The role of self-efficacy, task value, and achievement goals in predicting learning approaches and mathematics achievement

Hemin Khezri azar, Masoud G. Lavanasi, Ehsan Malahmadi, Javad Amani

Department of Educational Psychology and Counseling, University of Tehran, Tehran, Iran

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Abstract

Relations among self-efficacy, task value, achievement goals, learning approaches, and mathematics achievement were examined in a path analysis model. Results revealed self-efficacy exerted a direct, positive influence on task value, mastery goals, performance-approach goals, deep approach, and mathematics achievement; self-efficacy influenced performance-avoidance goals negatively; task value had a direct effect on mastery goals and deep approach. While mastery goals affected deep approach in a positive way, performance-avoidance and performance-approach goals had positive effects on surface approach. Deep approach had a direct positive effect on mathematics achievement while surface approach exerted a direct negative effect on it.

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1. Introduction

Mathematics and factors influencing students' achievement or failure in it have always been a basic issue in education; however, despite the extensive line of research conducted and heavy budgets spent, there are still huge numbers of students who experience failure in mathematics each year (Malekzade, 2005). Therefore, identifying factors affecting students' performance in this course and determining the size of these effects can be critically important in helping students improve their achievement in mathematics. Cognitive and motivational variables are among those factors influencing achievement; to determine the relationships of cognitive and motivational factors with achievement, social-cognitive approaches, which adopt a cognitive and motivational perspective towards identifying the determinants of behaviour, have been particularly attended by researchers (Dupeyrat & Marine, 2005). Bandura's social-cognitive theory, achievement goals theory and expectancy-value model lie within the framework of these approaches.

1.1. Self-efficacy

Self-efficacy is the main construct in Bandura's social-cognitive theory which refers to one's beliefs and judgments regarding their ability to accomplish specific tasks such as mathematics (Bandura, 1993). Researchers
have shown students' beliefs in their self-efficacy predict their performance in mathematics (Ayotola, & Adedeji, 2009; Levpuscek & Zupancic, 2009).

1.2. Task value and self-efficacy

According to Expectancy-value model, students' motivation to learn is dependent upon two components: expectations for achievement and value attributed to the task. In this study the emphasis was on the task value component. Task value is defined as the incentive for engagement in academic activities and consists of four components, namely attainment value; intrinsic value; utility value and cost (Wigfield & Eccles, 1992). Seo and Taherbhai (2009) state students' who believed they can perform a certain task were more likely to find their class interesting, important and useful. Moreover; research studies report a positive relationship between self-efficacy and task value (Bong, 2001; Seo & Taherbhai, 2009). Based on these findings we hypothesized self-efficacy would have a direct positive influence on task value.

1.3. Achievement goals, self-efficacy and task value

Achievement goals are situationally specific orientations which reflect the desire to acquire, develop and show off competence in a particular context (Harackiewicz et al. 1997). Elliot and Harackiewicz (1996) suggested a framework consisting of three components: mastery goals which focus on developing one's competence through gaining mastery over the task; Performance-approach goals which reflect one's tendency towards engaging in tasks for the sake of outperforming others and performance-avoidance goals which convey avoiding tasks lest one should look incompetent to others. Studies have indicated students' self-efficacy creates change in their achievement goals: students with high self-efficacy adopt mastery and performance-approach goals while those low in self-efficacy tend to prefer performance-avoidance goals (Elliot & Church, 1997; Liem, Lau & Nie, 2008; Seo & Taherbhai, 2009). Moreover, research on expectancy-value theory has shown task value, as perceived by students is related to their achievement goals (Wigfield, Anderman and Eccles, 2000; Liem, Lau & Nie, 2008). Therefore; we hypothesized self-efficacy and task value would be positive predictors of mastery and performance-approach goals; meanwhile, we hypothesized self-efficacy would exert a negative influence upon performance-avoidance goals.

