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An Investigation intothe Factors of Turkish Secondary School Students' Learning Engagement in Science Courses

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Abstract

This study examines secondary school students' learning engagement in science courses concerning gender, grades, parents' educational level, tutor support, experimentation and study frequency. The research method was a cross-sectional survey. The research was conducted among 820 secondary school students from seven public schools in the southern region of Türkiyeduring the 2019-2020 academic year. The data collection tool was the Turkish version of the Students' Adaptive Learning Engagement in Science (SALES) Scale. Independent samples t-test, one-way ANOVA, and two-way ANOVA were used for data analysis. Consequently, it is found that female students were more engaged in science courses than male students, students who conducted experiments were more engaged than those who did not, and those who studied more frequently were significantly more engaged in science courses. Furthermore, a noteworthy discrepancy was identified in the Learning Goal Orientation scale among the grade levels. However, it has been determined that whether students receive tutor support or their parents' education levels have no statistical effect on their engagement in science courses.

INTRODUCTION

Science education, which is essential to the development of every nation globally, has sometroubles (Gilbert, 2006; Stocklmayeret al., 2010; Tytler, 2007).There are different ways to categorise these troubles.Tytler (2007) describes the troublesin science education under four main elements that are closely linked: the decrease in students' attitudes towards science since the secondary school years, the decline in participation in science courses, the lack of science-qualified human labour force and the lack of qualified science teachers. Especially in the secondary school period, students' attitudes towards science and their career plans for science begin to form (Speering & Rennie, 1996). It is essential to seek ways for students to increase their interest in science and engage them more in the science learning process to find solutions to these troubles. Of the attitudinal components, self-regulation and motivation are essential as they affect the students' engagement in learning.Studies indicate that students' successful learning engagement in science is primarily determined by their level of motivation and self-regulation in science learning (Boekaerts & Cascallar, 2006; Hanrahan, 2002; Kaplan et al., 2009; Velayutham et al., 2011; Zimmerman, 2000).

Student Engagement: Self-regulation and Motivation

Self-regulation

Self-regulation is the process of self-direction in which students convert their cognitive abilities into academic skills (Zimmerman, 2002a). There are a variety of definitions of self-regulation, but three components seem especially important (Pintrich & De Groot, 1990). First, self-regulation is students' metacognitive strategies that enable them to succeed in academic tasks by regulating their cognition (Pintrich, 1999; Zimmerman & Pons, 1986). Second, self-regulated learning manages and controls the students' efforts on academic tasks (Corno, 1986). Third, self-regulating learning helps students use basic cognitive strategies to learn, understand, and remember the learning material (Zimmerman & Pons, 1988). Students who are able to use self-regulation strategies may be more actively engaged in learning because they are more aware of their own strengths and limitations, set goals, and use subject-specific strategies (Zimmerman, 2002b).

Motivation

Motivation refers to the reasons behind the behavior, which ischaracterized by willingness and volition (Lai, 2011). Motivation stimulates and encourages behaviour, directs behaviour, maintains behaviour to persist, and prefers a particular behaviour (Wlodkowski, 1978, p.12). Many theories explain the motivation to learn (Schunk et al., 2014). Goal orientation theory (also called achievement goal theory) specifically explains students' learning and performance on academic tasks or in school and hardly on academic choice (Elliot et al., 1999; Neuville et al., 2007; Pintrich, 2000). The expectancy-value theory explains how students value the task assigned to them, their belief that they will do the task in the best way, their insistence on performing the task, and their performance (Wigfield, 1994; Wigfield & Eccles, 2000). Social cognitive theoryrefers to interactions with other people and behavioural and environmental factors that affect human performance and learning (Cook & Artino, 2016).

