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Effect of Problem-solving Skills Education on Auto-regulation learning of High School Students in Tehran

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Abstract
The main objective of this research was problem-solving skills education on self-regulation learning of female high school students in Tehran. Sample size using multi-stage method and according to Cochran formula was 60 persons. Buffard Learning self-regulation questionnaire (11995) was used for data collection which contains 14 questions of five options in the three scales of cognitive, metacognitive and motivation. Problem-solving skill training was conducted in 12 sessions. Descriptive and inferential statistics were used for data analysis. Results showed that problem solving skills education is effective in self-regulation learning of students and has a good stability over time.

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1. Introduction
Self-regulatory learning is an educational concept that includes having confidence, motivation and capability for independent learning in challenging and dynamic learning environments (Montague, 2008). In recent decades, the role of self-regulation learning system in learning and student achievement has been remarkable.

Given the problems of modern societies, the main purpose of the education system, is to train independent and self-regulatory learners, in order to control their own learning process, monitoring and evaluation. Young (2001) believed that self-regulation is a capacity that individual use in order to balance their behaviors based on external and internal conditions and changes to the environment (Young, 2001).

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2. Problem statements

Self-regulatory abilities appear during childhood and adolescence period (Raffaeli et al., 2005). Seif et al (2006) found that learning strategies are predicted by self-regulatory mechanisms and self-regulation makes easy academic achievement. Today, most theorists is considered learning self regulation as a multidimensional process that includes elements of cognitive, emotional, behavioral and motivational (Bolhuis, 2003).

Cognition includes skills for decoding, to remember and recall information. Meta-Cognition includes skills which will enable learners to understand the cognitive processes. Motivation includes the beliefs and attitudes that are passed on cognitive and metacognitive skill development. all of the above mentioned materials are needed for self-regulation (Zimmerman, 2002; Young, 2005).

Self-regulated learners have four characteristics: 1 - independence in learning, 2 - efficiency in learning, 3 - and 4 accept responsibility for learning - the ability to use problem-solving skills. Noults describes self-regulatory learning as a learning process. People are starting their own learning, considered their learning needs and identify their goals. determine the required resources and finally, choose a good strategy to their learning (Han-Kim, 2010).

Students who have more self-regulation, social skills and fewer behavioral problems exhibit significant interaction in school and are more efficient (Winsler et al., 2004; Foulad Chang, 2003) and get a higher score in class activities (Kristie and Byrnes, 2006).

The main purpose of higher education organization is to train citizens with independent learning ability and self regulator. Results of previous studies showed that most students lack these skills, cannot how to start their learning, how to use of what resources are needed and how to conduct their learning process, and adjust their management.

A review of research literature suggests that problem solving is one of the fundamental skills in life issues. Today, in developed countries training of problem-solving skills constitutes one the components of curriculum. Problem-solving skills, improve student performance in all courses (Kirkley, 2003; Nouri et al., 2010).


Mayer (1983) defines a multi-step problem solving process, One must understand the relationship between past experiences and current issues and find an appropriate solution in accordance with these subjects.

Mayer proposed three characteristics for problem solving:

1-Problem solving is a cognitive process but can be inferred from behavior.
2-outcome of the problem solving process is providing solutions

3 - Solving the problem requires work or act is based on prior knowledge (Funkhouser and Dennis, 1992)

Different models are discussed for problem solving. Five problem stages is discussed according to IDEAL model include: 1) identifying the problem, 2) define the problem and collected relative data, 3) explore possible solutions 4) acting according to the solutions found, and 5) review of the last stages and evaluation of carried out activities (Wehmeyer, and Agran, 2001).

Problem solving skills is an intellectual, logical and systematic method which helps individual when dealing with problems, to search for multiple solutions then, select the best solution with regard to the conditions.

Mahmoud Radi (2006) suggested in his study teaching problem solving skills, improve communication quality, increasing assertiveness skills, self-efficacy arousal, learning, self-discipline and self-seeking students makes.

