils' explanations of their accomplishments and it is viewed as instrumental to academic achievement (Dickhäuser & Steinmeier-Pelster, 2002). Theoretically, high achieving students would be expected to have higher feelings of self-efficacy, but empirical evidence of this has been difficult to find, in spite that in the last 4 decades several educational researchers had used this concept to predict and explain a wide range educational phenomena from athletic skill to academic achievement.

Hardy (2014) claims that the study of self-efficacy may help teachers understand its underlying structure and the process through which academic self-concepts can be raised or lowered.

Marsh (1990) provided a theoretical perspective to explain how students develop self-efficacy

feelings by using two different frames of reference to evaluate their abilities and achievements in different domains (mathematical subjects vs. verbal subjects). Marsh argued that students differ on their feelings of academic self-efficacy by subject, and they

are mainly based on the feedback they receive about their achievements (Kesner, 2005).

Marsh (1990) also posited that Math and Verbal self-concepts are unrelated and independently developed with relation external and internal comparisons. Students compare their own math and verbal abilities with the perceived abilities of other students in their frame of reference.

METHOD

Quasi-experimental research methods are used, quasi-experimental research is research that resembles experimental research but is not true experimental research. Although the independent variable is manipulated, participants are not randomly assigned to conditions or orders of conditions because the independent variable is manipulated before the dependent variable is measured, quasi-experimental research eliminates the directionality problem.

PARTICIPANTS

The sample was selected from students in the eleventh grade in basic education in the Sultanate of Oman. The participants in this study were 80 secondary school students. Experimental group (EG) consisted of 40 students while the control group (CG) consisted of 40 students. In both groups, students' social, economic statuses, intelligence and previous scholastic achievement were nearly the same. The students' ages in both groups ranged from 16 to 17 years. The participants were selected by convenience random sampling.

The sample was randomly divided into two groups; experimental (n= 40 boys only) and control (n= 40 boys only). The two groups were matched on age, IQ, achievement, creative problem solving and academic self-efficacy.

Table 1. pretest mean scores, standard deviations, T- value, and significance level for experimental and control groups on age (by month), IQ, achievement, creative problem solving, and academic self-efficacy

Variable	Group	N	M	SD	T	P.
Age	Ex.	40	181.53	3.85	0.452	0.517
	Con.	40	180.71	3.81		
IQ	Ex.	40	118.71	6.23	0.596	0.483
	Con.	40	118.59	6.41		
Achievement	Ex.	40	42.17	2.97	0.643	0.393
	Con.	40	42.59	2.15		
Creative Problem Solving	Ex.	40	47.12	3.53	0.723	0.215
	Con.	40	46.78	3.12		
Academic Self-Efficacy	Ex.	40	68.45	3.27	0.551	0.451
	Con.	40	68.89	3.65		

DATA COLLECTION TOOLS

1- *The Raven's Colored Progressive Matrices Test*. The Raven's CPM is internationally recognized as a culture -fair or culture reduced test of non- verbal intelligence. This easily administered, multiple - choice pencil and paper test has no time limit, and comprises three sets of twelve matrix designs arranged to "assess mental development up to a stage when a person is sufficiently able to reason by analogy to adopt this way of thinking as a consistent method of inference" (Raven et al., 1993). The testee is shown a series of patterns with parts missing. The parts removed are of simple shape and have been placed below the matrix. The testee can either point to the pattern piece s/he has selected or write its corresponding number on the record form (Lezak, 1995). The total score is the total number of matrices completed correctly, and the test is thus scored out of 36. The retest reliability of the Raven's CPM was revealed to be .90. The degree of correlation between the Raven's CPM and the WISC revealed correlations of 0.91.

2- The "Self-Regulated Learning Strategies Scale" consists of 30 items and eight dimensions (motivation regulation, effort regulation, planning, attention focusing, using additional resources, summarizing strategy, emphasis strategy, and self-direction). In this scale, prepared in accordance with a six-point Likert-type scale, the items were graded as "always = 6," "mostly = 5," "frequently = 4," "sometimes = 3," "rarely = 2" and "never = 1." The reliability coefficients of the sub-dimensions of the scale were 0.79 for

motivation regulation, .69 for effort regulation, 0.81 for planning, 0.78 for attention focusing, 0.77 for using additional resources, 0.76 for summarizing strategy, 0.78 for emphasis strategies, and 0.76 for self-direction. The results of the fit statistic obtained with CFA were as follows: AGFI = 0.81, RMSEA = 0.065, NNFI = 0.88, RMR = 0.063, and SRMR = 0.064. In addition, when the internal consistency coefficient of the sample group of the "Self-Regulated Learning Strategies Scale" in the present study was re-calculated it was found to be 0.91. Since the total points would be summed for the sample group, a two-level CFA was conducted. The fit indices obtained by CFA were as follows: $\chi^2 = 1314.13$ (sd = 327, $p < .001$), (χ^2/sd) = 4.02, RMSEA = 0.065, GFI = 0.87, NFI = 0.91, CFI = 0.93, and AGFI = 0.94, showing that the scale has good fit values.

