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Research Article

Investigation of the Self-Regulated Learning Strategies of Students from the Faculty of Education Using Ordinal Logistic Regression Analysis

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Abstract

The purpose of this study was to reveal whether the low, medium, and high level self-regulated learning strategies of third year students at the Education Faculty of Cumhuriyet University can be predicted by the variables of gender, academic self-efficacy, and general academic average. The study uses the Relational Screening Model. The dependent variable of the study was the "self-regulated learning strategies" of the students and the independent variables were gender, academic self-efficacy, and general academic average. The universe of the study consisted of 1398 third year students from 11 departments of the Education Faculty of Cumhuriyet University. The sample of the study consisted of 826 third year students from 11 departments of the Education Faculty of Cumhuriyet University, all chosen by simple random sampling. In the study, as a tool for data collection, the "Academic Self-Efficacy Scale" was used to identify the academic efficacies of the students, and the "Self-Regulated Learning Strategies Scale" was used to identify the self-regulated learning strategies of the students. In the analysis of the data, a clustering analysis of the dependent variable and the three-category ordinal logistic regression analysis was used since it was ordered. On examining the results of the logistic regression analysis, it could be seen that gender, general academic average, and academic self-efficacy of the students predicted the self-regulated learning strategies to a significant level.

Keywords

Self-regulation • Self-regulated learning strategies • Academic self-efficacy • Academic success • Ordinal logistic regression

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One of the most important targets of education in the developing and changing world is to raise individuals to think, explore, question, produce, decide by themselves, undertake the responsibility of learning, control their learning processes, take part actively in such processes, and have self-confidence in their capabilities and correctly use these capabilities, instead of individuals raised with traditional education involving mechanical learning. In recent years, exploration and understanding of their own learning processes by the students as well as the support given by trainers in learning-teaching environments has gained importance with respect to achieving effective learning. It is now well-known that the factors effective for learning are not only cognitive as affective factors also have an important role (Tait-McCutcheon, 2008).

One of the most important factors influencing learning and academic success is the concept of self-regulation. The research on the concept of self-regulation emerged in the mid-1980s to answer the question, "How can students manage their own learning processes?" (Zimmerman, 2001).

There are various definitions of the concept of self-regulation in literature. According to Bandura (1986), who first introduced the concept, self-regulation is the individual playing an effective role in and controlling the learning-teaching process by the identification of learning targets. Zimmerman (1989), who attracted attention with his work on self-regulation, defined this self-regulation as the extent to which the students actively participate in their learning processes with respect to meta-cognition, motivation, and behavior, while Kauffman (2004) defined it as the learner's attempt to control and manage complex learning activities. Pintrich (2000), however, expressed self-regulation as an active and constructive process by which the students identify their learning objectives and regulate their cognition, motivations, and behavior. Considering the definitions of self-regulation, the requirement for students to play an active role in the learning processes emerges as a common point. The individual will become aware of his/her own learning, will establish his/her own control, and will assess himself/herself in processes in which he/she is active. Risemberg and Zimmerman (1992) defined self-regulation as determining objectives, developing strategies to achieve these objectives, controlling the gains of these strategies, and indicating the importance of the utilization of self-regulated learning strategies.

One of the fundamental factors that affects the learning process based on self-regulation is self-regulating strategies. Self-regulation strategies are cognitive strategies such as repetition, interpretation, and organization of the effort spent by the students when they are accomplishing a task in the learning-teaching process (Pintrich & De Groot, 1990). Self-regulation is in a cyclic relationship with a multitude of variables; for example, when the self-efficacy level of the students on a subject increases, it may affect their self-regulation skills on the subject, and using self-regulation strategies may increase their self-efficacies, ensuring more self-regulation. From another perspective,

individuals with high academic success may ensure more self-regulation, and individuals who can self-regulate may increase their academic success.

