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The role of motivation and cognitive engagement in science achievement

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ABSTRACT: The purpose of this study was to investigate the contribution of the motivational beliefs (self-efficacy and task-value) and cognitive engagement to seventh grade students' science achievement. For the specified purpose, cross-sectional correlational research design was used. The data were gathered from the seventh grade students of public middle schools by means of three data collection instruments namely, Background Characteristics Survey (BCS), Motivation and Cognitive Engagement Scale (MCES) and Science Achievement Test for 7th Grade (SAT). The MCES is a self-report instrument including the selected items from the Science Learning Inventory (SLI- Part A) and from Turkish Version of Motivated Strategies for Learning Questionnaire (MSLQ) in order to measure students' motivational beliefs (self-efficacy and task-value) and the level of their cognitive engagement. A total of 861 seventh grade students (398 girls and 456 boys) participated in the study. Multiple Linear Regression Analysis was used to analyze the data. Results revealed that motivational beliefs (i.e. self-efficacy and task value) positively and significantly contributed to the prediction of students' science achievement and the self-efficacy appeared as the best predictor of the science achievement. Cognitive engagement failed to significantly predict students' science achievement. Finally, bivariate relations among independent variables (self-efficacy, task-value and cognitive engagement) were examined through simple correlation analyses. The result indicated positive and significant correlations among self-efficacy, task-value and cognitive engagement variables.

KEY WORDS: expectancy-value theory, self-efficacy, task-value, science achievement

INTRODUCTION

Over about half century, expectancy- value theory has been among the theories which gained general acceptance to explain students' achievement related outcomes (Wigfield, 1994). The theory basically

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claims that individuals' expectations for success and subjective task values are the main mediators for their subsequent behaviors such as performance, persistence, and task choice (Atkinson, 1957; Eccles, Adler, Futterman, Goff, & Kaczala, 1983; Eccles & Wigfield, 2002; Trautwein, Marsh, Nagengast, Oliver Lüdtke, Nagy & Jonkmann, 2012; Wigfield, 1994; Wigfield & Eccles, 1992). Accordingly, the theory grounded on these two basic constructs expectancy for success, which refers to individuals' beliefs about the extent to which they can exhibit successful performance on certain tasks in a short-term or long- term future, and subjective task-value, refers the beliefs about the extent to which individuals perceive a task as important, useful and enjoyable (Eccles & Wingfield, 2002). Although Bandura (1997) asserted that expectation for success construct in expectancy-value theory refers only outcome expectations and is not related with personal or efficacy expectations (self-efficacy), expectancy value theorists claimed that expectation for success construct measures individuals' own expectations and is more related to personal or efficacy expectations rather than outcome expectations. Actually, according to expectancy value theorists, expectancy for success is more analogous to Bandura's self-efficacy construct and is measured in similar ways (Eccles & Wigfield, 2002). In line with this idea, expectation for success construct in expectancy value theory was assessed in terms of self-efficacy construct in the present study. Bandura (1997) defined self-efficacy as individuals' confidence in their competence to organize and execute a given course of action to solve a problem or achieve a task. Accordingly, goal setting, activity choice, willingness to expend effort and persistence on a task originates from the individuals' self-efficacy. Indeed, a study conducted by Hoy (2004) revealed that students with high self-efficacy level had tendency to expend more effort, show more persistency when they faced with difficulties and problems and utilized various learning strategies to achieve the given tasks. In addition, the meta-analyses conducted by Multon, Brown, and Lent (1991) showed a positive relationship between self-efficacy and academic performance measured in terms of performance on the standardized tests, classroom-related tests and basic skill tasks. More specifically, results indicated that students' self-efficacy beliefs explain 14% of variance in their academic performance. Parallel to this finding, a great deal of studies showed that students' self-efficacy is significantly and positively associated with science achievement (Britner, 2008; Caprara, Fida,Vecchione, Del Bove, Vecchio, Barbaranelli, & Bandura, 2008; Chen & Pajares, 2010; Hidi, Ainley, Berndorff, & DelFavero, 2006; House, 2008; Lavonen & Laaksonen, 2009; Yoon, 2009). For instance, according to the results of the study conducted by Chen and Pajares (2010), there was a positive direct relationship between self-efficacy and science achievement. Similarly, Yerdelen (2013) found self-efficacy as the strongest predictor of science achievement. Because, according to Bandura (1997), individuals' self-efficacy may vary across different tasks, activities, domains, and context, in the current study, relationship between students' self-efficacy and achievement will be assessed specifically in the science domain. Accordingly, students' self-efficacy will be measured specific to science domain.

