Structural Modeling for Influence of Mathematics Self-Concept, Motivation to Learn Mathematics and Self-Regulation Learning on Mathematics Academic Achievement

Hamideh Jafari Koshkouei¹, Ahmad Shahvarani¹, Mohammad Hassan Behzadi¹*
Mohsen Rostamy-Malkhalifeh¹

(1) Department of Mathematics, Science and Research Branch, Islamic Azad University, Tehran, Iran

Abstract
The present study was carried out to investigate the influence of mathematics self-concept (MSC), motivation to learn mathematics (SMOT) and self-regulation learning (SRL) on students’ mathematics academic achievement. This study is of a descriptive survey type. 300 female students at the first grade of high school (the second period) in City Qods, were selected by multiple step cluster sampling method and completed MSC, SMOT and SRL questionnaires. Mathematics academic achievement was measured by mathematics scores in the first semester of 1393-94 education year. Results obtained by data analysis indicated that the primary conceptual model of the research was an appropriate model and possesses good fitness. Therefore, influence of mathematics self-concept, motivation to learn mathematics and self-regulation learning on mathematics academic achievement was confirmed. On the other hand, it was revealed that mathematics self-concept had influence on motivation to learn mathematics, and motivation to learn mathematics had effect on self-regulation learning. Compared to motivation to learn mathematics and self-regulation learning, mathematics self-concept was a stronger predictor for mathematics academic achievement. Detailed analysis of variables’ direct effects showed that mathematics self-concept had considerable direct influence on motivation to learn mathematics.

Keywords: Mathematics self-concept (MSC), Motivation to learn mathematics (SMOT) and self-regulation learning (SRL), Mathematics academic achievement.