The literature on the subject reports numerous studies that reveal the relationship between the concept of self-regulation and gender (Akkaya, 2012; Alçı & Altun, 2007; Cebesoy, 2013; Çelik Ercoşkun & Köse, 2014; Erdoğan & Şengül, 2014; Gömleksiz & Demiralp, 2012; Kadıoğlu, Uzuntiryaki, & Çapa Aydın, 2011; Özkal & Sucuoğlu, 2013; Sağırlı & Azapağası, 2009; Üredi & Üredi, 2005; Yüksel, 2013; Zimmerman, Bandura, & Martinez-Ponds, 1992; Zimmerman & Martinez-Pons, 1990), self-efficacy (İsrael, 2007; Ocak & Yamaç, 2013; Pintrich, 1999; Pintrich & De Groot, 1990; Virtanen, Nevgi, & Niemi, 2014; Zimmerman & Martinez-Pons, 1990), and academic success (Akkuş İspir, Ay, & Saygı, 2011; Altun, 2005; Altun & Erden, 2013; Arsal; 2009; Bembenutty, 2011; Bono & Bizri, 2014; Cheng, 2011; Duru, Duru, & Balkıs, 2014; Malpass, O'Neil, Harold, & Hocevar, 1999; Tekbıyık, Camadan, & Gulay, 2013; Turan & Demirel, 2010; İsrael, 2007; Üredi & Üredi, 2005, 2007; Yüksel, 2013).

The fact that self-regulation is related to many variables and that the mutual interaction of these variables at different levels form a complex structure requires a multi-dimensional investigation of the link between the self-regulated learning strategy levels of individuals and variables such as gender, self-efficacy, and academic success.

In line with this, the purpose of the study was to reveal whether the low, medium, and high levels of self-regulated learning strategies of third year students at the Education Faculty of Cumhuriyet University can be predicted by the variables gender, academic self-efficacy, and general academic average.

Method

The study used the Relational Screening Model. Logistic regression analysis, which is a statistical method used in relational screening models, was used to analyze the data. The main purpose of a logistic regression analysis is to establish an acceptable model that can consistently define the relationship between the predictor (independent) variables and the predicted (dependent) variables using the least number of variables possible (Atasoy, 2001). Logistic regression analysis ensures the establishment a regression model without assumptions such as normality, continuity, co-variance, and multi-variable normality (Tabachnick & Fidell, 1996, p. 521).

The dependent variable of the study was the "self-regulating strategies" of the students and the independent variables were gender, academic self-efficacy, and general academic average. The "self-regulating strategies," which is the dependent variable, were subjected to a two-stage clustering analysis, defining it as a three-category variable consisting of "low," "medium," and "high" self-regulating levels.

While the independent variable gender was a categorical (discrete) variable, academic self-efficacy, and general academic average were continuous variables.

Universe and Sample

The universe of the study consisted of a total of 1398 students in the third year in 11 departments of the Education Faculty of Cumhuriyet University, enrolled in the courses for the academic year 2014–2015. The sample of the study consisted of 826 students in the third year in 11 departments of the Education Faculty of Cumhuriyet University. The following sample size determining formula for a universe of known size was used. The sample size was calculated in accordance with the following formula, by taking the significance level as 0.05 and the sampling error as d = ±0.03, and p = 0.5 and q = 0.5, from different genders and departments so that it reflects different opinions and ideas (is heterogeneous) (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz, & Demirel, 2010, p. 96; Yazıcıoğlu & Erdoğan, 2004, p. 49–50).

$$\frac{Nt^2pq}{(N-1)d^2 + t^2pq}$$

The sample size was calculated as at least 302 students. In choosing the sample, a simple random sampling method in which all elements have the same odds to be included in the sample (Karasar, 2006, p. 112) was used. Taking into account this information, 834 students were contacted, but eight students were excluded making missing value and extreme values analysis, and 826 were included.

In accordance with this, Table 1 gives the gender and department distribution of the students included in the study.