The other central construct in the expectancy-value theory is the task-value referring individuals' perceptions regarding importance, usefulness, interestingness and cost of an activity (Eccles et al., 1983). Accordingly, there are four sub-components of task value namely, attainment value which concerns the importance of the activity for the individual, intrinsic value which involves the enjoyment that the individuals feel during the activity, utility value which refers to the usefulness of the activity for individuals and cost which concerns the perceived negative outcomes as a result of the activity (Eccles et al., 1983) According to expectancy-value theorists, task value is directly linked to students' effort, persistence, task choices, and achievement (Wigfield & Eccles, 2000). Cole, Bergin and Whittaker, (2008) also demonstrated that students who perceive the task as important, useful and interesting are more likely to engage in the task, show persistence and expend effort. Actually, a great deal of studies in the literature revealed positive association between students' task-value and academic achievement (Eccles & Wigfield, 2002; Pintrich & De Groot, 1990; Pintrich & Schunk, 2002) and specifically, science achievement (Sungur, 2007; Yumusak, Sungur, & Çakıroğlu, 2007). Considering the fact that, students' task value may change across different tasks, in the current study, students' perceptions regarding the usefulness, interestingness and importance of tasks used in the science classes will be measured and its relation with science achievement will be examined.

Overall, aforementioned literature demonstrated that motivational variables including self-efficacy and task value are significant predictors of students' achievement. However, considerable research also revealed the significant role of cognitive engagement in students' achievement (Akyol, 2009; Greene, Miller, Crowson, Duke, & Akey, 2004; Pintrich, Smith, Garcia, & McKeachie 1993). Cognitive engagement concerns students' willingness to expend effort and long period of time to comprehend a subject deeply or master a difficult skill and the type of processing strategies that they use for learning (Fredericks, Blumenfeld & Paris, 2004; Ravindran, Greene, & Debacker, 2005; Rotgans & Schmidt, 2010). Weinstein and Mayer (1986) claimed that cognitive engagement is essential for learning and academic achievement. Indeed, A study conducted by Fredericks et al. (2004) showed that the students cognitively engaged tend to utilize various learning strategies. These strategies are essential agents for students' achievement because they enable the students to learn meaningfully (Yumuşak, 2006).

The learning strategies can be classified into two groups, namely cognitive and metacognitive strategies (Pintrich et al., 1993). Rehearsal (i.e., memorizing the subject by repeating words by oneself), elaboration (i.e., associating new learnings with previous knowledge), and organizational strategies (i.e., grouping the subject hierarchically) and critical thinking (i.e., transferring previously learned knowledge to new situations) are examples of cognitive strategies (Weinstein & Mayer, 1996). Various studies reported that cognitive strategy use are associated with academic achievement and power of this relation show changes depending on which cognitive strategy is used (Pintrich et al., 1993; Sedaghat, Abedin, Hejazi, & Hassanabadi, 2011; Yumuşak, 2006). For example, the strategies like elaboration, organization and critical thinking require deep processing of information. Whereas the strategies like rehearsal involve superficial processing of information (Weinstein & Mayer, 1986). Hence, students who use deep processing strategies like elaboration, organization and critical thinking are expected to show better academic performance compared to the students who use superficial or sallow strategies like rehearsal (Pintrich's et al., 1993; Sedaghat et al., 2011). Monitoring (e.g., checking the comprehension level during activity), planning (e.g., skimming the text before reading), and regulating strategies (e.g., rereading the parts of the text which has not been understood) are the instances of metacognitive strategies, which are related with cognitive regulation (Pintrich, 1999), that is, thinking about how to think during the learning or solving a problem (Livingston, 2003; Metcalfe & Shimamura, 1994; Flavell, 1999). Use of metacognitive strategies are remarkable signs of cognitive engagement, thus, instructors desire their students to perform more metacognitive behaviors (Linnenbrink & Pintrich, 2003). A study conducted by Akyol (2009) revealed positive association between metacognitive strategy usage and science achievement.