1 Introduction
Education of students in all periods is performed to change their behavior, visions and skills and finally is assessed as academic achievement. Studying factors affecting academic achievement is a complicated process because this concept has numerous dimensions affected by both environmental and inherent factors [3]. Regarding complexity of the current world and increasing growth of technology and astonishing revolutions in human life on one hand, and the role of mathematics in believing students’ creativity and
thinking power on the other hand, identification and analysis of the factors affecting mathematics academic achievement is a critical research issue in training and education system. Reviewing academic achievement in high schools show that mathematics academic achievement is not the output of a single factor; rather, it is determined by a large number of factors and variables. William James is considered as a pioneer theorist in the field of scientific psychology who proposed his first theory on the “self” concept. He divided the “self” in to two categories that is: self as the subject of an action; and self as the matter of knowledge or objective self [15]. Self as the subject is an aspect of “self” which constantly organizes and interprets the experience resulting from communication with people, things and events; whereas objective “self” is an aspect that includes abilities, physical properties (personality, roles, communication), mental properties (awareness, thoughts and cognitive mechanisms) and material properties which characterizes someone from the other ones [8]. According to Albert (1961), self-concept refers to individual’s perception about his personality; the author defines self-concept as: individuals’ perception about their traits and individuals’ attitude about their own personality [9]. Reyes (1984) maintained that mathematics self-concept of a person refers to his perception about his abilities to do well in the mathematics field via self-confidence in mathematics learning [29]. Gilles bunker (1992) believes that “self” is a part of knowledge constructed by people about their actions in the world and in answering to this question: “who am I?” [8]. Marsh (1996) defined mathematics self-concept as self-learner’s perception on individual perceived mathematics skills and abilities, mathematical reasoning ability, interest in mathematics and enjoying from mathematics [23]. Psychologists believe that a large part of individual properties and characteristics depends on the image one has formed about himself, that is his self-concept [10]. Regarding importance of self-concept, academic achievement and their relations, a large number of studies have been conducted; for example, Hatzigeorgiadis, Zourbanos, Pounpaki and Theodoriksy (2009) found out that by improvement of self-concept and self-confidence, cognitive anxiety is reduced among the students. Thus, they do better in their duties and acquire higher achievement. Academic achievement and self-concept are two processes that are highly interrelated and have high interaction [10]. Investigating academic and non-academic self-concepts and their predicting ability about female academic achievement, Karimzadeh and Mohseni (2005) found out that in mathematics-physics group, verbal and mathematics self-concepts can predict students’ achievement; while in human science group; it is only mathematics self-concept that can predict students’ academic achievement. The authors also reported that a more positive academic self-concept results in higher academic achievement and increased probability of their participation in mathematics-physics courses [13]. Pahleven Sadegh (2005) studied the theories in the field of self-concept and literature of mathematics achievement and investigated the relation between self-concept and individual and socioeconomic variables based on the data reported by Teams (2003). The author concluded that mathematics self-concept has direct effect on mathematics achievement in Persian students [2]. Hatami et al (2012) reported presence of a positive and significant relation between academic self-concept and academic achievement and the role of this factor in determining academic performance [3]. Dermitzaki et al (2009) indicated that self-concept is enhanced in students who have higher success and achievement in doing the assignment and solving the problems [22]. Motivation to learn mathematics is another variable that is highly correlated with mathematics self-concept and academic achievement. The rate of students’ motivation to learn various academic courses depends on their experience on encountering such courses. It is well documented that strong motivation leads to permanent learning and weak motivation results in low learning. Indeed, motivation is driving force for learning that can maximize students’ learning [6]. According to Seifert (1994), motivation is tendency to doing some work in a special mode; while motive is a certain demand or need which causes behavior. Thus, motivation can be regarded as a general factor in creation of behavior; while motive, more exactly than motivation, is special factor for creation of a behavior [5]. Many studies have reported the importance of motivation and its significant and positive correlation with academic achievement, and have shown that academic achievement is closely related to mental health. However, reduced motivation for education is a widespread problem across both
developed and developing countries; and this issue is clearly investigated in many researches [17]. Akabas and Kan (2006) maintained that emotional factors such as motivation and anxiety have enormous effects on academic achievement and are considered as important components in education and training processes [20]. Attempting to improve emotional and cognitive consequences of mathematics learners and learning in school, Tella et al (2007) found that among various personal and psychological factors regarded by experts of academic achievement, motivation has higher influence and this variable is effective even on other variables. The authors observed significant difference between students regarding their academic achievement based on their motivation. In the other words, their results indicated that students with higher motivation had better performance compared to their low-motivated counterparts. Following the results of Bank and Finlapson (2000), Tella remarked that: successful learners are clearly more motivated than unsuccessful ones [27]. Aida and Wan (2009) reported that motivation and self-efficiency is higher among the students who make vast attempt for learning mathematics and doing corresponding assignments [19]. As a social-cognitive theorist, Zimmerman (1986) defined self-regulation learning as a kind of learning in which, instead of relying on parents, teachers and other educational factors for acquiring knowledge and skill, students start and direct their own attempts. He defined self-regulation as the process for keeping thoughts, behaviors and excitements in active mode for achieving the goals; and also the rate of active participation of students in their learning processes via metacognitive, motivational and behavioral perspective [20]. Odonell et al (2007) cited that self-regulation is a cooperation process in which, both teacher and student design, monitor and evaluate the academic activity [25]. The basic framework of this hypothesis is based on the assumption that how students set themselves from cognitive, metacognitive, motivational and behavioral perspectives [31]. According to Heu (2000), self-regulation learners have five fundamental properties as follows: 1) they have knowledge; meaning that they are equipped with sufficient knowledge on themselves, environment, suitable learning strategies and assignment content; 2) they use knowledge; meaning that they use knowledge for problem solving and achievement; 3) they are self-motivated meaning that they have sufficient intrinsic motivation for making the activities; 4) they have critical thinking that is they constantly concentrate on their learning experience; 5) they have a feeling of responsibility meaning that they direct learning processes by themselves and consider themselves committed to this issue (74).