Table 1
Personal Information of the Students in the Universe and included in the Sample

Variables	Universe		Sample	
Gender	*f*	%	*f*	%
Female	903	64.59	553	66.95
Male	495	35.41	273	33.05
Departments				
Pre-School Teaching	218	15.59	125	15.13
Primary School Teaching	209	14.95	129	15.62
Social Sciences Teaching	192	13.73	113	13.68
Science Teaching	200	14.31	101	12.23
Primary School Mathematics Teaching	86	6.15	58	7.02
Turkish Language Teaching	109	7.80	89	10.77
Guidance and Psychological Counselling Teaching	84	6.01	59	7.14
Secondary School Mathematics Teaching	53	3.79	35	4.24
Music Teaching	28	2.00	27	3.27
Drawing Teaching	34	2.43	18	2.18
Religions and Ethics Teaching	185	13.23	72	8.72
Total	1398	100.00	826	100.00

Note. f = frequency.

On examining Table 1, it can be seen that the universe of the study consisted of 1398 students, and the sample consisted of 826 students. Considering the gender distribution of the students included in the sample, 66.95% (f: 553) were female, and 33.05% (f: 273) were male. The distribution of the students on department basis is also given in Table 1.

Data Collection Instruments

In the study, as a tool for data collection, the "Academic Self-Efficacy Scale," developed by Kandemir and Özbay (2012), was used to determine the academics self-efficacy of the students. The "Self-Regulated Learning Strategies Scale" developed by Kadıoğlu et al. (2011) were used to determine the self-regulated learning strategies of the students.

The "Academic Self-Efficacy Scale" consists of 19 items and four factors (*coping with academic problems, spending academic effort, academic planning, and academic methods*). In the scale, which was prepared as a five-point Likert-type scale, the responses are graded as "strongly agree = 5", "quite agree = 4", "agree = 3", "partially agree = 2" and "strongly disagree = 1." The Cronbach's alpha internal consistency coefficients were .90 for the first factor, .78 for the second factor, .77 for the third factor, .69 for the fourth factor, and .91 for the whole scale. Total correlations of items for each dimension ranged between .36 and .67. The fit indices obtained by Confirmatory Factor Analysis (CFA) were: $X^2 = 513.04$ (sd = 148, $p < .001$), (x^2/sd) = 3.47, GFI = .90, RMSEA = .073, RMR = .04, standardized RMR = .056, CFI = .97, and AGFI = .87. All these figures show that the scale has good fit values. In addition, when the internal consistency coefficient of the sample group of the "Academic Self-Efficacy Scale" in the present study was re-calculated, it was found to be 0.91. Since the total points were summed for the sample group, a two-level CFA was conducted. The fit indices obtained by CFA were: $X^2 = 533.79$ (sd = 148, $p < .001$), (x^2/sd) = 3.61, RMSEA = .056, GFI = .94, NFI = .98, CFI = .98, and AGFI = .92, showing that the scale has good fit values.

The "Self-Regulated Learning Strategies Scale" consists of 29 items and eight dimensions (*motivation regulation, effort regulation, planning, attention focusing, using additional resources, summarizing strategy, emphasis strategy, and self-direction*). In this scale, prepared in accordance with a six-point Likert-type scale, the items were graded as "always = 6," "mostly = 5", "frequently = 4", "sometimes = 3", "rarely = 2" and "never = 1." The reliability coefficients of the sub-dimensions of the scale were .77 for motivation regulation, .68 for effort regulation, .82 for planning, .76 for attention focusing, .78 for using additional resources, .74 for summarizing strategy, .79 for emphasis strategies, and .77 for self-direction. The results of the fit statistic obtained with CFA were as follows: AGFI = .84, RMSEA = .064, NNFI = .89, RMR = .060, and SRMR = .060. In addition, when the internal consistency

coefficient of the sample group of the "Self-Regulated Learning Strategies Scale" in the present study was re-calculated it was found to be 0.90. Since the total points would be summed for the sample group, a two-level CFA was conducted. The fit indices obtained by CFA were as follows: $X^2 = 1624.18$ (sd = 342, $p < .001$), (x^2/sd) = 4.75, RMSEA = .067, GFI = .88, NFI = .94, CFI = .95, and AGFI = .95, showing that the scale has good fit values.