3- Academic Achievement Test: The end-of-year examination results of the participants in math standardized and marked by the teachers, and provided the summative evaluation scores for the analysis. Hence, scores in the math served as the measures of students' achievement.

4- Scale of creative problem solving Prepared by the researcher including two tasks, first; self-report questionnaire (22 items) including background information and Likert-scale items was administered to the, second (11 situations), The Cronbach alpha reliability check was (0.81), and experimental validity with achievement was (0.74).

5- Academic self-efficacy, Artino (2012), self-efficacy scale was used. The questionnaire includes 30 items and three subscales: talent, effort, and context. The items have been designed by Likert scale with four-choice answers (from one to four). The designer of this instrument reported reliability and reliability coefficient of subscales of talent, effort, and context as follows respectively: 0.82, 0.78, 0.66, and 0.70. Karimzadeh and Nikchehreh (2009) evaluated the reliability of 0.76 for total scale and 0.66, 0.65 and 0.60 for talent, effort, and context respectively. The validity of the questionnaire was calculated by numerical sigma (0.86) based on opinion of ten professors.

EXPERIMENTAL DESIGN

An experimental Pretest-Posttest Control-Group design was used in this study. In this design, two groups are formed by assigning (40) of the students to the experimental group and (40) to the control group. Students in the experimental and control groups were pretested and post tested in the same manner and at the same time in the study. The bivalent independent variable was the self-regulated learning strategies program and it assumed two values: presence of the self-regulated learning strategies program (for the experimental group) versus absence of the self-regulated learning strategies program (for the control group). The dependent variables were the gains in scores on creative problem solving and academic self-efficacy scales from the pretest and posttest.

PROCEDURES

Pre-intervention testing: All the eighty students in grade ten completed The Raven's Colored Progressive Matrices Test, which assesses students' intelligence; academic self-efficacy Scale, which assesses students' academic self-efficacy, creative problem solving scale, which assesses creative problem solving. Additionally, the end-of-year examination results of the participants in social studies standardized and marked by the teachers, and provided the summative evaluation scores for the analysis. Hence, scores in the social studies served as the measures of students' achievement. Thus data

was reported for the students who completed the study.

General Instructional Procedures: The self-regulated learning strategies program was conducted to the whole class by their actual teacher during the actual lesson period for 12 weeks with 50 minute sessions conducted three times a week. The program was designed based on the three basic fundamentals of self-regulated learning, namely dimensions (motivation regulation, effort regulation, planning, attention focusing, using additional resources, summarizing strategy, emphasis strategy, and self-direction. In the 'orchestrated immersion' phase, the students, with the help of their teacher, used various pictures, power-point presentations, cartoons and comic strips.

These helped them the concepts presented and the subject matter as a whole as well. As for 'relaxed alertness,' phase, cooperative learning was present. Students collaborated with one another. Students were asked to write down, share and discuss with their classmates. The aim was to eliminate fear in the learners while maintaining highly challenging environments. During the 'active processing' phase, the learner was allowed to consolidate and internalize information by actively processing it. simulations, group discussions, role plays and dramatization techniques were used in order to ensure the retaining of the obtained knowledge and to ease the structuring of this knowledge as well as applying it into new situations.

Fidelity of Treatment: To ensure that the self-regulated learning strategies program was delivered as intended by the researcher, the following four safeguards were implemented. The first safeguard was that the teacher received training to criterion in how to apply the self-regulated learning strategies program instructional procedures. The second safeguard was that teacher met with the researcher day after day and communicated daily with the researcher (as needed) to discuss any noteworthy occurrences that took place when implementing the self-regulated learning strategies program instructional procedures. Reported difficulties occurred rarely and usually involved the need to

individualize further for a particular student to deal with a behavioral issue. Responses to issues such as these were discussed and implemented.

DATA ANALYSIS

A two-groups pre-post design was used to compare creative problem solving and academic self-efficacy before and after the intervention. T-test was conducted. At each time point (pre/post), the mean and standard deviation were used to summarize group responses. Probability levels of 0.05 or smaller indicated significant differences between the experimental and control groups means. The data collected through the pre-test and

post-test were entered into Statistical Package for Social Sciences (SPSS) version 22.

RESULTS

It was hypothesized that there were differences in post-test scores mean between control and experimental groups on creative problem solving Test. Table 2. shows T. Test results for the differences in post- test mean scores between experimental and control groups in creative problem solving. According to table 2., there has been found a significant difference the differences in post- test mean scores between experimental and control groups in creative problem solving ($t=7.31$, $p= 0.00$; $p<0.01$) in favor of the experimental group.

Table 2. T. test results for the differences in post- test mean scores between experimental and control groups in creative problem solving

Test				
Creative problem solving	Exp.	Con.	T	P.
	58.61	46.93	7.31**	0.000

Note: **P <0.01

The second hypothesis was that there were differences in post-test scores mean between control and experimental groups on academic self-efficacy Test. Table 3. shows T. Test results for the differences in post- test mean scores between experimental and control groups in academic self-

efficacy. According to table 3., there has been found a significant difference the differences in post- test mean scores between experimental and control groups in academic self-efficacy ($t=9.38$, $p= 0.00$; $p<0.01$) in favor of the experimental group.

