

## Examination of the Self-Regulated Learning Processes for Low and High Achievers in Biology

### Abstract

This study aimed at comparing high and low achievers with respect to various self-regulated learning processes. For the specified purpose, 252 Turkish high school students were administered the Motivated Strategies for Learning Questionnaire. Results indicated that there were significant mean differences between high and low achievers with respect to various motivational (i.e., intrinsic goal orientation, extrinsic goal orientation, self-efficacy, test anxiety) and cognitive-behavioral (i.e., meta-cognitive self-regulation, effort regulation and help seeking) processes. In addition, regardless of the achievement level of the students, intrinsic goal orientation, task value, and self-efficacy were found to be significantly linked to various cognitive and behavioral processes of self-regulated learning.

**Key words:** *biology achievement, self-regulatory processes.*

### Introduction

Grounded within social-cognitive theory, Zimmerman's (2000) model defined self-regulated learning as the process whereby students personally activate and sustain their behaviors, cognition, and motivation that are systematically oriented toward attainment of academic goals. Accordingly, Zimmerman's model of self-regulated learning stressed the importance of cognitive, behavioral and motivational processes in students' academic performance: *Cognitive processes* involved in self-regulated learning contributing to academic performance include the use of various cognitive strategies, like rehearsal, elaboration, organization,

and critical thinking and metacognitive strategies like planning and monitoring. *Behavioral processes* involved in self-regulated learning include students' use of various resource management strategies, such as time and study environment management strategies, effort regulation on academic tasks, help seeking strategies, and peer learning strategies (Pintrich & DeGroot, 1990). *Motivational processes* of self-regulated learning involve students' goal orientations, task value beliefs, control of learning beliefs, self-efficacy and affect. Goal orientations concern students' reasons for doing a task or engaging in an activity. Students with intrinsic goal orientation tend to involve in a task to learn and understand whereas students with extrinsic goal orientation involve in a task to show their abilities to others or get a reward. In contrast, task value beliefs refer to students' perceptions regarding the importance or usefulness of a given task (Wigfield & Eccles, 2000). Among the variables included in the motivational processes, control of learning beliefs, on the other hand, involve students' attributions for their success and failure. As a central part of the social cognitive theory, self-efficacy concerns students' judgments about their abilities to accomplish academic tasks (Usher & Pajares, 2009). According to Zimmerman (2000), all these cognitive, meta-cognitive, and affective processes are part of self-regulated learning interacting with each other in a cyclical manner. Accordingly, self-regulated students are found to set goals effectively, plan and use strategies to realize their goals, manage resources and monitor their progress. They are self-efficacious about their abilities to master a learning task. Thus, self-regulated learning is considered to be highly related to the quality of learning and positive academic outcomes. In fact, it is a significant predictor of academic achievement, and the use of internalized self-regulatory strategies help students achieve in school.

However, many motivational and cognitive processes of self-regulation are thought to vary as a function of the task or domain. For example, Wolters and Pintrich, (1998), in their study, found mean level differences by subject area in the motivation and cognitive strategy use variables. Accordingly, it is suggested that investigation and measurement of self-regulation should be sensitive to context (Duncan & McKeachie, 2005). In line with this idea, the presented study put emphasis on the course level and examined high school students' self-regulated learning processes in relation to their academic achievement, specifically in biology. Therefore, this study has a potential to make a unique contribution to the growing body of literature investigating the context specificity of students' self-regulated learning. Further studies can examine students' self-regulated learning in different courses to demonstrate the generalizability of the findings across different contexts and domains.

Overall, the presented study aimed at comparing the low and high achievers in biology with respect to the motivational and cognitive-behavioral components of self-regulated learning. In the study, while goal orientations, control of learning beliefs, task value, and test anxiety were examined as motivational components of self-regulation, the use of various cognitive and behavioral strategies including cognitive and meta-cognitive strategies, management of time and study environment, effort regulation, peer learning, and help seeking were examined as cognitive-behavioral components of self-regulation. The current study treated cognitive and behavioral components of self-regulated learning as a single component considering a general cognitive model of information processing and learning (Pintrich, Smith, Garcia, & McKeachie, 1993; Weinstein & Mayer, 1986). More specifically, the presented study poses the following research questions: a) Is there a difference between low and high achievers in biology with respect to motivational and cognitive-behavioral components of self-regulation? b) What is the relationship between motivational and cognitive-behavioral components of self-regulation for low achievers in biology? c) What is the relationship between motivational and cognitive-behavioral components of self-regulation for high achievers in biology?