Analysis of the Data

The logistic regression analysis is named according to the structure of the dependent variable to which logit transformation is applied. When the dependent variable is a categorical variable with at least three choices and is ordinally scaled, the "ordinal logistic regression analysis" is used (Ayhan, 2006, p. 19; Çokluk, 2010, p. 1362). In the ordinal logistic regression analysis, the categories must be coded in an ordered way, from low to high (Ayhan, 2006, p. 19). In this study, as the continuous variable of the self-regulated learning strategy (the dependent variable in the logistic regression analysis) was transformed into a discrete variable with three categories, and as there was an ordinal relationship between these categories, the ordinal logistic regression analysis was used. Considering that there was the possibility that the individuals in the heterogeneous data set were from separate universes, we decided to use the "two-stage clustering analysis" and to form homogenous subgroups of individuals.

In the study, a two-stage clustering analysis was applied to the "Self-Regulated Learning Strategies" Scale scores of the third year students at the Faculty of Education, and in examining the BIC (Bayesian Information Criterion) values (BIC_1 = 585.473, BIC_2 = 286.387, BIC_3 = 209,895), three clusters were decided to be created. The two-stage clustering analysis can properly cluster continuous and categorical data, and the results of the statistical work obtained after dividing the heterogeneous data set into homogenous sub-clusters are more accurate (Kayri, 2007, p. 97). To determine the number of sub-clusters of the universe, BIC was used. Thus, the dependent variable was defined as a three-category variable consisting of "low," "medium," and "high" self-regulated learning strategies. The results of the two-stage clustering analysis of the dependent variable are given in Table 2.

Table 2
The Results of the Two-Stage Clustering Analysis of the Dependent Variable

Variable	Cluster	f	%	Average	Standard deviation
Dependent variable	1	113	13.68	79.63	11.30
	2	321	38.86	107.60	7.39
	3	392	47.46	137.37	12.03

As can be seen from Table 2, as a result of the two-stage clustering analysis, the self-regulated learning strategy scale average score of the 113 students (13.68%) in

the first cluster was 79.63, and the standard deviation was 11.30; the self-regulated learning strategy scale average score of the 321 students (38.86%) in the second cluster was 107.60, and the standard deviation was 7.39; and the self-regulated learning strategy scale average score of the 392 students (47.46%) in the third cluster was 137.37, and the standard deviation was 12.03. Hence, the first cluster consisted of students with a "low" level, the second cluster consisted of students with a "medium" level, and the third cluster consisted of students with a "high" level of self-regulated learning strategy, respectively. Thus, the three-category dependent variable was obtained.

In this study, where the ordinal logistic regression analysis was used because the dependent variable had three categories and because there was an ordinal relationship between these categories, students with a high level of self-regulated learning strategy were taken as the "reference category." The coefficients obtained in accordance with this reveal the effect of students on the probability of having a high level of self-regulated learning strategy.

Data preparation. Before starting the logistic regression analysis, missing value and extreme value analyses were conducted. The five forms that had missing values as a result of the missing value analysis were excluded from the analysis. As a result of the extreme value analysis, the data outside the observed [−3, +3] interval for the general academic average and the academic efficacy variables were identified, and three forms were excluded from the analysis. The model was tested over a total of 826 data obtained at the end of the extreme values and missing values.

As the logistic regression analysis is very sensitive to high correlations between independent variables, there must not be a problem of multicollinearity between the variables. Multicollinearity arises when the correlations between variables is high ($r > .90$) (Tabachnick & Fidell, 1996). In the present study, there was no multicollinearity because the correlation values were $< .90$.