According to literature, self-regulation is an important factor for students’ academic achievement. Cleary and Zimmerman found out that among students with low level of self-regulation skills, some behaviors such as ignoring class topics, low-level study skills and denying participation in school are frequently observed. Moreover, achieving educational goals via devoting time to self-regulation skills education within lessons especially in the fields of mathematics and reading has been reported (86). Researches of mathematics education experts such as Schoenfeld (1985), Montague (1992) and Chi (1998) suggest that to achieve skills for mathematics problem solving, the students should be equipped by cognitive and metacognitive strategies that is self-regulation learning strategies in addition to learning mathematics principles [29]. Zimmerman and Ponz (1988), Chen (2002) and Lee (2008) reported that there is significant relation between academic achievement and application self-regulation learning strategies. Moreover, many authors including Zimmerman and Ponz (1988) showed that self-regulation learning education can enhance academic achievement and facilitate learning motivation (85). Sharp (2002) assessed motivation to learn among the subjects after performing self-regulation learning education and found out enhanced learning motivation in treatment group compared to control (78). Bembenutty (2008) reported that students that can regulate cognitive, motivational and behavioral aspects of their academic performance were successful learners (62). Rut Leshberger (2012) remarked the role of self-regulation in improvement of standard mathematics tests (37). Shalchi et al (2013) maintained that students who are strong in mathematics have higher self-regulation learning skills and make better use of self-regulation and motivational behaviors to circumvent over problems. In the other words, while weak students rarely use self-regulation learning strategies, the
characteristic of strong students is their cognitive and metacognitive skills in learning process. Moreover, education of self-regulation learning strategies plays important role on enhancement of weak students’ performance. This is in agreement with the results reported by Wall et al (2009), Su (2008), Kajbaf et al (2003), Hejazi et al (2007), Khademi et al (2006), Alborzi and Samani (2008) who emphasized on the role of self-regulation learning and its influence on academic achievement and richer learning (29). Hatami et al (2012) indicated that as an individual variable, self-regulation learning plays the most important role in prediction of academic achievement and this is well justified by theoretical principles of self-regulation learning [12]. The study conducted by Ashari et al (2009) revealed that education of self-regulation learning strategies is closely related to learning rate and positively and significantly enhances learning and students’ academic achievement [4]. The objective of the present study was to determine the relations between mathematics self-concept, motivation to learn mathematics and self-regulation learning with mathematics academic achievement and find answer to the following questions by means of structural relation modeling and theoretical model: Do mathematics self-concept, motivation to learn mathematics and self-regulation learning influence mathematics academic achievement among the students of the first grade (the second period) of high schools in City Qods? Is the theoretical model presented in Figure 1 able to reveal structural relation between mathematics self-concept, motivation to learn mathematics and self-regulation learning on mathematics academic achievement of female students of the first grade of high schools in City Qods?

Figure 1: Primary conceptual model

2 Methodology

Statistical population includes all female students at the first grade of high school in City Qods, during 2014-2015 education year including 1343 students out of which, 300 persons were selected randomly. This is a descriptive survey. Using structural equation model (SEM), we tried to propose a model to describe relation pattern among the research variable. This method was used to evaluate direct and indirect effects of all the studied variables on each other and also on mathematics academic achievement. Hypotheses were tested by LISREL 8.8 and SPSS 18 software. At first, data normality was tested. Then confirmatory factor analysis was conducted and finally, the model of research hypotheses was run. SEM starts with defining a model that should be estimated. This model is a special causal structure among a set of latent constructs. A SEM is composed of two components: a structural model that reveals causal structure among the latent variables and a measurement model that defines the relation between latent and observable variables [4].
This models deals with the relations among the variables. We draw measurement model (Figure 1) and show the latent and observable variables and test variables’ relations using structural equation model.