Although there are many theories to explain human motivation, it can be claimed that motivation has three components: Learning goal orientation (a factor of goal orientation theory), task value (a factor of expectancy-value theory), and self-efficacy (a factor of social cognitive theory) (Zimmerman, 2002). Learning goal orientation is concerned with the development of students' competencies. It also focuses on helping students to understand, learn and specialise in their tasks (Ames, 1992; Dweck & Leggett, 1998). According to learning goal orientation, students evaluate their learning processes for their own merits (Zimmerman, 2002). The task value component refers to students' perceptions of the interest, usefulness, importance and cost of a learning activity (Eccles & Wigfield, 1995; Neuville et al., 2007; Wigfield, 1994; Wigfield & Eccles, 1992). According to this theory, students' valuing the tasks assigned to them enables them to understand better, learn about that task (Wolters et al., 1996), and thus increase their achievement (Velayutham et al., 2011). Self-efficacy is a person's belief that they can do something in a subject (Zimmerman & Cleary, 2006). Furthermore, self-efficacy is highly correlated with self-regulation (Pajares, 2002). Self-regulation, like self-efficacy, is a factor of social cognitive theory. In social cognitive theory, self-efficacy is the most important driving force for motivation. This theory explains the factors affecting self-efficacy and supports self-regulated learning. Meanwhile, self-regulation, like self-efficacy, is a component of social cognitive theory (Cook & Artino, 2016).

In literature, some studies examine perceptions of engagement in terms of some variables in science education. In this regard, the studies conducted with gender (İrven & Şenler, 2017; Ongowo & Hungi, 2014; Örücü, 2019; Tang & Neber, 2008; Velayutham et al., 2012); grade level (Ongowo & Hungi, 2014; Örücü, 2019; Tang & Neber, 2008); culture (Neber et al., 2008; Pasha-Zaidi et al., 2019; Tang & Neber, 2008), teaching and learning approach (Bedford, 2017). Studies examining the gender variable have shown that gender does not significantly affect perceptions of engagement. For example, İrven and Şenler's (2017) study with 4th-grade students, Ongowo and Hungi's (2014) and Tang and Neber's (2008) studies with high school students, and Örücü's (2019) study with teacher candidates concluded that gender was no influential variable on students' perceptions of engagement in education. The studies investigating the effect of grade level on students' motivational beliefs and self-regulation skills in science learning have produced mixed results. For example, in Tang and Taber's (2008) study, the grade level does not affect the students' motivational beliefs and self-regulation skills (except for the Effort Goal sub-scale, which is a scale of Goal Orientations scale), while in Ongowo and Hungi (2014)'s study, it was observed that there was a difference between grade levels.

In reviewing studies on the effects of different variables; Örücü (2019) also examined the effects of type of high school graduation, parents' income and education level, weighted grade point average, and computer and internet connection status on perceptions of engagement.Consequently, it was concluded that as the weighted grade point averages of the pre-service teachers increased, their self-regulation increased, and their motivation toward science showed a significant difference according to whether they had an internet connection. However, it was understood that high school graduate, parent income, and parent education level variables have any statistically effect on perceptions of engagement in science learning. In another similar study, Velayutham and Aldridge (2013) investigated the effects of student cohesiveness, participation, inquiry, teacher support, cooperation, task orientation and equity variables on high school students' perceptions of engagement in science learning. The study concluded that the variables of student cohesiveness, investigation and task orientation were the most effective predictors of students' motivation components (learning goal orientation, science task value and self-efficacy) and self-regulation in science learning.

In Türkiye, students make their field selection at the end of the 9th grade of high school (Ministry of National Education, MoNE, 2004). Field selection is an important step in the current Turkish education system, serving as a prerequisite for choosing a university subject and career path, and it is worth noting that this decision has significant implications for their future. High school students in Turkey can choose from four fields: mathematics-science, Turkish-mathematics, Turkish-social studies, or foreign language (Sığın & Sarıçam, 2022). There is a need for research into the various factors that influence students' engagement in science learning before students maketheir field selection.There is limited research on the factors that influence high school students' engagement in science learning (Örücü, 2019). However, no studies have yet been identified at the secondary school level. Therefore, this study investigates the effects of many variables on secondary school students' engagement in science learning. In this regard, the following research questions have been sought:

1. Does the secondary school students' engagement in science learning significantly change regarding gender?
2. Does the secondary school students' engagement in science learning significantly change regarding the grade level?
3. Does the secondary school students' engagement in science learning significantly change regarding the parents' education level?