## **Method**

### **Sample**

The participants in the study were 252 Turkish high school students (99 girls, 121 boys, 32 missing) with the age range of 15 to 18 years. The students were classified as high achievers and low achievers based on their biology grades: While the students that obtained 25% in biology grades were classified as low achievers, students above 75% were classified as high achievers.

### **Instruments**

*Motivated Strategies for Learning Questionnaire (MSLQ)*: It is an 81-item self-report questionnaire developed by Pintrich et al., (1993). Students rate themselves on a seven point Likert scale from “not at all true of me” to very true of me” concerning different aspects of their learning, namely, motivation to learn and ability to use various cognitive, metacognitive and resource management strategies.

## Results

Table 1 presents the descriptive statistics for different aspects of self-regulated learning. As shown in the Table, the low achievers have higher scores compared to the high achievers with respect to all the motivational and cognitive-behavioral components of self-regulated learning except for task value and self-efficacy. This finding implies that the high achievers are likely to feel more self-efficacious in biology and perceive biology as interesting, useful, and important. On the other hand, the low achievers appear to use cognitive and behavioral strategies more often than high achievers.

MANOVA was conducted to determine whether the observed differences between the low achievers and the high achievers in biology with respect to different aspects of self-regulation are statistically significant. Dependent variables were the students' scores on 15 different constructs measured by the MSLQ. A statistically significant mean difference was found between the low and the high achievers with respect to the collective dependent variables,  $F(15, 155)=826.88$ ,  $p=0.000$ ,  $\eta^2= .24$ . The follow-up univariate ANOVA results showed that there was a significant difference between the low achievers and the high achievers with respect to only intrinsic goal orientation, extrinsic goal orientation, self-efficacy, test anxiety, meta-cognitive self-regulation, effort regulation, and help-seeking ( $p<0.05$ ). When the mean scores shown in Table 1 were examined, it was found that while the high achievers had higher mean scores on self-efficacy and task value, they had lower scores in test anxiety, intrinsic goal orientation, extrinsic goal orientation, meta-cognitive self-regulation, effort regulation, and help seeking.

**Table 1.** Descriptive Statistics for Motivational and Cognitive-Behavioral Components of Self-Regulated Learning

Variable		Low Achievers (n=69)		High Achievers (n=102)	
		Mean	SD	Mean	SD
Motivation	Intrinsic Goal Orientation	5.08	1.17	4.59	1.50
	Extrinsic Goal Orientation	5.60	1.12	4.94	1.27
	Task Value	5.05	1.32	5.14	1.46
	Control of Learning Beliefs	5.71	1.14	5.48	1.03
	Self-efficacy	4.70	1.26	5.16	1.27
	Test Anxiety	4.13	1.10	3.68	1.19

Variable		Low Achievers (n=69)		High Achievers (n=102)	
		Mean	SD	Mean	SD
Cognition- -Behavior	Rehearsal	4.81	1.34	4.62	1.55
	Elaboration	4.64	1.31	4.64	1.39
	Organization	4.65	1.29	4.71	1.58
	Critical Thinking	4.44	1.27	4.31	1.43
	Metacognitive Self-regulation	4.51	.92	4.18	1.03
	Time and Study Environment	4.73	.76	4.65	.72
	Effort Regulation	3.99	.86	3.68	1.07
	Peer Learning	3.68	1.33	4.27	1.32
	Help Seeking	4.66	1.15	4.24	1.20

### The relationship between motivational cognitive components of self-regulated learning for low achievers

Canonical correlation was conducted to examine the relationship between the set of motivational variables (i.e., goal orientations, task value beliefs, control of learning beliefs, and test anxiety) and cognitive-behavioral variables (i.e., use of various cognitive, metacognitive, and resource management strategies) for the low achievers. The results indicated that the canonical correlation coefficient for the low achievers was .75 (56 % of overlapping variance). With a cutoff correlation

