A case study of the predicting power of cognitive, metacognitive and motivational strategies in girl students' achievements

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Abstract

The purpose of this research was to determine the power of predicting cognitive, metacognitive and motivational strategies in girl students' achievements in a Tehran middle school. The sample contained 245 third-grade students who were selected by multiple cluster sampling. Data were gathered with three instruments, and their validity and reliability were confirmed. These instruments were Self-regulation in Learning Questionnaire, Motivational Strategies Questionnaire and students' average scores. Multiple regression analysis showed that all of the strategies could anticipate the achievements, though the strongest predictors were metacognitive strategies.

Keywords: Cognitive strategies; metacognitive strategies; motivational strategies; achievement

1. Introduction

A student’s achievement is an academic variable that has been regarded as a function of many factors. One of the most important factors in this achievement is learning strategies. Learning strategies are plan actions that facilitate learning. They include cognitive, metacognitive, and motivational strategies.

The term "cognitive strategies" in its simplest form is the use of cognition to solve a problem or complete a task. Cognitive strategies are some mental processes or procedures used for accomplishing a particular cognitive goal. Cognitive strategies are task specific and are used in cognitive processes and help a person to manipulate information – such as note taking or asking questions through various rehearsals, elaborations and organizational strategies (Vaidya, 1999). So, students use cognitive strategies for learning, retention and comprehension. Cognitive strategies may also refer to \textit{procedural facilitators} that help an individual achieve a particular goal (e.g., understanding a text) and serve to support the learner as he or she develops internal procedures that enable him/her to perform tasks that are complex (Bereiter & Scardamalia, 1987). Cognitive strategies can increase the efficiency and confidence of the learner in approaching a learning task, as well as his/her ability to develop a product, retain essential information, or perform a skill. Recently, the relationship between cognitive strategies and student's achievement has been explored in a number of studies. These studies have demonstrated that there are positive, significant relationships between cognitive strategies and achievement in arithmetic, comprehension, problem solving, and mathematical problem solving (Samadi, 2002; Alborzi & Samani, 2000). In addition, research shows...
that cognitive strategy in teaching definitely has positive impacts on student performance (Yumasak, Sungur, & Çakiroğlu, 2007). Studies conducted on experts and novices, or proficient and less proficient students, have demonstrated that experts in comparison with novices have used more cognitive strategies and outperformed them in performing the task.

Another effective tool in learning is metacognitive strategies. The concept of metacognition is one of the most important cognitive concepts that help people perform many cognitive tasks more effectively, and is often associated with Flavell (1979). He presents metacognition within a tripartite theoretical framework. According to Flavell (1976, 1979) "metacognition is thinking about thinking" and consists of both metacognitive knowledge and metacognitive experiences or cognitive regulation. Metacognitive knowledge refers to acquired knowledge about cognitive processes, which can be used to control cognitive processes. He further divides metacognitive knowledge into three categories: knowledge of person, task, and strategy. Metacognitive strategies are executive in nature and used for selecting, planning, monitoring, evaluating, and regulating progress, which control cognitive processes and ensure that the goal has been reached (e.g., quizzing oneself to evaluate one's understanding of that text) (Najar, 1999). These strategies are managerial and their use may be linked to efficient ways of improving performance in academic and work environments. Teachers can teach these strategies in class. In addition, these strategies can be learned and transferred from one area to another. Several studies have shown that metacognitive strategies are a finite set of common skills that are highly correlated to academic success (Garcia & Pintrich, 1994; Pintrich, 1994; Samadi, 2008). Recent research on middle schools suggests that metacognition (i.e., self-regulated behavior) is a strong predictor of their academic successes and facilitates their learning in different areas (e.g., mathematical problem solving) (Samadi, 2002).