3 Data Collection Instrumentations

1. Mathematics self-concept questionnaire: “self” description questionnaire was first prepared by Herbert W Marsh in 1983 based on Marsh and Shavelson hierarchical multiple model of “self”. The questionnaire was revised by Marsh in 1990. The mathematics self-concept scale entitled MSC that is used in the present study was extracted by Githua and Mangi from Marsh’s “self” questionnaire using mathematics-related factors analysis. This questionnaire is composed of 12 items in Likert scale and 5 choices ranging from completely disagree (1) to completely agree (5). There is inverse score for some questions. This questionnaire has two sub-scales as interest in mathematics and perception of ability. Validity and internal homogeneity of this questionnaire in the study conducted by Githua and Mangi was 0.88 (8). Cronbach’s alpha was used to calculate reliability which was estimated as 0.969. To confirm obtained causal structure and to test power and significance of contribution of each factor in measuring mathematics self-concept, confirmatory factor analysis was carried out (all factors were higher than 0.50). Indices of goodness of fit such as RMSEA (root mean square Error of approximation) 0.039, GFI (goodness of fitness index) 0.97 and adjusted AGFI 0.94, showed that the model is well fitted.

2. Motivation to learn mathematics questionnaire: motivation to learn mathematics questionnaire denoted by SMOT was extracted from PhD dissertation of Bernard Naynji Githua entitled as factors related to motivation to learn mathematics in high school students of Kenya in 2001. This questionnaire includes 28 items and four sub-scales relating to interest in mathematics, mathematics learning relevance, probability of success in mathematics, and satisfaction with mathematics. The items were set based on Likert scale and five choices ranging from completely disagree (1) to completely agree (5). There is inverse score for some questions. Internal homogeneity of this scale was reported as 0.89 by Githua and Mangi. Reliability of this questionnaire was investigated by Kiyamanesh (2003) and corresponding Cronbach’s alpha was reported by the author as 0.923. In this study, reliability coefficient as determined by Cronbach’s alpha was 0.983. Confirmatory factor analysis was conducted to evaluate questionnaire validity. Fitness indices such as RMSEA0.037, GFI 0.96 and adjusted AGFI 0.93 were calculated and showed that the model is well fitted.

3. Self-regulation learning questionnaire: self-regulation learning questionnaire (SRL) has been prepared by Pintrich and Degroot (1990). This questionnaire includes two scales of motivational beliefs and self-regulation learning strategies. We used self-regulation learning strategies scale which is composed of two sub-scales as cognitive strategies (training, description, and organization) and metacognitive strategies (metacognitive strategies and management of individual attempts). The items were set based on Likert scale and five choices ranging from completely disagree (1) to completely agree (5). Inverse scores were used in some questions. The scale is composed of 22 items whose reliability for cognitive and metacognitive sub-scales were determined by Pintrich and Degroot as 0.83 and 0.74; respectively. Hatami (2012) reported Cronbach’s alpha for cognitive and metacognitive sub-scales as 0.82 and 0.80; respectively (12).

Reliability was calculated as 0.975 in the present study using Cronbach’s alpha. Confirmatory factor analysis was applied to validate the questionnaire. Indices of goodness of fit such as RMSEA (root mean square Error of approximation)0.036, GFI (goodness of fitness index) 0.9 and adjusted AGFI 0.89 showed that the model is well fitted.

4. Mathematics academic achievement: mathematics scores in Day month of 2014-2015 were used as the index of mathematics academic achievement.
4 Results

Data normality should be tested before data analysis and statistical tests. In data normality test, null hypothesis claiming that data distribution is normal is tested \((p<0.05)\). If significance value is equal to or higher than 0.05, null hypothesis is accepted, meaning that data distribution is normal. Data normality test was performed by Kolmogorov-Smirnov technique. This was done because researches conducted by structural model are based on data normality assumption. In confirmatory factor analysis and structural equation model, it is not required for all data to be normal; rather, the factors (constructs) should be normal (69). Based on the results, significance level in all cases was higher than 0.05, thus null hypothesis is confirmed and data distribution is normal. Therefore, parametric tests and confirmatory factor analysis can be used. By reading raw data in LISREL software and to test structural relations pattern among the variables, the correlation matrix among the observable variables is used as input in the program for analysis. Causal model was analyzed by LISREL and the results for confirming final model of the research is presented in Figure 2.