1.4. Learning approaches, self-efficacy, task value and achievement goals

Because learning approaches are determinant factors in academic performance as well as in knowledge acquisition (Chamorro-Premuzic, Furnham, & Lewis, 2007), and in quality and quantity of learning in students (Abraham et al, 2008) they have been emphasized. Kember, Biggs & Leung (2004) have proposed two distinguished learning approaches: deep and surface approach; deep learning approach is conceptualized as having an internal motivation, being engaged in the task and a craving for knowing anything about a particular topic, while in surface learning approach one is not interested in the task itself (Chamorro-Premuzic, Furnham, & Lewis, 2007). Research suggests deep approach is positively related to academic achievement while surface approach is negatively related to it (Chamorro-Premuzic & Furnham, 2008; Kizilgunes, Tekkaya & Sungur, 2009).

Researchers have shown self-efficacy is positively related to deep approach to learning, effort and persistence (Bandura,1996; Hoy, 2004; cited in Kizilgunes, Tekkaya & Sungur, 2009), and students with higher self-efficacy use deeper strategies for learning. Similarly, Wigfield, Tonks and Eccles (2004) state, students usually get more deeply engaged in an activity and persist on it for a fairly longer period of time when they find it of internal value to themselves. Studies also suggest task value can exert an indirect influence on student's achievement through the utilization of learning strategies (Pintrich & Schrauben, 1992). Therefore, we hypothesized self-efficacy and task value would be positive predictors of deep learning approach.

Few researches have concentrated on the relationship between achievement goals and learning approaches. Cano (2009) states both achievement goals and learning approaches include some forms of motivation: while learning approaches reflect internal motivation (deep approach) versus fear of failure and external motivation (surface approach), achievement goals emphasize enhancing competencies (mastery goals) as opposed to showing off competencies (performance goals). That is to say, learning approaches and achievement goals are interrelated; mastery goals are related to deep processing and internal motivation, and performance goals are related to surface
processing and external motivation. We therefore hypothesized mastery goals would positively relate to deep learning approach, while performance-approach and performance-avoidance goals would positively relate to surface learning approach.

1.5. The current study

The purpose of the present study was to test a conceptual model of the relations among self-efficacy, task value, achievement goals, learning approaches and mathematics achievement. The present study will increase our understanding of adolescents’ motivation in mathematics at high school. It will also test the causal links between self-efficacy, task value and achievement goals and will seek to improve our knowledge of the association of these motivational variables to learning approaches and mathematics achievement.

2. Method

2.1. Participants

Participants were 280 third grade high-school students, studying mathematics at a high school in Mahabad city in Iran. The sample comprised of 167 (%59.6) males and 113 (%40.4) females.

2.2. Instruments

The subscales of Middleton and Midgley Self-efficacy in Mathematics (1997), Midgley et al Achievement Goals (2000), Pintrich, et al. Task value (1991), and Learning Approaches Questionnaire (Kember, Biggs & Lung, 2004) were used in this study; Total number of the items was 46. All the items of the Questionnaire were changed to fit the mathematics class. The structure of the instruments was examined using confirmatory factor analysis and reliabilities of the resulting scales were assessed with Cronach’s alpha.

Self-efficacy: This scale included 4 items which assessed students’ beliefs about their abilities in mathematics ($\alpha = 0.83$). Results of confirmatory factor analysis (GFI= 0.99, AGFI= 0.97; RMSEA= 0.03) indicated the considerable and significant contribution of each of the items in measuring self-efficacy.

Task value: This scale included 6 items which asked students to state how much they found learning mathematics useful, important and appealing ($\alpha = 0.88$). Indices of confirmatory factor analysis (GFI=.99, AGFI=.97, RMSEA=.03) indicated that the model fitted with the sample data.

Achievement goals: This scale included 14 items which measured three types of achievement goals: mastery goals ($\alpha = 0.88, 5$ items); performance-approach goals ($\alpha = 0.88, 5$ items); performance-avoidance goals ($\alpha = 0.79, 4$ items). Indices obtained from confirmatory factor analysis (GFI= 0.92, AGFI= 0.88; RMSEA=0.07) Suggested the appropriate fit of the model with the data.

Learning approaches: This Questionnaire included 22 items which measured deep and surface approaches (11 items for deep and 11 items for surface approaches). Cronach's alpha coefficients for deep and surface learning approaches were obtained 0.81 and 0.68, respectively. In addition, indices obtained from confirmatory factor analysis (GFI=.88, AGFI=.85, RMSEA=.06) indicated the appropriate fit of the model with the data.