Finally, the other effective learning tool is comprised of motivational strategies. Motivational strategies are one of the most effective strategies in learning. The concept of motivation is among the most important components of learning in any educational environment (Maehr, 1984). Motivational strategies are energetic strategies. Motivation is the sum of a person's behavior and expectation. Motivational processes refer to conscious or implicit regulatory cognitive processes that guide behaviors toward the goal. A motivated person is one who integrates his/her knowledge and beliefs with behavior. Social-cognitive learning theory defines motivation in terms of student's: a) self-efficacy beliefs about their abilities to engage, persist, and accomplish specific tasks (Bandura, 1986); b) goal-setting activities (Dweck, 1991); and, c) adapting help seeking (Newman, 2002). Self-efficacy beliefs provide the foundation for human motivation, well being and personal accomplishment and powerfully influence the level of accomplishment that one ultimately achieves (Zimmerman, 1994). Self-efficacy is associated with the use of high cognitive and metacognitive strategies and resists doing tasks. Adapting help seeking is a motivational strategy (Boekaerts, Pintrich & Zeidner, 2000). Adapting help seeking mediates the relationship between academic difficulty and successful task completion. The process of adaptive help seeking involves self-reflection and self-related affective motivational factor. Several studies have shown that self-efficacy beliefs, goal orientation and adapting help seeking positively relate to academic achievement. Studies have clearly shown if oriented toward learning goals have demonstrated high levels of learning (Zimmerman, Bandura & Martinez-Pons, 1992). Dweck (1986) and Zimmerman (1994) contended that learning goal orientation is positively related to achievement. A review of literature has showed that there are significant relationships between motivational strategies and academic achievements of students (Zimmerman et al., 1992; Dweck, 1991). The present study aimed to examine simple and mutual relationships between learning strategies (cognitive, metacognitive and motivational strategies) and determination power of anticipation strategies on learning achievements of girl students of a Tehran middle school.

2. Method

This research is a descriptive research of correlation design that was carried out in Tehran. The target population for the study comprised of all girl students of middle school in 1, 6 and 19 educational districts of Tehran. The study participants were 245 third grade middle schools students that were selected by multiple cluster sampling method from the districts. Their age ranged with a mean 13 year and 11 month and standard deviation 9 month. Data were collected using 3 Instruments: Motivational Regulation Strategies Questionnaire (Wolters, 1998), Self-regulation in Learning Questionnaire (Zimmerman & Martinez-Pons, 1986) and students' average scores in first and second semester in year 2010 to measure achievement.

Motivational Regulation Strategies Questionnaire (Wolters, 1999) was used to measure motivational strategies. These questionnaires have 28 five point Likert items ranging from 1 (Not at all typical of to me), to 5 (very much typical to me). Components of these questionnaires are: self-reinforcement strategy, environment control
performance self-talk, interest enhancement and self-talk dominance. Reliability of this questionnaire is acquired by Cronbach's alpha Coefficients that are illustrated in Table 1.

**Table 1. Reliability of Motivational Regulation Strategies Questionnaire**

<table>
<thead>
<tr>
<th>Component</th>
<th>Items used</th>
<th>Cronbach's alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reinforcement strategy</td>
<td>7,8,1,2,3,4,5,6</td>
<td>0.80</td>
</tr>
<tr>
<td>Environment control</td>
<td>9,10,11,12,13,14</td>
<td>0.62</td>
</tr>
<tr>
<td>Interest Enhancement</td>
<td>15,16,17,18,19</td>
<td>0.54</td>
</tr>
<tr>
<td>Self-talk performance</td>
<td>20,21,22,23,24</td>
<td>0.44</td>
</tr>
<tr>
<td>Self-talk dominance</td>
<td>25,26,27,28</td>
<td>0.78</td>
</tr>
</tbody>
</table>

2- Self-regulation in Learning Questionnaire (Zimmerman & Martinez-Pons, 1986) was used for measurement of cognitive and metacognitive strategies. This Questionnaire has 15 four point Likert items ranging from 1 (very little of to me) to 5 (always off to me). Reliability of this Questionnaire was calculated by Cronach's alpha ($r = 0.62$) that was satisfactory. Validity of this questionnaire was determined in previous research by its correlation with students score in Mathematics and English lesson (table 2).

**Table 2. Pearson correlation between Self-regulation score and GPA, final Mathematics score and final English score**

<table>
<thead>
<tr>
<th>Subject score on tests</th>
<th>$r$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation of Self-regulation score with GPA</td>
<td>0.38</td>
<td>0.001</td>
</tr>
<tr>
<td>Correlation of Self-regulation score with final Mathematical score</td>
<td>0.34</td>
<td>0.001</td>
</tr>
<tr>
<td>Correlation of Self-regulation score with final English score</td>
<td>0.30</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Table 2 shows that correlation between self-regulation scores and GPA is 0.38 and it is significant at the 0.001 level and also correlation between self-regulation scores and final mathematical score is 0.34 and it is significant at the 0.001 level. Finally, correlation between self-regulation scores and final English score is 0.30 and it is significant at the 0.001 level. Mean average or GPA of girl students in the first and second semester in year 2010 were used in measurement achievement.