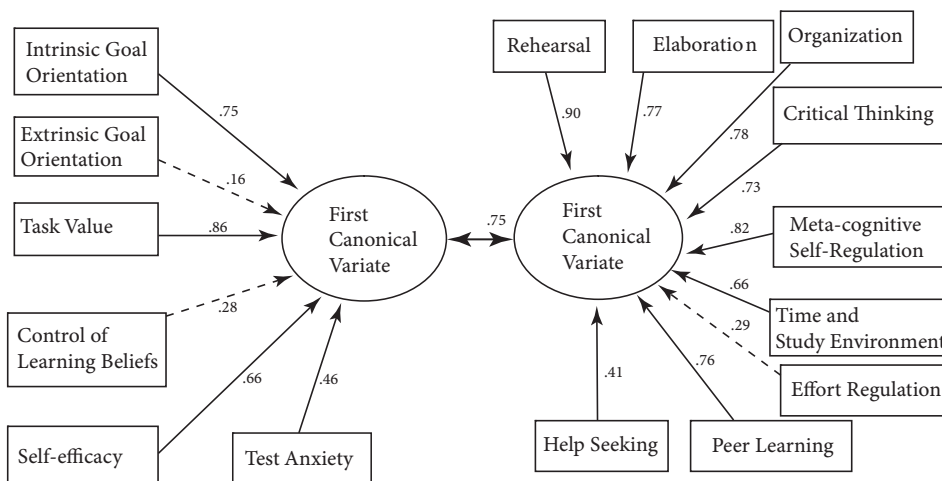


Figure 1. Relationship between motivational and cognitive-behavioral components of self-regulated learning for low achievers (Dashed lines are not significant)

of .3, the results showed that the low achievers in biology who have higher levels of intrinsic goal orientation, task value beliefs, control of learning beliefs, self-efficacy, and test anxiety in biology are likely to use various strategies like rehearsal, elaboration, organization, critical thinking, meta-cognitive self-regulation, time and study environment structuring, peer learning, and help-seeking at higher levels (cf., Figure 1)

### The relationship between motivational cognitive components of self-regulated learning for high achievers

A second canonical correlation was conducted to examine the relationship between the set of motivational variables and cognitive-behavioral variables for the high achievers. The results showed that the canonical correlation coefficient for the high achievers was .74 (55 % of overlapping variance). With a cutoff correlation of .3, the findings suggested that the high achievers in biology who have higher levels of intrinsic goal orientation, task value beliefs, control of learning beliefs, and self-efficacy tend to use strategies in the cognitive set (i.e., rehearsal, elaboration, organization, critical thinking, meta-cognitive self-regulation, time and study environment structuring, peer learning and help-seeking) at higher levels. (cf., Figure 2)

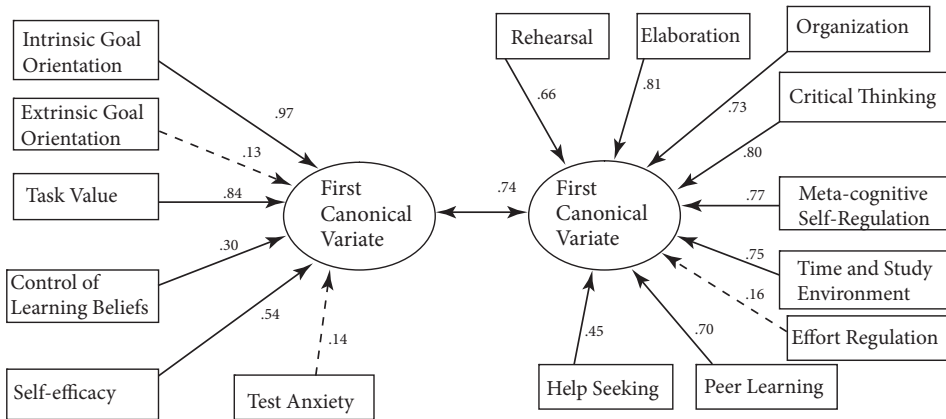


Figure 2. Relationship between motivational and cognitive-behavioral components of self-regulated learning for high achievers (Dashed lines are not significant)

## **Discussion**

This study presented an attempt at comparing the low and high achievers in biology with respect to the motivational and cognitive-behavioral components of self-regulated learning. The results showed that the high achievers feel more self-efficacious in biology compared to the low achievers. Accordingly, the high achievers appeared to be more confident about their abilities and skills to accomplish tasks assigned in biology classes. This finding was in congruence with the findings in the literature demonstrating that self-efficacy is positively linked to achievement and a wide variety of adaptive academic outcomes, such as cognitive engagement and the use of various cognitive and meta-cognitive strategies (see Linnenbrink & Pintrich, 2003; Pintrich, et al. 1993). Indeed, the canonical correlation analyses conducted in the present study demonstrated that regardless of the achievement group, the students who believe they can do assigned tasks are likely to use various cognitive, meta-cognitive and resource management strategies at higher levels.

In addition, canonical correlation analyses showed that intrinsic goal orientation is positively associated with self-regulatory processes for both the low and high achievers. Indeed, the relevant literature revealed a significant relationship between intrinsic goal orientation and the use of cognitive and meta-cognitive strategies involved in deeper processing of information (Pintrich & Schunk, 2002). Regarding task value beliefs, while the current study revealed no difference between the high and low achievers, task value beliefs were found to be positively linked to the use of various self-regulatory strategies. Consistent with this finding, McCoach and Siegle (2003) suggested that if students value neither the task nor the outcome, they will not have motivation to put their best effort when completing the task. Accordingly, students who consider tasks and activities as important, useful, and interesting tend to use various cognitive and meta-cognitive strategies as well as time and study environment management strategies, help seeking, and peer learning strategies at higher levels.