McMoran et al (2007) found that teaching problem-solving skills, increased ability to increase student understanding and personal skills as well as higher levels of mental health.

Based on Bornstein results in 2003, "Self assessment", "self-efficacy," "self governance" and a timely diagnosis, "problematic situations" are among the criteria through which they could estimate the level of self-regulation. Murtagh et al (2004) showed that problem solving is one of the most important predictive variables for "mental health".

Based on available evidence, this study was to attempt to answer these questions:

1. Whether teaching the problem-solving skills has an effect on learning of student self-regulation.
2. Whether teaching the problem solving skills has good stability over time. On learning of students self-regulation.
3. Methodology

Statistical population, sample size and methods:

This quasi-experimental study is a pre-test-post-test design with control group and follow up stage.

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest</th>
<th>Independent variable</th>
<th>Posttest</th>
<th>Follow up stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental group (E)</td>
<td>$T_b$</td>
<td>$X$</td>
<td>$T_{a1}$</td>
<td>$T_{a2}$</td>
</tr>
<tr>
<td>Control group (C)</td>
<td>$T_b$</td>
<td>-</td>
<td>$T_{a1}$</td>
<td>-</td>
</tr>
</tbody>
</table>

At the first, self-regulation learning questionnaire were administered on selected schools. Then, students who self-regulatory learning rate were lower than their average level determined. Sixty persons were randomly selected among them. Then, the selected group was divided into two groups. One group was determined as a test group and the others as a control group.

Before operation, pre-test and after it post test were carried out for two groups simultaneously. The follow up stage was carried out on experimental group two months after post-test.

The study population consisted of all high school students during the school year 2012.

Sample size: due to continuous measure scale and two domains research hypotheses in the 95% confidence level, the sample size based on Cochran formula (Cochran 1977) was 60 persons.

Equation 1: Cochran formula $= \frac{\sigma^2 Z_{1-\alpha/2}^2}{d^2}$

Sampling method: in the present study, the multistage sampling method is used as follows:

First stage: two educational regions were randomly selected among the training areas of Tehran.

Second stage: Among the region's schools, a girls' high schools were randomly selected.

Third stage: Learning self-regulation questionnaire, were administered on all students. Learning rate of students who self-regulation is lower than average level is determined.

Fourth stage: sixty persons were randomly selected among them and divided into two groups. one of them were randomly selected as a test group and the others as a control group.

Sampling tools:

Learning goals were assessed using a questionnaire developed by Bouffard and colleagues. (1995). This questionnaire has 14 questions with five options in three dimensions as Cognitive, metacognitive and motivational.

Seyf et al., (2006) reported the questionnaire reliability coefficient 0.89 using retest method, and Karshki (2008), Bouffard et al., (1995) and Evenson (2004) reported it as 0.88, 0.84, 0.86 respectively according to Cronbach's alpha methodology.

In the present study, reliability coefficient was determined 0.87 by Cronbach's alpha method. Content validity of the self-regulation learning questionnaires were evaluated by relevant experts and experienced teachers and based on their comments reforms was carried out.

Problem-solving skills training during 12 sessions, each session 2 hours on the experimental group was taught.

Data analyzing method: descriptive statistics and inferential statistics (covariance and paired t-test) was used for analyzing data.
4. Conclusion
Data were analyzed using analysis of covariance. At first it is necessary to be reported the results of the Levene's Test of Homogeneity of Variance.

<table>
<thead>
<tr>
<th>Index</th>
<th>F test</th>
<th>D coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Self regulation</td>
<td>0.76</td>
<td>0.33</td>
</tr>
</tbody>
</table>

According to Table 2, the calculated value for Levine test is not significant at P value of 0.05. Therefore, assuming equal variances is confirmed so, considering other hypotheses for data analysis, analysis of covariance can be used.

The first hypothesis of the study is problem-solving skills training effective on students' self-regulation learning?

To investigate the significance of the variations, and determine the effect of self-regulation in learning problem solving skills, Co-variance analysis was used.