For the dependent variable, there also must not be a problem of multicollinearity between independent variables. In order to validate this assumption, the tolerance and Variance Inflation Factor (VIF) values were calculated. It is expected that the tolerance value is greater than .02 and that the VIF value is smaller than 10 (Field, 2009, p. 242; Kalaycı, 2010, p. 267). Examining whether there is a multicollinearity problem between the independent variables for the dependent variable, this assumption is validated. The tolerance and VIF values for the predictor variables are given in Table 3.

Table 3
Results of the Multicollinearity Assumption between Independent Variables

Variables	TOLERANCE	VIF
Gender	0.905	1.104
Academic self-efficacy	0.971	1.030
General academic average	0.914	1.095

When Table 3 is examined, it is seen that the tolerance value was .905 for the gender variable, .971 for the academic self-efficacy variable, and .914 for the general academic average variable; all were greater than .02. The VIF values were 1.104 for the gender variable, 1.030 for the academic self-efficacy variable, and 1.095 for the general academic average variable; all were less than 10. Thus, the relevant assumptions were validated.

An important assumption in the ordinal logistic regression analysis is the parallelism assumption. When determining the most appropriate logit models, the number of which must be the binary combinations of the number of categories and the parallelism of the models to each other are analyzed (Özdamar, 2013, p. 526). In the parallelism assumption, there is the requirement that the estimated values of the parameters must pass through the same intercept (Akın & Şentürk, 2012, p. 189). The chi-square test was used to test the validity of the parallelism assumption, and the results obtained are given in Table 4.

Table 4
Results of the Parallelism Assumption in the Ordinal Logistic Regression

Model	−2 Log likelihood (−2LL)	χ^2	df	*p*
Null Hypothesis	1375.981			
General	1369.420	6.561	3	.087

H_0 = Parameter estimates pass through the same intercept.
H_1 = Parameter estimates pass through different intercepts.
df: degree of freedom

It is seen in Table 4 that the parallelism assumption is validated as tested by the chi-square test ($\chi^2 = 6.561$, $p > .05$). This means that the H_0 hypothesis is supported, and the parallelism assumption of the model is validated. This shows that each category of the dependent variable of self-regulated learning strategies was equal. When the analyses of the assumption test results were generally assessed, it was determined that the Ordinal Logistic Regression Analysis can be applied.

Findings and Interpretation

This section covers the findings of the Ordinal Logistic Regression Analysis. The model fitness information table of the analysis gives the 2 log likelihood (−2LL) values for the model established without independent variables and that with independent variables. Table 5 presents the findings related to model fitness.

Table 5
Model Fitness Information

Model	−2 LL	χ^2	sd	*p*
Only the intercept	1497.083			
Final	1375.981	121.101	3	.000

On examining Table 5, it is seen that there was a significant difference between the model established with the independent variables and the initial model established without the independent variables ($\chi^2 = 1497.083 - 1375.981 = 121.102$, $p < .05$). This indicates the existence of a relationship between the dependent variable and the independent variables. In another stage, the goodness of the fit of the model was examined. Pearson evaluates the data fit of the model using the chi-square and deviation statistics and the difference between the observed and expected values (Şenel & Alatlı, 2014, p. 40). The test results for the goodness of the fit of the model are presented in Table 6.

Table 6
Results of the Goodness of Fit Test

	χ^2	df	*p*
Pearson	1326.979	1345	.632
Deviation	1281.962	1345	.889

H_0 = Model represents the data.
H_1 = Model does not represent the data

When Table 6 is examined, it is seen that the Pearson's chi-square value (χ^2 = 1326.979, $p > .05$) and the deviation chi-square value (χ^2 = 1281.962, $p > .05$) were not significant. This means that the H_0 hypothesis was supported and that the model was consistent with the data.

In the present study, the accuracy of the fit of the model was also tested by the pseudo-R^2 value. The pseudo-R^2 value aims to measure and assess the power of the relation between the dependent variable and the independent variables. The McFadden, Cox-Snell, and Nagelkerke R^2 statistics are the most used pseudo-R^2 statistics (Şenel & Alatlı, 2014, p. 41). The findings obtained in the analysis are given in Table 7.