The entire subject participants were administered the Self-regulation in Learning Questionnaire (Zimmerman & Martinez-Pons, 1986). Instruction on how to respond to the questionnaire was read to the participants. This ensures its proper filling. Data collection was done immediately after the administration and all the response sheets were retrieved from the respondents. Finally, average score of the students were collected from their portfolio.

SPSS version 13 was used to compute Pearson correlations. Pearson correlation was conducted to simply investigate the relationship between strategies (cognitive, metacognitive, and motivational) with student's academic achievement. Multiple regressions were used to determine power of predicting students’ academic achievement by cognitive, metacognitive, and motivational strategies.

### 3. Results

The purpose of the study was to investigate the relationship of cognitive, metacognitive and motivational strategies to academic achievement. There is significant correlation between learning strategies (Cognitive, metacognitive, motivational) and achievement (table 3).

**Table 3. Pearson between cognitive strategies, meta cognitive strategies, and motivational strategies**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cognitive strategies</th>
<th>Metacognitive strategies</th>
<th>Motivational strategies</th>
<th>Achievement</th>
</tr>
</thead>
</table>
To know the anticipation power of cognitive, metacognitive, and motivational strategies for student achievement multiple regression analysis was used (table 4).

Table 4. The result of multiple regression achievement by cognitive, metacognitive and motivational strategies

<table>
<thead>
<tr>
<th>predictors</th>
<th>First step</th>
<th>Second step</th>
<th>Third step</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>t</td>
<td>P</td>
</tr>
<tr>
<td>Cognitive strategies</td>
<td>0.39</td>
<td>20.38</td>
<td>0.0001</td>
</tr>
<tr>
<td>Metacognitive strategies</td>
<td>0.21</td>
<td>11.70</td>
<td>0.0001</td>
</tr>
<tr>
<td>Motivational strategies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>0.39</td>
<td>0.67</td>
<td>0.68</td>
</tr>
<tr>
<td>R²</td>
<td>0.152</td>
<td>0.451</td>
<td>0.462</td>
</tr>
<tr>
<td>p</td>
<td>0.0001</td>
<td>0.0001</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Table 4 shows cognitive strategies can anticipate 15 percents of achievement variation ($R = 0.39, R^2 = 0.152, p < 0.0001$). Metacognitive strategies can anticipate 30 percents of achievement variation. This means that cognitive and metacognitive strategies altogether can anticipate 45 percents of achievement variation ($R = 0.67, R^2 = 0.451, p < 0.0001$). Motivational strategies also anticipate 1 percent of achievement variation. All of them (cognitive, metacognitive and motivational strategies) can anticipate 0.46 percents of achievement variation.

4. Discussion

The aim of this study was to explore relationships between learning strategies and achievement, and determine the power of anticipating cognitive, metacognitive, and motivational strategies for students' academic achievements. The gained results have generated the following findings: firstly, there is a positive, significant correlation between cognitive, metacognitive, and motivational strategies with achievement. A similar finding is provided by Eshel and Kohavi (2003). In their study, they acquired a significant positive correlation between self-regulated learning strategies (i.e., cognitive, metacognitive and motivational strategies) and academic achievement. This finding is
parallel with the study of Cleary and Zimmerman (2004). They who found that students who are self-regulators in learning, compared to those who are not self-regulators (or are dependent to teachers or parents) have higher achievements. Second, cognitive, metacognitive and motivational strategies are predictors for the student's academic achievement. The literature (e.g., Zimmerman, 1994; Schunk, 1995), supports the result that cognitive, metacognitive and motivational strategies are significant predictors of achievement. Third, the strongest predictor is metacognitive strategies. They increase motivational strategies and enable students to achieve more success and enable them to manage their learning. Literature supports the result that the strongest predictor in teaching/learning processes is metacognitive strategies (Thiede, Anderson, & Therriault, 2003). Based on the findings of the present study, it would seem appropriate that teachers' and students' awareness of the nature and dimensions of cognitive, metacognitive and motivational strategies be further enhanced. Teachers and students need to be provided with opportunities to explore and broaden their views about learning strategies, especially metacognitive strategies. Efforts can be devoted to help students develop an understanding of learning at a higher level of the hierarchy of conceptions of learning. This can be addressed either explicitly or implicitly in the curriculum activities and programs.

Reference