4. Does the secondary school students' engagement in science learning significantly change regarding tutor support?
5. Does the secondary school students' engagement in science learning significantly change regarding experimenting?
6. Does the secondary school students' engagement in science learning significantly change regarding the studying frequency?

METHOD

Study Design

This study isa cross-sectional, one of the descriptivesurvey designs, which isnon-experimental quantitative research (Fraenkel et al., 2012). In this design, a snapshot of the sample is obtained by collecting the data from the sample group for one time (Creswell, 2012). This 'snapshot' provides researchers with either retrospective or prospective research (Cohen et al., 2007). This study aimed to investigate how grade level and other variables influence secondary school students' engagement in science learning. A cross-sectional design was chosen, as opposed to longitudinal research, because it allowed for a timely assessment of the current situation of those participating (Creswell, 2012).

Study Group/Partipicants

820 Turkish secondary school students attending the autumn semester of 2019-2020 participated in the study. The sample included 438 (53.4%) female and 382 (46.6%) male students aged 11-13, in grades 5 to 8, from seven public schools located in two cities in the southern part of Türkiye. The convenience sampling method was employed. The students were informed of the study's objectives before their inclusion. The study protocol specified that participant identities would remain anonymous and only voluntary participation would be accepted. Data was collected solely from volunteers, and all participants were assessed using the same measurement tool.

Data Collection

An adapted Turkish version (Yetişir & Ceylan, 2015) of the original Students' Adaptive Learning Engagement in Science questionnaire (SALES), originally developed by Velayutham et al. (2011), was used to evaluate student perceptions of their engagement in science courses. The SALES identify key determinants of student engagement, motivation and self-regulation. The SALES has 32 items in four scales, Learning Goal Orientation, Task Value, Self-Efficacy, and Self-Regulation. The SALES is a five-point Likert questionnaire, ranging from strongly disagree to strongly agree. Each scale has an equal number of items, and the Cronbach Alpha value of each factor is over 0.90 (Velayutham et al., 2011). In this study the Turkish version of SALES was used. This version has four scales, each one eight items as the original scale (Yetişir & Ceylan, 2015). In this study, Cronbach's Alpha reliability values were computed as $\alpha = 0.95$ for overall SALES; $\alpha = 0.84$ for the Learning Goal Orientation scale, $\alpha = 0.83$ for the Task Value scale, $\alpha = 0.83$ for the Self-efficacy scale, and $\alpha = 0.89$ for the Self-regulation scale.

Furthermore, the personal information form prepared by the researcher was utilised to get information about students' gender, grades, education status of parents, the presence of someone to help with studying, experimenting in the course, internet access, studying frequency, participation level to science course, level of finding the course difficult.

Data Analysis

Descriptive statistics and inferential analysis methods, using SPSS 26 software, were used to analyse the data in this study. The independent sample t-test, one-way ANOVA, and two-way ANOVA, which are inferential analysis methods, were used. Descriptive statistical analysis was used to determine whether students' scores at each factor level were normally distributed. This was done by examining the normal distribution analysis of the overall scale scores at each factor level. The mean (M), kurtosis, skewness, standard deviation (sd) and histogram plots were analysed within the defined ranges to interpret the study (see Table 1). The descriptive statistics process concluded that the data were normally distributed.

Tablo 1. *Mean, Standard Deviation, Skewness and Kurtosis Indexes for Each Scale and Overall of the SALES*

Scale	Mean	sd	Skewness	Kurtosis
Learning Goal Orientation	4.33	0.68	-1.214	1.346
Task Value	4.10	0.74	-0.698	-0.028
Self-efficacy	4.14	0.74	-0.903	0.758
Self-regulation	4.21	0.77	-1.087	1.036
Overall SALES	4.19	0.64	-0.778	0.033

sd=standard deviation

Table 1 shows that the skewness and kurtosis values of all scales and overall SALES are between -1.5 and +1.5. The fact that the skewness and kurtosis values are between -1.5 and +1.5 indicates that the data is normally distributed (Tabachnick & Fidell, 2013).