5 Goodness of fitness

The above structural model has been saturated in two steps. Fitness indices showed favorable values. Normal Chi square was estimated as 1.712 which lies in the 1-5 acceptable range. Thus, the structural model has good fitness.

\[
\frac{\chi^2}{df} = \frac{35.97}{21} = 1.712.
\]

Since fitness index of RMSEA was 0.021 which is lower than 0.05, the model is well fitted. Other indices of goodness of fitness are in the acceptable range.

<table>
<thead>
<tr>
<th>Fitness index</th>
<th>IFI</th>
<th>NNFI</th>
<th>NFI</th>
<th>AGFI</th>
<th>GFI</th>
<th>RMSEA</th>
<th>SRMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptable</td>
<td>0</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>&lt;0.1</td>
<td>&lt;0.05</td>
<td></td>
</tr>
<tr>
<td>Calculated</td>
<td>0.97</td>
<td>0.96</td>
<td>0.96</td>
<td>0.94</td>
<td>0.021</td>
<td>0.039</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Indices of goodness of fitness for structural model of the main hypothesis
Figure 2: Results of confirmation of final model

Table 2 shows standard factor loadings of dependent and independent components and t-value of each component for latent variable. Path coefficients are significant (p<0.05). Factor loadings of dependent and independent factors are higher than 0.2 which are acceptable values, suggesting that components are indices for latent variables. This value shows that the relation between latent variables (dimensions of each main construct) and observable variables is acceptable. To test significance of the relation between variables, t-value was used. Since significance level is investigated at 0.05, if t-value is higher than 1.96, then the relation
is significant. Measurement indices in all the cases were higher than 1.96, suggesting significance of the observed correlations.

Table 2: Loading factors of latent variable indices and t-values

<table>
<thead>
<tr>
<th>t-values</th>
<th>(standard) loading factor</th>
<th>Index</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>24.72</td>
<td>0.93</td>
<td>Interest in mathematics</td>
<td>Mathematics self-concept</td>
</tr>
<tr>
<td>24.29</td>
<td>0.97</td>
<td>Perception of ability</td>
<td>motivation to learn mathematics</td>
</tr>
<tr>
<td>12.26</td>
<td>0.94</td>
<td>Interest in learning mathematics</td>
<td></td>
</tr>
<tr>
<td>12.02</td>
<td>0.57</td>
<td>Perceived probability of Success in mathematics</td>
<td></td>
</tr>
<tr>
<td>27.42</td>
<td>0.89</td>
<td>Satisfaction in learning mathematics</td>
<td></td>
</tr>
<tr>
<td>18.16</td>
<td>0.74</td>
<td>Relevance in learning mathematics</td>
<td>self-regulation learning</td>
</tr>
<tr>
<td>11.83</td>
<td>0.35</td>
<td>Cognitive</td>
<td></td>
</tr>
<tr>
<td>5.95</td>
<td>0.92</td>
<td>Metacognitive</td>
<td></td>
</tr>
<tr>
<td>11.83</td>
<td>0.97</td>
<td>Mathematics scores</td>
<td>Mathematics academic achievement</td>
</tr>
</tbody>
</table>

Table 2 shows standard factor loadings of latent variables and t-value of each variable. Path coefficients are significant (p<0.05).