<table>
<thead>
<tr>
<th>index</th>
<th>Sum of Square</th>
<th>F degree of freedom</th>
<th>Mean of Square</th>
<th>F test</th>
<th>D coefficient</th>
<th>Eta-squared</th>
<th>Statistical power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self regulation learning</td>
<td>205.478</td>
<td>1</td>
<td>205.478</td>
<td>14.796</td>
<td>0.00</td>
<td>0.206</td>
<td>0.966</td>
</tr>
<tr>
<td>Error</td>
<td>5281.721</td>
<td>1</td>
<td>528.721</td>
<td>38.072</td>
<td>0.00</td>
<td>0.4</td>
<td>1.00</td>
</tr>
<tr>
<td>Total</td>
<td>791.588</td>
<td>57</td>
<td>13188</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

As can be seen, the level of self regulation learning of students who have received problem-solving skills is significantly higher than the self regulation learning level of students who have not received this training. As shown in the Table3, Eta square of the difference is 0.206 and statistical power is equal to O.P=0.966.

The second hypothesis of the study: teaching problem solving skills, self-regulation learning of students has a good stability over time.

As mentioned in Table 4, differences in the self regulation learning scores of the experimental group in posttest stage compared to follow up stage is not significant. Thus, it is concluded that education of the problem solving skills is effective on self-regulation learning of students and has good stability over time.

5. Discussion
The results of this study shows that learning rate of self-regulation in students with training in problem-solving skills are significantly more than students without these trainings. Therefore a problem-solving skill training is effective in self-regulation learning of students and has good stability over time.

Results of previous studies showed that self-regulation learning is an active and organized procedure. Through it learners selected their learning goals and try to regulate, control and monitor their cognition, motivation and behavior (Stetanou, 2001).
Self-regulation has three elements: cognitive, metacognitive and motivational (Boufard et al., 1995). Metacognition as self-monitoring and self-judgment has a basic role in self regulation. Cognitive and motivational components interact with each other and increase the learning ability. Self-regulation helps students when engage in a task, monitor their own learning and select successful strategies (Zimmerman, 2002). Self-regulation, caused to control impulse and also makes time management and coping with the stress. by goal orientation and self-control (Montague, 2004), self-reference system (Zimmerman, 2002) and efficiency(Paris et al., 2001) are related.

Bolhuis (2003) found that problem-solving skills training enhance and facilitate lifelong learning of students. Students are active learners. They have potentially ability to monitor, control and regulate the cognitive, motivational and behavioral strategies as well as environmental conditions. They have criteria that they can be monitored and evaluated their own learning process (Pintrich, 2004). the most important processes of self-regulated learning include: setting goals, planning, organizing, using cognitive strategies, self- learning , time and place management, self monitoring, self evaluation, and structuring the environment.

Effectiveness of students work in self-regulated learning related to interaction of these processes together. None of them alone can cause the complex behaviour of self regulation learning (Loyens, 2008).

Results of William's study (2004) showed that problem-based teaching methods affect students' self-regulation techniques and its effect over time is stable. The results of the present study are consistent with William's research findings.


Students who have highly rated self-regulation skills are, learn more with little effort, and report higher levels of satisfaction with their academics(Zimmerman, 2002).In contrast, students who do not discipline themselves, show more impulsive behavior, have poor academic achievement and cannot demonstrate its ability (Zito, 2007).

Research results of Welch (2009) showed that training of problem-solving skills is effective in self learning, self-monitoring, and self-discipline of students.

Results of Griffith et al (2005) confirmed that problem-solving skills training as a method of short-term intervention is effective in increasing students' self-regulation of learning. Its effect is persistent over time. The results of this study are consistent with findings of the present study.

Results of previous studies showed that students who use self-regulation strategies, have greater self-efficacy and learning (Lazakido, et al., 2010; Welvet, 2005, Kajbaf, 2004)

Based on the available evidence is thus: Self-regulation is an acquired skill that requires training and practice. Problem-solving skills training acts as a shield against negative events and case to the active participation of students in the learning process.

6. References