FINDINGS

Influence of Gender on Engagement

The t-tests were carried out in order to determine the significant differences exist between female and male students' mean values obtained from the Learning Goal Orientation, Task Value, Self-efficacy and Self-regulation scales and overall SALES. The descriptive statistics of the SALES scores and t-test results obtained from different genders are presented in Table 2.

Table 2. *Descriptive Statistics and T-test Results for Each Scale and Overall of the SALES by Gender*

Scale	Groups	n	M	sd	df	t	p
Learning Goal Orientation	Female	438	4.42	.63	818	4.194	.000
	Male	382	4.22	.72			
Task Value	Female	438	4.22	.67	818	5.409	.000
	Male	382	3.95	.78			
Self-efficacy	Female	438	4.22	.66	818	3.339	.001
	Male	382	4.04	.82			
Self-regulation	Female	438	4.34	.66	818	5.299	.000
	Male	382	4.05	.85			
Overall SALES	Female	438	4.30	.57	818	5.222	.000
	Male	382	4.07	.70			

Table 2 indicates that female students had higher mean scores than male students, and these differences were statistically significant for all scales and overall SALES. There were significant differences in Learning Goal Orientation [$t_{(822)}$=4.067, p<.01], Task Value [$t_{(822)}$=5.403; p<.01], Self-efficacy [$t_{(822)}$=3.417; p<.01], Self-regulation [$t_{(822)}$=5.334; p<.01] and overall SALES [$t_{(822)}$=5.245; p<.01] scores for female and male students, in favour of females. These results showed that girls were more motivated and self-regulated than boys in science learning.

Influence of Grade Level on Engagement

One-way ANOVA was applied in order to see whether students' SALES scores differ significantly accordingly to their grades. Table 3 presents the descriptive statistics of the SALES scores and one-way ANOVA results based on students' grade levels.

Table 3. *Descriptive Statistics and ANOVA Results for Each Scale and Overall of the SALES by Grade Level*

Scale	Grade	n	M	sd	df1	df2	F	p	Description (Tamhane)
Learning Goal Orientation	5	67	4.02	.79	3	186	5.428	.001	6>5
	6	187	4.34	.73					7>5
	7	241	4.34	.67					8>5
	8	325	4.38	.61					
Task Value	5	67	3.96	.81	3	186	1.991	.114	-
	6	187	4.20	.78					
	7	241	4.08	.72					
	8	325	4.08	.70					
Self-efficacy	5	67	3.92	.74	3	186	2.232	.083	-
	6	187	4.14	.83					
	7	241	4.13	.69					
	8	325	4.18	.72					
Self-regulation	5	67	4.02	.82	3	186	1.896	.129	-
	6	187	4.25	.78					
	7	241	4.18	.76					
	8	325	4.24	.74					
Overall SALES	5	67	3.98	.69	3	186	2.906	.034	-
	6	187	4.23	.71					
	7	241	4.18	.64					
	8	325	4.22	.58					

Table 3 indicates that ANOVA did not reveal any statistical differences between the Task Value scale [$F_{(3\text{-}816)}$=1.991; p>.01], The Self-efficacy scale [$F_{(3\text{-}816)}$=2.232; p>.01], and the Self-regulation scale [$F_{(3\text{-}816)}$=1.896; p<.01], and overall SALES [$F_{(3\text{-}816)}$=2.906; p<.05] of the students' mean scores in terms of their grade levels. However, the difference between the Learning Goal Orientation scale [$F_{(3\text{-}816)}$=5.428; p<.01] of the students was statistically significant at .01 level regarding the students' grade levels. Post-hoc comparisons using the Tamhane test indicated statistically significant differences between the scores of 6th and 5th graders, between 7th and 5th graders, and between 8th and 5th graders in favour of the 6th, 7th, and 8th graders at the Learning Goal Orientation scale.