Table 7
Results of the Pseudo-R^2 Value

Cox and Snell	Nagelkerke	McFadden
0.136	0.158	0.074

As can be seen from Table 7, the pseudo-R^2 values by Cox and Snell, Nagelkerke, and McFadden statistics were .136, .158, and .074, respectively. As the interpretation of Cox and Snell pseudo-R^2 value is difficult, the Nagelkerke value is considered (Field, 2009, p. 269), and this value shows that the percentage of the dependent variable is explained by the independent variables (Oruç & Özen Kutanis, 2015, p. 41). Because the R^2 value is not a good criterion in logistic regression analysis, it is

low in these analyses (Akın & Şentürk, 2012, p. 190). According to this, the level of explanation of the dependent variable by the independent variables was determined as 15.8%. Within the scope of the study, the dependent variables of gender, academic self-efficacy, and general academic average were considered; however, there are many other variables that may affect self-regulated learning strategies (motivation, behavior, the characteristics of the student and the teacher, the education levels of the parents, etc.) It should be stated that increasing the number of the independent variables may increase the existing level of explanation.

The Wald test must also be conducted to see whether the independent variables are significant. Testing the logistic regression analysis by the Wald statistic offers the advantage of finalizing this analysis with non-biased and non-deviating parameter findings (Çokluk, 2010, p. 1394). To interpret the model, the exponential of the Wald statistic was obtained to reveal the odds ratio. The odds ratio indicates how many times more or less is the likelihood of one event being investigated with respect to another event being investigated and is calculated by the equation *Odds ratio* = $e^{a+\beta} / e^{a} = e^{\beta}$" (Salmi, Desenclos, Grein, Moren, & Bremer, 2015). The results of the analysis conducted in accordance with this are given in Table 8.

Table 8
Expression of the Significances of the Model Parameters

Variables		β	Wald	Odds ratio (e^{β})	*p*
Dependent variable	1 (Low)	2.227	13.622		.000
	2 (Medium)	4.394	50.603		.000
Independent variable	Gender (0)	−0.673	19.280	0.5102	.000
	Gender (1)	0[a]			
	Academic self-efficacy	0.050	83.271	1.0513	.000
	General academic average	0.575	9.204	1.7771	.002

Examining the findings of the significance analyses of the model parameters reveals that the variables gender (p = .000), academic self-efficacy (p = .000), and general academic average (p = .002) are significant on self-regulated learning strategies. The parameter significance values corresponding to this statistic must be smaller than .05 (Akın & Şentürk, 2012, p. 190; Field, 2009, p. 259). It is stated that the parameter interpretation of the ordinal logistic regressions analysis is different and more complex than binary and multinomial logistic regression analysis, that the exponential of the estimated parameter values must be taken to interpret them, and that the reference categories should also be identified. That is to say, interpretation must be made according to the identified reference category. This way of exploring parameter significances is called the "interpretation according to the odds ratio" (Akın & Şentürk, 2012, p. 190; Garson, 2012, p. 44). Field (2009, p. 942) also suggests the interpretation according to the odds ratio. In line with this, the exponential values are calculated in Table 8, and the reference category for the gender variable was set as female students.

Field (2009, p. 786) mentions an increased ratio if the odds value is greater than 1 in the interpretation of the odds ratio, and a decrease ratio if the odds value is smaller than 1. According to this, the probability of the male students having high self-regulated learning strategies was .67 less with respect to female students. Considering the odds ratio of the gender variable, it is seen that the odds ratio was .5102, i.e., less than 1, and that male students had .51 times less self-regulated learning strategy with respect to female students. On the other hand, a one unit increase in academic self-efficacy variable increases the probability of self-regulated learning strategies being high by .050 units. Considering the odds ratio of the academic self-efficacy variable, it is seen that the odds ratio was 1.0513, i.e., more than 1. This reveals that one unit increase in academic self-efficacy variable increases the level of self-regulated learning strategies 1.05 times. Lastly, one unit increase in general academic average of the students increases the probability of self-regulated learning strategies being high by .575 units. Considering the odds ratio of the general academic average variable, it is seen that the odds ratio was 1.7771, i.e., more than 1, and that one unit increase in general academic average variable of the students increases the level of self-regulated learning strategies 1.78 times.