As in the present study, several studies assessed the cognitive and metacognitive strategies as the components of the cognitive engagement (Linnenbrink & Pintrich, 2003; Metallidou & Vlachou, 2007; Rastegar, Jahromi, Haghighi and Akbari, 2010). For example, Greene, Miller, Crowson, Duke and Akey (2004) examined cognitive engagement in terms of cognitive and metacognitive strategies and they found that cognitive engagement was a significantly linked to academic performance.

Shortly, related literature has attracted attention to the cognitive engagement as a good indicator of students' learning and achievement.

Cognitively engaged students appeared to use various strategies in their learning. Accordingly, current study aims to examine students' cognitive engagement in science classes in its relation with science achievement.
In addition, the related literature suggested that students' motivation (i.e. self-efficacy and task-value) is positively associated with the their cognitive engagement (i.e., cognitive and metacognitive strategy use; Kahraman & Sungur, 2011; Linnenbrink & Pintrich, 2003; Pintrich & De Groot, 1990; Pintrich & Garcia, 1991; Schunk 2005; Sungur, 2007; Sungur & Güngören, 2007; Yumusak et al., 2007). Consequently, it appeared that the students who are self-efficacious and perceive the tasks as important, useful, and interesting are likely to show more persistence, exert more effort and use various cognitive and metacognitive strategies to comprehend related contents. In line with these findings, current study, also aims to examine the relationship between students' motivation and cognitive engagement in science in order to provide evidence for the generalizability of the findings across different domains.

Significance of the Study

The fact that Turkish students general science achievement scores are below the average of the international exams like Trends in International Mathematics and Science Studies (TIMSS) and Program of International Students Assessment (PISA; Gök, 2014; MEB, 2013; Şişman, Acat, Aybay & Karadağ, 2011) can be seen obviously in Ministry of Education reports. Therefore, there is a need of the researches examining the reasons of the current situation of science education in Turkey (MEB, 2013). The present study, which aims to reveal the role of motivation and cognitive engagement in science achievement, can provide some suggestions to improve the science achievement of the students in the schools and in international exams. Indeed, some researchers argued that the relationship between the motivation and academic achievement is indecisive and there is a need for more studies about the student motivation enabling useful insight for the educators and curriculum makers to provide a qualified educational medium for the students (Kulwinder Sigh, 2014). In present study, based on expectancy-value theory, the contribution of the student motivation specifically self-efficacy and task-value to science achievement was examined.

According to Wigfield, Tonks and Eccles (2004), individuals' expectancies for success and task value beliefs can be influenced by their culture and context. The authors further stated that different cultures and countries provide different learning environments influencing the individuals' motivation in various activities leading to differences in their expectancies and values. However, King and McInerney (2014) argued that despite of the role of contextual factors in basic motivational processes, the western theories of achievement have paid little attention to this fact. In fact, Taş and Çakır (2014) reported that a great deal of studies about motivational beliefs and their relation with the learning strategies (i.e., cognitive engagement) was conducted in western countries whereas relatively a few studies examining these constructs were from eastern countries (Kahraman & Sungur, 2011; Sungur, 2007). For instance, as stated before, Kulwinder Sigh's (2014) study showed that the relationship between the motivational beliefs and academic achievement seemed indecisive in Indian culture. Thus, there is a need for more studies researching motivational beliefs and cognitive engagement in different countries, especially in eastern countries to better understand their relation with the academic achievement. Accordingly, although culture or context is not a variable specifically examined in the currents study, the present study can make contribution to the related literature by providing insights about generalizability of the findings across countries.