Influence of Parents' Education Levels on Engagement

To examine the interaction effect of mother's education level and father's education level on motivation beliefs and self-regulation skills in science learning, Two-way ANOVA was employed. Table 4 shows the mean scores of SALES variables by parents' education of students, and Table 5 presents the two-way ANOVA results.

Table 4. *The Mean Scores of Each Scale and Overallof the SALES by Parents' Education Levels*

Parents	Scale	Mean				
		None	Primary	Secondary	High	University
Mother Education Level	Learning Goal Orientation	4.15	4.29	4.35	4.36	4.41
	Task Value	3.96	4.04	4.13	4.15	4.12
	Self-efficacy	3.97	4.12	4.14	4.18	4.17
	Self-regulation	4.02	4.14	4.22	4.31	4.27
	Overall SALES	4.03	4.15	4.21	4.25	4.24
Father Education Level	Learning Goal Orientation	4.14	4.33	4.30	4.37	4.34
	Task Value	3.81	4.04	4.11	4.12	4.15
	Self-efficacy	3.91	4.08	4.14	4.16	4.21
	Self-regulation	3.95	4.12	4.18	4.28	4.27
	Overall SALES	3.95	4.14	4.18	4.26	4.24

Table 4 shows that as the students' maternal education levels increase, the mean values of the Learning Goal Orientation scale increase regularly. After a regular increase in the Task Value scale, the Self-efficacy scale, and the Self-regulation scale and overall SALES's mean scores until high school, there is a slight decrease in the mean values of university-educated students. Furthermore, as the students' fathers' education levels increase, the mean values of the Task Value and Self-efficacy scales increase regularly. After a regular increase in the Learning Goal Orientation scale and Self-regulation scale and overall SALES's mean scores until high school, there is a slight decrease in the mean scores of university-educated students.

Table 5. *Two-Way ANOVA Results for Each Scale and Overall of the SALES by Parents' Education Levels*

Variable	Grade Level	Sum of Squares	df	Mean Square	F	p
Learning Goal Orientation	Mother Edu. Level (A)	3.688	4	0.922	1.999	.093
	Father Edu.level (B)	2.322	4	0.581	0.259	.285
	A*B	7.403	16	0.463	1.003	.451
Task Value	Mother Edu. Level (A)	2.711	4	0.678	1.236	.294
	Father Edu.level (B)	4.026	4	1.006	1.835	.120
	A*B	7.399	16	0.462	0.843	.636
Self-efficacy	Mother Edu. Level (A)	2.237	4	0.559	1.012	.400
	Father Edu.level (B)	2.519	4	0.630	1.140	.337
	A*B	10.232	16	0.639	1.157	.298
Self-regulation	Mother Edu. Level (A)	1.161	4	0.290	0.494	.740
	Father Edu.level (B)	2.326	4	0.582	0.990	.412
	A*B	9.139	16	0.587	0.972	.485
Overall SALES	Mother Edu. Level (A)	2.134	4	0.534	1.294	.271
	Father Edu.level (B)	2.408	4	0.602	1.460	.213
	A*B	6.138	16	0.384	0.930	.534

As seen in Table 5, there was no interaction effect of mother's education level and father's education level on overall SALES[F= 0.930, p>.05] and all scales; Learning Goal Orientation [F=1.003, p>.05], Task Value [F=0.843, p>.05], Self-efficacy [F=1.157, p>.05], Self-regulation [F=0.972, p>.05].

Influence of Tutor Support on Engagement

The independent t-test was conducted to determine whether teacher support had an impact on students'perceptions of engagement. Table 5 presents the descriptive statistics of all scales and overall SALES and t-test results.