Results and Discussion

The purpose of this study was to reveal whether the low, medium, and high level self-regulated learning strategies of third year students of the Education Faculty of Cumhuriyet University can be predicted by the variables gender, academic self-efficacy, and general academic average.

Examining the results of the logistic regression analysis, it is seen that the gender, general academic average, and academic self-efficacy of the students predicted the self-regulated learning strategies at a significant level.

The literature screening revealed studies on variables influencing the self-regulated learning strategies of the students. Gender is an important variable of self-regulated learning strategies. The present study revealed that the female students used the self-regulated learning strategies more than the male students. The literature contains studies that similarly report that female students use the self-regulated learning strategies more than male students (Akkaya, 2012; Alçı & Altun, 2007; Çelik Ercoşkun & Köse, 2014; Erdoğan & Şengül, 2014; Kadıoğlu et al., 2011; Özkal & Sucuoğlu, 2013; Yüksel, 2013; Zimmerman et al., 1992). In a study by Üredi and Üredi (2005) conducted with students of the eighth grade, it is reported that male students use the self-regulated learning strategies more. Also, there are studies that report that gender does not cause a significant difference in the self-regulated learning strategy (Cebesoy, 2013; Gömleksiz & Demiralp, 2012; Sağırlı & Azapağası, 2009; Zimmerman & Martinez-Pons, 1990). The PhD thesis by

Altun (2005) revealed that scores of meta-cognitive self-regulation, regulation of time and study environment, effort regulation, strategies to seek help, and self-efficacy perception, which are learning strategies based on self-regulation, have different prediction orders in explaining success in mathematics. It was concluded that in explaining the success of males in mathematics, meta-cognitive self-regulation, regulation of time and study environment, and self-efficacy perception, which are learning strategies based on self-regulation, have positively significant effects, while in explaining the success of females in mathematics, only effort regulation strategy had a positively significant effect.

Another important variable of self-regulated learning strategy is academic self-efficacy. The present study determined that self-regulated learning strategies and academic self-efficacy show parallel changes. The literature survey revealed that students with high self-efficacy use self-regulation strategies more frequently (Zimmerman & Martinez- Pons, 1990). Students having self-regulation skills use more strategies and report a higher self-efficacy perception (Zimmerman, 1990). The study of Ocak and Yamaç (2013) concluded that self-efficacy directly predicted self-regulation strategies positively. Similarly, Pintrich (1999) determined that self-efficacy was positively related to self-regulation strategies, and that the students who believed that they could learn and trust their skills used self-regulation strategies more frequently. The studies conducted by Pintrich and De Groot (1990) and Virtanen et al. (2014) it was revealed that there was a relationship between self-efficacy and self-regulation. In another study by Israel (2007), a positive and medium-level relationship between self-efficacy and self-regulation strategies was reported. This can be interpreted as effective application of self-regulation strategies by the students depend on the development of self-efficacy perceptions on learning and performance (Schunk & Ertmer, 1999).