Furthermore, based on available literature, cognitive engagement is expected to be a strong predictor of academic performance, that is, the students who have high cognitive engagement are likely to perform well on the tasks (Paris & Paris, 2001; Pintrich & De Groot, 1990; Pintrich & Garcia, 1991; Weinstein & Mayer, 1986; Zimmerman & Martinez- Pons, 1986). Therefore, the investigation of the students' cognitive engagement level and its contribution to science achievement can reveal students' current status concerning these variables and their relations with each other leading to some valuable practical suggestions to the teachers and curriculum makers to improve science education in Turkey.

Finally, in the present study, a new instrument was constructed using selected items from the Science Learning Inventory (SLI; Seyedmonir, 2000) and Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al.,1993) to measure all aspects of student motivation (i.e., self-efficacy and task- value) and cognitive engagement in science comprehensively . Through the combination of these two instruments, it is intended that related constructs are represented by a larger number of items specific to science domain, enhancing the validity and reliability. Indeed, results of the current study showed that the newly constructed instrument provides a valid and reliable measure of students' motivation and cognitive engagement. Thus, it is suggested that this instrument can be used in the future studies examining student motivation and engagement.

METHODOLOGY

Sample

Participants of this study were 861 seventh grade Turkish students from five elementary public schools. Of 861 students, 398 (46.2 %) were girls and 456 (53.0 %) were boys. Their mean age was 13.09 (SD = .55). Their mean last semester science grade was 3.83 (SD = 1.06)

Instruments

Motivation and Cognitive Engagement Scale (MCES): The MCES was constructed to measure students' motivational beliefs and cognitive engagement in three dimensions, namely self-efficacy, task value, and cognitive engagement. Accordingly, during the construction of the MCES, items targeting students' self-efficacy, task value and cognitive engagement were selected from the MSLQ (Pintrich, Smith, Garcia & McKeachie, 1991) and the SLI (Seyedmonir, 2000). More specifically, in order to assess students' self-efficacy in science, 8 items were selected from the self-efficacy for learning and performance sub-scale of the MSLQ and 5 items were selected from the motivation sub-scale of the SLI-A. In order to assess students' task value beliefs in science 6 items from the task value subscale of the MSLQ and 7 items from the motivation sub-scale of the SLI-A were selected. In addition, in order to assess the students' cognitive engagement, 15 items were selected from cognitive engagement and processes sub-scale of SLI-A and one item was selected from metacognitive self-regulation sub-scale of the MSLQ.

The MSLQ items used in the MCES were already adapted into Turkish by Sungur (2004). In the present study, the selected Motivation and Cognitive Engagement and Processes sub-scales items in SLI-A were translated and adapted into Turkish by the researcher. The translated version of the items was examined by two instructors from faculty of education for content validity. The instructors also examined the items for clarity, comprehensiveness, and sentence structure. Additionally, an expert in an Academic Writing Center in a large university checked for the grammar structure of the translation. Moreover, in order to determine whether the items were clear and understandable for the seventh grade students, the translated items were administered to three seventh grade students and their opinions regarding the clarity of the items were gathered. Based on the feedbacks from the experts and the students, minor revisions were made in a few items and items were prepared on a 4-point scale. After making necessary revisions, the MCES with 42 items from the MSLQ and SLI-A was pilot tested. Of 42 items, 13 belong to self-efficacy sub-scale, 13 belong to task value sub-scale, and 16 belong to cognitive engagement subscale.

A pilot study was carried out with 251 seventh grade students to evaluate the psychometric properties of the MCES. Result revealed that the MCES sub-scales had sufficiently high internal consistencies as indicated by Cronbach's alpha values of .86 for self-efficacy, .86 for task-value, and .81 for cognitive engagement. In order to validate the 3-factor structure of the MCES, a Confirmatory Factor Analysis (CFA) was conducted using LISREL 8.80. According to the CFA results, although the goodness of fit indices (GFI) were not within acceptable limits, remaining indices supported the three factor structure of the MCES and model fit was good ($\chi 2/df = 1.55$, CFI = .97, GFI = .79, NFI = .93, RMR = .05, SRMR = .06, RMSEA = .05).