MANOVA results also showed that the high achievers have a lower level of test anxiety in biology compared to the low achievers. On the other hand, the canonical analysis conducted for the low achievers indicated a positive relationship between test anxiety and the use of self-regulatory strategies. These findings suggested that the low achievers have higher levels of test anxiety but this anxiety appears to act as a motive for them to use various self-regulatory strategies in their biology learning. Indeed, when the high and low achievers' self-regulatory strategies were compared, the low achievers were found to use metacognitive strategies and help seeking strategies less than the high achievers. These findings can be partly explained by

the Turkish educational system which is highly competitive and examination-orientated (Senler & Sungur, 2009). In Turkey, starting with middle school years, students enter nationwide normative exams to be able to attend better high schools and universities. Most students take private tutorials to be able to get better scores in these exams. Therefore, concerning the exams, low achievers may be experiencing more anxiety than high achievers. High achievers, on the other hand, are not found to seek help or use other behavioral or cognitive strategies at higher levels. Most probably, they just study for the exams without emphasizing learning and mastering the course material as indicated by their lower score on the intrinsic goal orientation sub-scale. At this point, it is important to consider how teachers convey instruction in biology classes and how they assess students' performance since the type of instruction and assessment strategies used have a direct effect on student self-regulated learning (Wolters, Pintrich & Karabenick, 2003): In Turkey, teachers tend to instruct students about what to study, how to study, and when to study, with limited emphasis on autonomy and choice. In the presented study, the students' biology grades were used to classify them as low achievers and high achievers. Therefore, these grades depend on scores from teacher-made tests. Accordingly, it is expected that in learning environments where teachers provide explicit directions regarding what to read, what assignments to complete, and how to do these assignments, students conforming to these teachers directions are expected to be more successful but less self-regulated in their learning (McInerney, 2008).

## **Bibliography**

- Duncan, T.G., & McKeachie, W. J. (2005). The making of the Motivated Strategies for Learning Questionnaire. *Educational Psychologist*, 40, 117–128.
- Linnenbrink, E.A. & Pintrich, P.R..(2003). The role of self-efficacy beliefs in student engagement and learning in the classroom. *Reading and Writing Quarterly*, 19, 119–137
- McCoach, D.B. & Siegle, D. (2003). Factors that differentiate underachieving gifted students from high achieving gifted students. *Gifted Child Quarterly*, 47, 144–154
- McInerney, D.M. (2008). The motivational roles of cultural differences and cultural identity in self-regulated learning. In: D.H. Schunk and B.J. Zimmerman (Eds), *Motivation and self-regulated learning: Theory, research, and applications* (pp. 369–400) New York, NY: Lawrence Erlbaum Associates.

- Pintrich, P.R., & De Groot, E. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, 82, 33–40.
- Pintrich, P.R., Smith, D.A.F., Garcia, T. & McKeachie, W.J. (1993). Reliability and predictive validity of the motivated strategies for learning (MSLQ). *Educational and Psychological Measurement*, 53, 801–813.
- Pintrich, P.R., & Schunk, D.H. (2002). *Motivation in education: Theory, research, and applications*. Columbus, OH: Merrill.
- Senler, B. & Sungur, S. (2009). Parental influences on students' self-concept, task value beliefs, and achievement in science. *The Spanish Journal of Psychology*, 12, 106–117
- Usher, E.L. (2009). Sources of middle school students' self-efficacy in mathematics: A qualitative investigation of student, teacher, and parent perspectives. *American Educational Research Journal*, 46, 275–314.
- Weinstein, C.E., and Mayer, R.E. (1986). *The Teaching of learning strategies*. In M. Wittrock, ed. *Handbook of research on teaching*, pp. 315–327. New York: Macmillan.
- Wigfield, A. & Eccles, J.S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology*, 25, 68–81.
- Wolters, C.A., Yu, S.Y., & Pintrich, P.R. (1996). The relation between goal orientation and students' motivational beliefs and self-regulated learning. *Learning and Individual Differences*, 8, 211–238.
- Wolters, C.A., Pintrich, P.R., & Karabenick, S.A. (2003). *Assessing academic self-regulated learning*. Paper prepared for the Conference on Indicators of Positive Development: Definitions, Measures, and Prospective Validity, Washington, USA.
- Zimmerman, B.J. (2000). *Attaining self-regulation*. In M. Kaerts, P.R. Pintrich, & M. Zeidner (Eds). *Handbook of Self-Regulation*. pp. 13–3