Table 3. T. test results for the differences in post- test mean scores between experimental and control groups in academic self-efficacy.

Test				
Academic self-efficacy	Exp.	Con.	T	P.
	85.39	69.81	9.38**	0.000

Note: **P <0.01

The third hypothesis was that there were there differences in pre- post-test scores mean of the experimental group on creative problem solving Test. Table 4. shows T. Test results for the differences in pre- post-test scores mean of the experimental group on creative problem solving

Test. According to table 4., there has been found a significant difference the differences in pre- post-test scores mean of the experimental group on creative problem solving ($t=8.57$, $p= 0.00$; $p<0.01$) in favor of post-test scores mean.

Table 4. T. test results for the differences in pre- post-test scores mean of the experimental group on creative problem solving Test

Test				
Creative problem solving	Exp.	Con.	T	P.

	58.61	47.12	8.57**	0.000
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Note: **P <0.01

The fourth hypothesis was that there were there differences in pre- post-test scores mean of the experimental group on academic self-efficacy Test. Table 5. shows T. Test results for the differences in pre- post-test scores mean of the experimental group on academic self-efficacy Test. According to

table 5., there has been found a significant difference the differences in pre- post-test scores mean of the experimental group on academic self-efficacy ($t=8.85$, $p= 0.00$; $p<0.01$) in favor of post-test scores mean.

Table5. T. test results for the differences in pre- post-test scores mean of the experimental group on academic self-efficacy Test

Test	Exp.	Con.	T	P.
Academic self-efficacy	85.39	68.45	8.85**	0.000

Note: **P <0.01

DISCUSSION

The Purpose of this study is to investigate the effect of a self-regulated learning strategies program on creative problem solving and academic self-efficacy among eleventh grade Omanis students. The results of this study indicated great gains for students in the experimental group in both creative problem solving and academic self-efficacy. This goes in the same line with the results of many studies. For example, Hardy, G. (2014), analysis of post-test and retention level tests revealed a significant difference between the groups favoring self-regulated learning strategies. Perry, N (2002), found that self-regulated learning strategies "...more significantly increased the students' academic achievement when compared to traditional teaching methods". The experimental group showed a 48.38% increase from the pre-test to post-test, whereas the control group showed an increase of 20.35%.

The performance of the experimental group in posttest in creative problem solving and academic self-efficacy can be explained by the gain achieved by the experimental group due to the application of the self-regulated learning strategies program which was built in the light of the integrated approach. This goes in the same

line with Schunk, D. (1996), claim that "Learning cannot be achieved by accident, but must be sought to by using techniques that stimulate the mind in certain ways in various fields, including art, crafts, music, body building tools, scientific stories, novels, trips, etc. , It is not too late to plant a tree for self-enrichment and mental development.

The mean scores of the control group scores on the creative problem solving and academic self-efficacy were low, while those of the experimental group were high, although there are no differences between the mean scores of the two groups in pre-test. This indicates that the program built for self-regulated learning strategies has taken into account the needs of multiple learners and their desire to learn, unlike the control group that has been learning in the traditional way in most of our schools.

This is consistent with the perspective that " the traditional methods used in our schools do not guide students as individuals towards materials, tasks, and do not provide the appropriate challenge for their potential and abilities to appear, which may make students hate the school as a whole, and the materials taught to them in general" (Baker& Baker, 2012).. This may be different if there is an amendment to the conditions of providing experiences based on

compensatory programs that help students to live with the educational situation and benefit from it. This is consistent with what Renzulli, Gentry & Reis (2014) that "students who attend school and lack fertile educational experience, can compensate for the land they lost if they find fertile experience in their classrooms.

CONCLUSIONS

This study goes some way to understanding creative problem solving and academic self-efficacy in Omanis eleventh grade primary students. The study shows that students in the experimental group, compared to those in the control group, develop robust creative problem solving and academic self-efficacy due to training in self-regulated learning strategies. The study shows that those young students have great chance of developing their creative problem solving and academic self-efficacy.

FUTURE RESEARCH AND RECOMMENDATIONS

As a result, teaching with program based on self-regulated learning strategies theory is effective in improving students' creative problem solving and academic self-efficacy, the study of the students and it improves and academic achievement. In this context, it is proposed that in the classroom teaching teachers should give utmost importance to the self-regulated learning strategies theory. As for research that can be done in the future, the impact of the self-regulated learning strategies theory teaching on students for effect of another variable. The results of this study have supported the claim of effectiveness of the cognitive and metacognitive strategies-based instructional model in enhancing creative problem solving, and academic self-efficacy. As a result of the robust evidence provided in this study, it is hoped that the cognitive and metacognitive strategies -based instructional model will be applied in improving learner outcomes in the future. The pedagogical knowledge needs to be evidence-based. The research and practice communities need to continue to work together to support learning for all students to be ready for their futures.

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