In order to improve the psychometric properties of the instrument, some revisions were made based on the results of the pilot study and feedbacks from the participants during the administration of the instrument. As part of this revision, some items were reworded, some of them were deleted or new items were added considering validity and reliability issues. After making necessary modifications, the revised instrument consisted of 44 items. Among these items, 12 belong to self-efficacy sub-scale, 13 belong to task value sub-scale, and 19 belong to cognitive engagement subscale.

In the main study, the revised instrument was used. The revised instrument with 44 items in 3 dimensions provided a reasonably good model fit ($\chi 2/df = 2.95$, CFI = .97, GFI = .85, NFI = .93, RMR = .05, SRMR = .06, RMSEA = .05). Moreover, in main study sub-scale reliability was .64 for self-efficacy, .73 for task-value and .84 for cognitive engagement.

The Science Achievement Test (SAT): The Science Achievement Test (SAT) for 7th grade was used to evaluate seventh grade elementary students' science achievement (Yerdelen, 2013). The SAT consists of 14 multiple-choice questions with four alternatives. The multiple –choice questions in the SAT were selected from the pool of the questions used in the previous years' nationwide exams for the seventh grade students. In the SAT, seven questions were related to the Body Systems, four questions were related to the Force and Motion and four questions were related to the Electricity. Number of items for each topic was determined considering the time allotted for each topic in the curriculum. The items were at knowledge, comprehension and application levels in the Bloom's taxonomy. In the current study, Kuder Richardson-20 reliability was found to be .81, indicating a sufficiently high reliability.

RESULTS

Descriptive Statistics

As seen in the Table 1, the means of Self-efficacy, Task-Value and Cognitive Engagement variables in the study were all above the midpoint of four-point Likert scale. This finding implied that, elementary students tend to perceive science classes as important, useful, and interesting. They also appeared to be self-efficacious in science classes. Although the lowest mean score belongs to cognitive engagement sub-scale ($M = 2.87$, $SD = .45$), the mean value well above the midpoint suggested that students are likely to use various cognitive strategies in science classes. On the other hand, the mean science achievement score of 7.36 out of 14 revealed that students have a moderate level of science achievement.

Table 1. Descriptive Statistics

Variables	*M*	*SD*
Self – Efficacy	2.91	.51
Task-Value	3.02	.51
Cognitive Engagement	2.87	.45
Science Achievement	7.36	3.67

Inferential Statistics

Multiple Linear Regression Analysis

A multiple linear regression analysis was conducted to evaluate the prediction of the science achievement of students from linear combination of self-efficacy, task-value, and cognitive engagement. Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity, and homoscedasticity. Analysis results indicated that self-efficacy, task-value, and cognitive engagement explained 11.20 % of the variance in the students' science achievement ($R = .34$, $F(3, 857) = 36.13$, $p < .01$). More specifically result revealed that although self-efficacy ($\beta = .22$, $sr2 = 0.03$ $p < .000$) and task-value ($\beta = .15$, $sr2 = .01$, $p < .001$) significantly predicted students' science achievement, cognitive engagement ($\beta = -.02$, $sr2 = .00$, $p > .05$) did not reach a statistical significance to predict science achievement. Table 2 summarizes the results of multiple regression analysis.

Table 2. Beta Coefficients, Related Significance Values and Part Correlation Coefficients

Independent Variables	Beta	*p*	*sr*
Self-Efficacy	.22	.000	.157
Task-Value	.15	.001	.104
Cognitive Engagement	-.02	.640	-.015

As shown in the Table 2, the largest β coefficient was .22, which was for the self-efficacy. In other words, the self-efficacy variable provided the strongest contribution to explaining the dependent variable (i.e., science achievement). Indeed, squared semi partial correlation of self-efficacy indicated that self-efficacy uniquely explains 3 percent of variance in students' science achievement. On the other hand, task value, which makes the second strongest contribution to the prediction of dependent variable, explains 1 percent of variance in science achievement. Sign of the beta coefficients also revealed that higher levels of self-efficacy and task-value were related with higher levels of science achievement. Thus, it appeared that students who believe in their abilities to be successful in science and find course materials, activities and content in science classes as important, useful, and interesting tend to have higher levels of science achievement.