Academic achievement: Final examinations are of great importance to students, and regarding the fact that these examinations are held on a nation-wide basis for all grade three students across the country, students’ score in mathematics exam were used as indices of their mathematics achievement.

3. Results

Table 1 shows mean scores, standard deviations and correlation coefficients among the variables. As shown in table 1, self-efficacy and task value correlated positively with each other. In addition, both self-efficacy and task value correlated positively with mastery and performance-approach goals. Self-efficacy was negatively related to performance-avoidance goals. Both self-efficacy and task value had positive correlations with deep approach and math achievement. Mastery goals were related positively to deep approach while negatively to surface approach. Performance-approach goals had a positive relationship with both deep and surface approaches. On the other hand, performance-avoidance goals were related positively to surface approach and negatively to deep ones. Mastery
goals and math achievement were positively correlated. Finally, deep and surface approaches had positive and negative correlations, respectively, to math achievement.

Table 1 Means, standard deviations, and correlations among variables involved in the model

|   | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | SD | M |
|---|---|---|---|---|---|---|---|---|----|---|
| 1 |   |   |   |   |   |   |   |   | 2.24 | 14.00 |
| 1 | 0.57** |   |   |   |   |   |   |   | 4.31 | 25.88 |
| 1 | 0.74** | 0.56** |   |   |   |   |   |   | 4.13 | 21.27 |
| 1 | 0.20** | 0.22** | 0.31** |   |   |   |   |   | 5.29 | 16.70 |
| 1 |   | 0.03 | -0.09 | -0.09 | -0.14* |   |   |   | 3.67 | 15.37 |
| 1 | -0.17** | 0.17** | 0.51** | 0.56** | 0.46** |   |   |   | 7.90 | 28.30 |
| 1 | -0.28** | 0.29** | -0.02 | -0.07 | 0.21** | 0.31** | 0.31** |   | 5.16 | 11.07 |

* p < 0.05 and ** p < 0.01

To test the suggested model, path analysis was conducted using LISREL 8/53. Figure 1 shows the obtained coefficient for the suggested relationships among the variables of the model. GFI, AGFI, CFI and RMSEA were the fit indices used to evaluate the model. In general, the recommended level of acceptable fit for GFI, AGFI and CFI, is .90 or above .90. As for, RMSEA, the recommended value should be less than .08 (Kline, 2005). With reference to fit indices the model had a good fit with the sample data (GFI= 0.97, AGFI= 0.93, CFI= 0.97, RMSEA= 0.06).

Table 2 Standardized direct and indirect effects of the path model

|   | R² | Total effect | indirect effect | direct effect | Path |
|---|---|-------------|----------------|-------------|------|
|.32 | .57** | - | .57** | To task value from Self-efficacy |
|.58 | .56** | .35** | .21** | To mastery goals from Self-efficacy |
|.62** | - | .62** | task value |
|.10 | .32** | - | .32** | To performance-approach from Self-efficacy |
|.02 | -.14* | - | -.14* | To performance-avoidance from Self-efficacy |
|.36 | .47** | .29** | .18** | To deep approach from Self-efficacy |
|.44** | -.10* | .35** | task value |
|.16* | - | .16* | mastery goals |
|.07 | -.07 | - | - | To surface approach from Self-efficacy |
|.14* | -.14** | - | - | Task value |
|.12 | -.23** | - | -.23** | mastery goals |
|.27** | - | .27** | performance-approach |
|.14* | - | .14* | performance-avoidance |
|.16 | .29** | .09** | .20** | To math achievement from Self-efficacy |
|.10** | -.10** | - | - | task value |
|.08** | -.08** | - | - | mastery goals |
|.06** | -.06** | - | - | performance-approach |
|.03* | -.03* | - | - | performance-avoidance |
|.16** | - | .16** | deep approach |
|.22** | - | -.22** | surface approach |

* p < 0.05 and ** p < 0.01

Table 2 shows the direct, indirect and total effects of the path model as well as the significance level for the relationships between predictive and dependent variables. It was found the direct effect of self-efficacy on task value, mastery goals, and performance-approach goals, deep approach and mathematics achievement was positive.
and significant. On the other hand, self-efficacy had a negative influence on performance-avoidance goals. Task value was found to have a significant positive influence on deep approach, only. Mastery goals had a positive influence on deep approach and a negative one on surface approach. Both performance-approach and performance-avoidance goals had positive effects on surface approach. In line with the hypotheses, it was found deep approach had a direct, positive and significant effect on mathematics achievement, while surface approach influenced mathematics achievement in a direct, negative and significant way.