Table 3: Summary of the results of the relations among latent variables

<table>
<thead>
<tr>
<th>t-values</th>
<th>Standard loading factor</th>
<th>Relation</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.24</td>
<td>0.66</td>
<td>Mathematics self-concept→ motivation to learn mathematics</td>
</tr>
<tr>
<td>12.85</td>
<td>0.46</td>
<td>Mathematics self-concept→ self-regulation learning</td>
</tr>
<tr>
<td>10.80</td>
<td>0.57</td>
<td>Mathematics self-concept→ mathematics achievement</td>
</tr>
<tr>
<td>3.75</td>
<td>0.67</td>
<td>motivation to learn mathematics → self-regulation learning</td>
</tr>
<tr>
<td>7.11</td>
<td>0.37</td>
<td>motivation to learn mathematics → mathematics achievement</td>
</tr>
<tr>
<td>12.37</td>
<td>0.54</td>
<td>self-regulation learning → mathematics achievement</td>
</tr>
</tbody>
</table>

As can be seen in Figure 2, motivation to learn mathematics with standard path coefficient of 0.67 has higher effect on self-regulation learning. Mathematics self-concept with standard path coefficient of 0.66 has influence on motivation to learn mathematics. In hypothesis test, results of structural model regarding hypothesis claiming that “mathematics self-concept affects motivation to learn mathematics” indicate that mathematics self-concept has effect as 0.66 on motivation to learn mathematics. This effect is direct at significance level of 21.24 (p<0.05), suggesting that students with high mathematics self-concept have higher motivation to learn mathematics. Results of structural model for the relation between mathematics self-concept and self-regulation learning show that mathematics self-concept has effect of 0.46 on self-regulation learning and significance value of 12.85 shows that the correlation is significant. Thus it can be concluded that mathematics self-concept has direct effect on self-regulation learning (p<0.05). Therefore, the hypothesis claiming that "mathematics self-concept affects self-regulation learning" is approved. Furthermore, mathematics self-concept has indirect influence on self-regulation learning which is mediated by motivation to learn mathematics. This shows that by increase in students’ mathematics self-concept, their self-regulation learning is enhanced and thus, the students become more self-regulated. Regarding the hypothesis claiming that "mathematics self-concept has influence on mathematics academic achievement", results of structural model shows standard factor loading as 0.57 between the two variables, and significance value of 10.80 indicates significance of this correlation. Thus it can be concluded that mathematics self-concept has direct effect on mathematics academic achievement (p<0.05). Moreover, our results showed that mathematics self-concept has both direct and indirect effect on mathematics academic achievement, with
the latter is mediated by motivation to learn mathematics and self-regulation learning. Concerning the hypothesis claiming that "motivation to learn mathematics influences self-regulation learning", results of structural model showing standard factor loading as 0.67 and significance value as 3.75 confirm significance of this correlation. Thus it can be concluded that motivation to learn mathematics has direct effect on self-regulation learning \( (p<0.05) \). Evaluation of the hypothesis claiming that “motivation to learn mathematics affects mathematics academic achievement” revealed that motivation to learn mathematics has 37% influence on mathematics academic achievement \( (p<0.05) \). on the other hand, significance value was estimated as 7.11 suggesting significance of the observed correlation. Motivation to learn mathematics both directly and indirectly (mediated by self-regulation learning) affects mathematics academic achievement. Regarding the hypothesis claiming that self-regulation learning affects mathematics academic achievement, standard factor loading and significance values were estimated as 0.54 and 12.37; respectively, which confirms this hypothesis \( (p<0.05) \).