Correlations

In order to address to the second research question, bivariate relations among independent variables (i.e., self-efficacy, task-value and cognitive engagement) were examined through simple correlation analyses. Results revealed that all independent variables were positively correlated with each other. These findings suggested that higher levels of self-efficacy ($r = .53$) and task value ($r = .58$) were associated with higher levels of cognitive engagement. In addition, a positive association was found between self-efficacy and task value ($r = .69$).

Overall, results showed that• student motivation (i.e., self-efficacy and task value) significantly contributed to the prediction of students' science achievement. Additionally, positive and significant correlations were found among self-efficacy, task-value and cognitive engagement variables. However, cognitive engagement failed to significantly predict students' science achievement.

DISCUSSION

In the current study, students' self-efficacy and task value were found to be significant predictors of their science achievement. This finding is parallel to the findings in the literature examining academic achievement in relation to self-efficacy and task-value (Eccles, 1983; Eccles and Wigfield, 2002; Wingfield, 1994; Trautwein et al., 2012). More specifically, according to the relevant literature, students with adaptive motivational beliefs such as higher levels of self-efficacy and task value are more likely to have higher levels of academic achievement. In addition, in the current study, self-efficacy appeared as the best predictor of the science achievement. This result is also in congruence with the findings of the various studies in the related literature (Metallidou & Vlachou, 2007; Pintrich & De Groot, 1990; Pintrich et al., 1993; Yerdelen, 2013). For example, Pintrich et al. (1993) reported that although both self-efficacy and task-value value have positive relations with academic performance, self-efficacy appeared as a better predictor of performance compared to task value. Moreover, in a more recent research, Areepattamannil, Freeman, and Klinger (2011) found that self-efficacy was one of the variables having a stronger positive relation with the science achievement compared to other motivation variables. Based on the findings, the researchers argued that students who feel more confidence in performing science related tasks and have more positive perception for their ability to learn science are more likely to have higher science achievement.

Thus, current study supported the findings of the related literature demonstrating that students' self-efficacy and task-value are significant predictors of their science achievement In addition; students' self-efficacy appeared as a better predictor of their science achievement. This finding was as expected because students who have higher levels of self-efficacy tend to show more resistance and spend more effort on the tasks when they confront with the difficulties (Pintrich & Schunk, 2002; Schunk & Zimmerman, 2006; Schunk & Mullen, 2012).

On the other hand, contrary to the findings in majority of the studies in the relevant literature, current study failed to demonstrate a positive association between cognitive engagement and science achievement. According to considerable research cognitive engagement and the academic achievement have a positive strong relation with each other (Ames & Archer, 1988; Appleton, Christenson, Kim, & Reschly, 2006;

Pintrich & Schrauben, 1992; Reschly, Huebner, Appleton, & Antaramian, 2008; Weinstein & Mayer, 1986). For example, Akyol (2009) found that students' science achievements were significantly predicted by the students' use of elaboration and metacognitive self-regulation strategies. In addition, Kaya and Kablan (2013) reported that combination of effort regulation, metacognitive self-regulation and critical thinking accounted for 13% of variance in the science scores.