![Figure 1](image-url)

**Figure 1.** A path model of self-efficacy, task value, achievement goals, learning approaches, and math achievement. (* p < 0.05 and ** p < 0.01).

### 4. Discussion

Results from path analysis showed self-efficacy related directly to task value. This finding is consistent with Seo and Taherbhai (2009) viewpoint indicating students high in self-efficacy would find mathematics classes more useful, important and valuable. Once students see a task of more use and value, their motivation is enhanced and consequently, they choose a deeper approach to learning which in turn improves their learning and academic achievement. Therefore, it is important to make an attempt to strengthen students self-efficacy beliefs and hence their perceptions of task value.

Results also indicated self-efficacy exerted a positive direct influence on mastery goals and a negative direct one on performance-avoidance goals; this finding is in line with Elliot's (1999) viewpoint in which he holds students who perceive themselves as highly competent are orientated towards achievement and positive outcomes and mostly choose mastery and performance-approach goals, while those who perceive themselves as less competent are orientated towards failure and performance-avoidance goals. It seems students high in self-efficacy center on enhancing their competencies and learning tasks and like to demonstrate their competencies to others.

Another finding of the study, which is consistent with results from previous researches (Ayotola, & Adedeji, 2009) was the direct as well as the indirect influences of self-efficacy on mathematic achievement. This finding emphasized the important of students' self-efficacy to their learning and success and showed students high in self-efficacy would adopt deeper learning approaches and consequently attain better achievement outcomes in comparison to their low-efficacy counterparts.

One other result from path analysis was the direct influence of task value on mastery goals and deep learning approach. It indicated students with high perceptions of task value in mathematics tended to choose mastery goals, and in the meantime, had a deeper learning approach, the result being more academic achievement among these students. This is a finding congruent with results from Liem, Lau and Nie (2008). The direct impact of task value on the choice of mastery goals reveals mathematics task value stimulates students to enhance their competencies in the course. Miller and Brickman (2004) believe one factor predicting the choice of achievement goals among students is their valuation of long-term goals. Once a particular subject is recognized as useful for future goals, it is going to be perceived more important regarding the fact that it is given a value as a means to attaining goals.

The study results also indicated mastery goals influenced mathematics achievement indirectly through the mediation of learning approaches. Mastery goals' influence was positive on deep approach and negative on surface approach. Dweck and Leggett (1988) believe mastery goals exert an indirect influence on academic achievement through the mediation of deep cognitive engagement and effort expenditure. Research also has indicated performance-approach and performance-avoidance goals are negatively, indirectly and significantly related to mathematics achievement through surface learning. In general, support previous findings which indicate mastery goals are related to adaptive beliefs and motivational behaviors while performance-approach and performance-avoidance goals are associated maladaptive ones. Based on findings obtained in this study it can be suggested that
classroom structures be designed by teachers in ways that they emphasize on the development and improvement of academic tasks and gaining mastery over them rather than on the competition among students and fear of seeming incompetent to others. Similarly, parents ought to avoid comparing their children with each other and instead help them strengthen their capabilities and competencies.

One other finding was that deep learning approach was positively related to mathematics achievement, while surface learning was negatively related to mathematics achievement. The obtained results corroborate previous findings, indicating students with deep approach are possessed of better academic outcomes as compared to those with surface approach (Chamorro-Premuzic & Furnham, 2008). Seemingly, higher academic achievement among the latter group is attributable to their more internal interest in learning and understanding academic materials.

Cano (2005) states, to enhance students’ learning we should bear in mind learning approaches are not the only characteristics living within students and are influenced by the whole teaching-learning system, being related to three of its components: goals, teaching and assessment. To improve learning it is not just sufficient to tell students what to believe in or which approach to choose for learning; rather, all the above-mentioned components should be made use of together to succeed in the improvement of academic performance. The study was conducted among students of mathematics, at grade three of high school and within a particular cultural context which entails observing the necessary caution while generalizing its findings to students of other branches, grades and cultures.

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