6 Discussion and Conclusion

Results obtained from structural model in the present study indicated that compared to motivation to learn mathematics and self-regulation learning, mathematics self-concept is a strong predictor for mathematics academic achievement. This is in agreement with the results obtained by Dermitzaki et al (2009), Githua and Mangi (2003), Talebzadeh et al (2011), Kiyamanesh and pourasghar (2006), Pahlevan Sadegh (2005), Karimzadeh and Mohsene (2005) who reported that mathematics self-concept has direct effect on Persian students’ mathematics achievement and is a powerful predictor for mathematics academic achievement. Indeed, mathematics academic achievement is enhanced when mathematics self-concept is improved among the students [22-23, 2, 14, 9-13]. Githua and Mangi (2003) maintained that mathematics self-concept is altered by means of intervening programs of educational material, learning-related activities, learning experience, education methods and suitable evaluation methods [23]. Moreover, it was revealed in the present study that mathematics self-concept has direct effect on motivation to learn mathematics and self-regulation learning. This is in accordance with the results reported by Dermitzaki and Efkleeds (2007) and Ashurzadeh (2008) who indicated that there is a positive and significant relation between mathematics self-concept and self-regulation learning [22]. We showed that mathematics self-concept affects mathematics academic achievement via influencing self-regulation leaning; this finding is in agreement with the results found out by Talebzadeh et al (2011). The authors reported that the relation between self-concept and academic achievement is mediated by self-regulation learning [9]. In addition to direct effect on mathematics academic achievement, motivation to learn mathematics has an indirect effect on mathematics academic achievement which is mediated by self-regulation learning. This variable has lower ability to predict mathematics academic achievement. On the other hand, direct influence of self-regulation learning on mathematics academic achievement. This variable acts as a mediator between mathematics self-concept and mathematics academic achievement. Bembenutty (2008) reported that many students, who can regulate cognitive, motivational and behavioral aspects of their academic performance, were successful learners. These findings revealed that self-regulation learning is a predictor of academic achievement and the learners should learn how to regulate their own performance and retain their goals despite difficulty of assignments [21]. The results of the present study indicate that it is possible to predict mathematics academic achievement by self-regulation learning. Effectiveness of application of self-regulation strategies to enhance academic achievement has been reported by Rut leshberger (2012), Asgari et al (2011), Talebzadeh et al (2011), Mohammad amini (2008), Mardali and Kushki (2008), as well as others [9-11, 16, 18]. Another finding of the present study was direct and strong effect of mathematics self-concept on motivation to learn mathematics, suggesting that if students’ mathematics self-concept is high, then their motivation to learn mathematics will be improved. This condition results in higher academic achievement directly and also
enhances students’ self-regulation learning and finally promotes their mathematics academic achievement. This is in accordance with the results found by Kiyamanesh and Pourasghar (2006) who showed that mathematics self-concept is a major determinant of motivation to learn mathematics and mathematics academic achievement [14]. In their investigation in high school, Timothy and Chen (2009) indicated that students’ primary motivation predicts students’ application of self-regulation strategies throughout the learning. This study highlights the importance of identification of students’ motivation and self-regulation changes during early years in high school and the prominent role of such a condition [28]. Based on the results obtained in the present study, it can be concluded that according to educational conditions, mathematics teachers can exploit suitable strategies for reconstruction of mathematics self-concept and fortification of students’ positive beliefs that may results in enhanced mathematics self-concept and elevated motivation to learn mathematics which ultimately leads to enhancement of mathematics academic achievement. Moreover, education of self-regulation strategies can be transmitted and educated to the students. More concentration of teachers on self-regulation and proposing lessons effectively emphasizing fortification of students’ self-regulation skills and the consequent mathematics academic achievement can be a helpful practice. Moreover, workshops can be held for mathematics teachers to enhance their knowledge and for students to enhance their mathematics self-concept, motivation to learn mathematics, self-regulation learning and to assist them in mathematics academic achievement and also to educate them about application of such strategies.

References


[22] Irini Dermitzaki, Angeliki Leondari, Marios Goudas, Relations Between Young Students’ Strategic Behaviours, Domain-Specific Self-Concept, and Performance in a Problem-Solving Situation, Learning and Instruction, 19 (2) (2009) 144-157.
http://dx.doi.org/10.1016/j.learninstruc.2008.03.002

http://dx.doi.org/10.1016/S0738-0593(03)00025-7


http://dx.doi.org/10.1080/00131880110107333


http://dx.doi.org/10.1016/j.jsp.2009.04.002

http://dx.doi.org/10.3200/JEXE.72.4.331-346


http://dx.doi.org/10.1037/0022-0663.82.1.51