Although, majority of the studies in the literature indicated a positive relationship between cognitive engagement and achievement, a few studies in the literature provide a support and explanation for the findings of current study (Baas, Castelijns, Vermeulen, Rob Martens & Segers, 2015; Rastegar et.al., 2010; Veenman, 2011). For example, Sungur et. al. (2007) conducted a study to explore the relationship among classroom environment perceptions, motivational (mastery goal orientation, performance goal orientation, self-efficacy, and intrinsic interest) and cognitive (strategy use) components of academic self-regulation, and science achievement. The researchers reported that the relationship between strategy use and science achievement was non-significant. This finding is similar to the present study's result. Moreover, Romainville (1994) conducted a qualitative study with 35 students to examine the relationship between university students' metacognition and their performance in terms of exploring the potential relationship between students' performance and their capacity to talk about, describe and criticize their cognitive strategies. The result indicated a positive relationship between metacognition and performance. However, the researcher reported that high achiever participants could not surely characterize their learning (cognitive) strategy. In other words, they could generally not identify how and where they used the cognitive strategies. Thus, the high achiever participants appeared to be unconscious about the strategies they used. Likewise, the high achiever participants in the current study might not be conscious of their usage of cognitive and metacognitive strategies, assessed as cognitive engagement in the current study (Linnenbrink & Pintrich, 2003; Metallidou & Vlachou, 2007; Rastegar et al., 2010), and might report that they did not use them or gave uncertain responses to the items. In order to determine whether this explanation applies to the current findings, present study should be replicated integrating qualitative data collection tools such as observations and think aloud procedures to the research design.

Although the findings of the current study did not provide a support for majority of the studies in the related literature showing students' cognitive engagement as one of the essential components in their learnings, the researcher still suggest that science tasks and activities are designed so that students' demonstrate higher levels of cognitive engagement.

Because, students who are cognitively engaged use various strategies which help them organize information, link what they newly learn to their previous knowledge, plan, monitor, and evaluate their own learning contributing to their academic achievement. Actually, as presented in the results section, in the present study, bivariate correlations revealed a positive association between cognitive engagement and science achievement.

Current findings also revealed positive and significant correlations between student motivation (i.e. self-efficacy and task-value) and cognitive engagement. These results were in congruence with the findings in the relevant literature (Pintrich & De Groot, 1990; Pintrich & Garcia, 1991; Linnenbrink & Pintrich, 2003; Schunk 2005; Sungur, 2007; Sungur & Güngören, 2007; Kahraman & Sungur, 2011; Yumusak et al., 2007). For instance, Pintrich and his colleagues (Pintrich, 1989; Pintrich & De Groot, 1990; Pintrich & Garcia, 1991) showed that self-efficacy and task-value beliefs had a strong and positive association with the use of cognitive strategies (e.g., rehearsal, elaboration, and organizational strategies) and metacognitive strategies (e.g., planning, monitoring, and regulating). Similarly, Yumusak et al. (2007) examined the contribution of motivational beliefs, cognitive and metacognitive strategy use to high school students' achievement in biology. The findings of the study revealed that motivational beliefs like intrinsic goal orientation, task value and self-efficacy were positively linked to cognitive and metacognitive strategy use (cognitive engagement). Indeed, concerning the relationship between self-efficacy and cognitive engagement, Schunk (2005) reported that high self-efficacy facilitates the students to dynamically use cognitive and metacognitive strategies. In line with this idea, Linnenbrink and Pintrich (2003) articulated that self-efficacy beliefs have direct relation with behavioral, motivational and cognitive engagement of the students on academic tasks. In addition, Pintrich and Schrauben (1992) stated that value beliefs like importance and utility can enhance students' cognitive engagement and their use of diverse cognitive and metacognitive strategies. Indeed, Zimmerman (2005) argued that students may have knowledge and skills about various strategies but if they are not motivated, they will be less likely to utilize these strategies. Accordingly, learning environments should be designed so that students' motivation in terms of self-efficacy and task value is enhanced.

IMPLICATION AND CONCLUSION

In expectancy-value theory perspective, the current study aimed to investigate the contribution of students' motivation (i.e. self-efficacy and task-value) and cognitive engagement on seventh grade students' science achievement. The results of the present study showed that both self-efficacy and task-value are significant predictors of the science achievement. Unsurprisingly, self-efficacy appeared the best predictor of the academic achievement as in various studies in the literature (Pintrich & De Groot, 1990; Pintrich et al., 1993; Metallidou & Vlachou, 2007; Yerdelen, 2013).