The last variable that has an effect on self-regulated learning strategy was the general academic average. The study determined that self-regulated learning strategies and general academic averages show parallel changes. The concept of self-regulation may predict academic success, and vice versa, academic success may predict the concept of self-regulation. The present study revealed the effect of general academic average variable on self-regulation strategies. As stated in the study by Turan and Demirel (2010), "successful students play a more active role in learning; they process new knowledge more effectively, relate the old knowledge and the new knowledge, regulate and transform the presented material, set targets for themselves, plan their strategies, and ask for help when needed." That is, successful students regulate their learning activities themselves (Bland, 2005). In addition to studies supporting the obtained result, there are also studies indicating the effect of the self-regulation concept on academic success. In the experimental study by Arsal (2009), identifying the effect of self-regulation teaching on academic success and attitude, it was determined that self-regulation has a positive effect on academic success. There are numerous studies indicating that the self-regulation strategy is a factor affecting

success (Akkuş İspir et al., 2011; Altun & Erden, 2013; Bembenutty, 2011; Bono & Bizri, 2014; Cheng, 2011; Üredi & Üredi, 2005, 2007). Yüksel (2013) revealed that there was a positive medium-level relationship between the self-regulation skill levels and success levels of teacher candidates. The study by Malpass et al. (1999) involving students attending secondary school determined a positive relationship between self-regulation and success in mathematics. The study by Altun (2005) involving university students determined a positive relationship between success in mathematics and learning strategies based on self-regulation and self-efficacy perception. Tekbıyık et al. (2013) concluded in their study that the self-regulation strategies used in science and technology courses were a significant predictor of the academic success in science and technology courses. Similarly, the experimental study by Israel (2007) determined that self-regulation training increased the success of the students on a science course. Duru et al. (2014), in their study in which they investigated into the relationships between exhaustion, academic success, and self-regulation, concluded that academic success was negatively related to exhaustion, and positively related to self-regulation. Supporting this finding, Zimmerman (1990) reported that learners having self-regulation learning strategies approached educational tasks ardently and with self-reliance, that they searched for and found the ways to be successful even if they encounter barriers such as poor study conditions and complex text books, and that they conducted deep research on a subject in the best way. According to this, it may be said that individuals with high levels of self-regulation skills also have a high level of success.

Recommendations

In line with the results of the study, the following recommendations were developed:

- The variables that have an effect on the self-regulation skills of university students attending different faculties and departments may be determined and comparative studies can be conducted.
- Studies at different educational stages and with different groups (teachers, students, lecturers, etc.) may be conducted to determine self-regulation skills.
- The self-regulation skills of the students based on courses can be investigated for comparative studies. This way, the analogous and different aspects of self-regulation skills in different courses may be revealed.
- It is maintained that in addition to quantitative data to determine which characteristics of the students have an effect on self-regulated learning strategies, using composite models involving qualitative and quantitative data, will provide a multi-dimensional assessment. At this dimension, the present study that used self-regulation, gender, academic self-efficacy, and success variables may be supported by qualitative studies (observation, interviews, etc.) for a deeper examination.

- It is maintained that experimental studies to develop self-regulated learning skills will contribute to this field. Learning environments based on self-regulation may be established to examine the proficiencies of teacher candidates to establish such environments. In addition, whether the course contents established would give rise to a difference in the self-regulation skills of the students may be studied.
- Seminars for the students may be organized to ensure that they develop self-regulation skills; research projects and homework may be more frequently assigned.
- The extent of the effect of undergraduate programs on the development of self-regulated learning strategies in students may be studied in more detail.
- Environments that will develop the self-regulation skills of the students may be established in undergraduate programs. For example, it is maintained that the establishment of environments where the students may express and discuss their feelings and ideas freely, where they can interact mutually, where they can be active in the learning process, where they can set targets for themselves and try ways to achieve them, where they can manage their own learning processes and ensure that they undertake responsibilities and make self-assessment will positively contribute the development of the self-regulation skills of the students. In addition, it is believed that investigating the effect of such environments on the academic success, self-efficacy, motivation, and attitude of the students will be useful.
- An optional course titled "Learning Based on Self-Regulation" may be recommended for undergraduate programs for the development of self-regulation skills of the students.
- In the present study, to total score of the scales used was taken into account. It is believed that in subsequent studies, separate investigations of the sub-dimensions of the scales will be useful.

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