Accordingly, designing learning environments that help students enhance their self-efficacy level appears to be important to improve their science achievement. According to Bandura (1994), individuals' self-efficacy level can be developed from four sources: task mastery (e.g., success experiences); social persuasion/support; vicarious experiences (e.g., Observing others); and emotional or somatic states. Accordingly, science teachers can support their students' self-efficacy development stressing the linkage between the students' effort and their successes rather than making the normative comparisons (Pintrich & Schunk, 2002). In addition, learning materials and activities in science classrooms should allow the students to have successful experiences enhancing their self-efficacy level. Additionally, social supports like teachers', parents' or classmates' verbal encouragements help the students improve their self-efficacy level. Those verbal encouragement messages should stress that the student has a competency to achieve the related science tasks and activities, but those messages should be realistic and suitable for the students and not beyond their current knowledge and capabilities (Brtiner & Pajares, 2006; Usher & Pajares, 2006). Moreover, the social interactions among the students in the classrooms may have important role in improving their self-efficacy. Similarly, teacher attitudes towards the students' behaviors can have determinative role in shaping their motivation. If a science teacher, for example, encourages students to involve in an activity and help them see mistakes as part of learning, students can feel more efficacious and enthusiastic to take part in the activities.

In line with these ideas, various instructional methods such as Learning Cycle (5E or 7E), Problem Based Learning (PBL), Project Based Learning and Argumentation etc. can be used to help the students improve their motivation (i.e. self-efficacy and task-value). For instance, in PBL instructional method, students engage with ill-structured problems originated from the real-world scenarios (Finkle & Torp, 1995). While engaging with these type problems, the students can relate their classroom learnings with their own daily lives. This situation can help students perceive the classroom learnings as valuable for themselves (Ramsden, 1997). In this manner, the students' task-value beliefs can show development and the increase in the task-value can lead to more effort, more persistence on the given tasks resulting in better academic performance. In addition, as pointed out by Dunlap (2005), dealing with ill-structured problems and the interactions inside the groups can strengthen, extend, and sustain self-efficacy, professional identity, and overall performance. Actually, ill-structured problems in the PBL require the students to decide on which sources and strategies they will use to solve the problems. This situation gives opportunity to the students to see the relation between their accomplishment and their effort. Accordingly, such kind of experiences can help the students feel more efficacious.

In general, it is advised that science teachers try to create learning environments advancing students' motivational beliefs such as putting emphasis on the importance of the learning material and stressing on the changeable nature of ability, leading discussion about the usefulness of science tasks. Such activities can improve students' self-efficacy and task-value beliefs which are influential on task choice, effort and persistence and their achievements (Eccles, et. al., 2002).

LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

The participants of the study were limited only to seventh grade students. Similar studies can be conducted with the students from the other grade levels. In addition, variables of the current study were not examined in relation to other learner characteristics (e.g., demographic variables, family characteristics, health related factors, etc.) and teacher characteristics (e.g., teaching style). However, future studies can investigate whether such learner and teacher characteristics interact with students' motivation, cognitive engagement, and science achievement using advanced statistical techniques such as structural equation modeling or HLM. Moreover, in the current study, the data were obtained only from self-report instruments. Self-report instruments may not be sufficient to capture students' actual motivational beliefs and strategy use. Thus, the other ways of data collection like observation and interview etc. can be utilized in the similar studies in order to get an in-depth understanding of the observed relations. Since the current study is a cross-sectional correlational study, the reached results cannot indicate cause-effect relation among the variable. Experimental studies can also be designed to explain such relationships. Additionally, the SAT utilized in the current study is limited to the content of first semester of seventh grade science curriculum and contained 14 items. Most items in the SAT were at the comprehension level. In the future studies, science achievement tests covering a wider range of subject matter and, accordingly, more items and emphasizing higher order thinking skills can be used to evaluate the science achievement of the participants.

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