Table 6. *Descriptive Statistics and t-test Results for Each Scale and Overallthe SALES by Tutor Support*

Scale	Groups	n	M	sd	df	t	p
Learning Goal Orientation	No	270	4.30	.70	734	-.844	.399
	Yes	466	4.34	.66			
Task Value	No	270	4.06	.75	734	-.804	.421
	Yes	466	4.10	.72			
Self-efficacy	No	270	4.11	.77	734	-.573	.566
	Yes	466	4.14	.72			
Self-regulation	No	270	4.16	.80	734	-.837	.403
	Yes	466	4.21	.75			
Overall SALES	No	270	4.16	.66	734	-.875	.382
	Yes	466	4.20	.62			

Table 6 displays that all scale and overall SALES mean scores of students who receive and do not receive private tutoring support are closely similar.According to the results of the independent t-test, there were no significant differences in Learning Goal Orientation [t(734)=-,844 p>.01], Task Value [t(734)=-.804; p>.01], Self-efficacy [t(742)=-.573; p>.01], Self-regulation [t(734)=-.837; p>.01] and overall SALES [t(734)=-.734; p>.01] scores for students who did and did not have tutor support.

Influence of Experimenting on Engagement

To determine whether there were significant differences between students' mean scores who were doing experiments and not were obtained from allscales and overall SALES; independent t-tests were enforced. The results are shown in Table 7.

Table 7. *Descriptive Statistics and T-test Results for Each Scale and Overall the SALES by Experimenting*

Scale	Experiment	n	M	sd	df	t	p
Learning Goal Orientation	No	314	4.26	.71	808	2.239	.025
	Yes	496	4.37	.66			
Task Value	No	314	4.01	.77	808	2.710	.007
	Yes	496	4.15	.71			
Self-efficacy	No	314	4.02	.80	808	3.593	.000
	Yes	496	4.21	.69			
Self-regulation	No	314	4.08	.83	592.196	3.500	.000
	Yes	496	4.28	.72			
Overall SALES	No	314	4.09	.68	808	3.499	.000
	Yes	496	4.25	.61			

As seen in Table 7, according to the results of the independent t-test, statistically significant differences were detected in the Task Value [$t_{(808)}$=2.710; p<.01] scale, The Self-efficacy [$t_{(808)}$=3.593; p<.01] scale, and the Self-regulation [$t_{(592.196)}$=3.500; p<.01] scale of the students who did and did not experiment. However, statistically significant differences were not found only in theLearning Goal Orientation [$t_{(808)}$=2.239, p>.01] scale of the students who did and did not experiment.

Influence of Studying Frequency on Engagement

One-way ANOVA was conducted to see whether students' SALES scores differ significantly according to their studying frequency in the science course. Table 8 presents the descriptive statistics of the SALES scores and one way ANOVA results based on students' studying frequency in the science courses.

Table 8. *Descriptive Statistics and ANOVA Results for Each Scale and Overall the SALES by Studying Frequency*

Scale	Studying Frequency	n	M	sd	df1	df2	F	p	Description
Learning Goal Orientation	1	239	4.49	.64	4	797	12.361	.000	1>3, 1>4, 1>5, 2>4 2>5
	2	334	4.37	.64					
	3	108	4.20	.71					
	4	77	4.09	.72					
	5	44	3.88	.70					
Task Value	1	239	4.34	.66	4	797	18.393	.000	1>2, 1>3, 1>4, 1>5, 2>4
	2	334	4.11	.70					
	3	108	3.93	.73					
	4	77	3.66	.74					
	5	44	3.74	.90					
Self-efficacy	1	239	4.29	.72	4	797	11.524	.000	1>3, 1>4, 1>5, 2>4 2>5
	2	334	4.20	.70					
	3	108	3.98	.80					
	4	77	3.82	.73					
	5	44	3.73	.73					
Self-regulation	1	239	4.41	.70	4	797	19.639	.000	1>3, 1>4, 1>5, 2>3 2>4, 2>5
	2	334	4.28	.65					
	3	108	3.96	.90					
	4	77	3.74	.87					
	5	44	3.81	.84					
Overall SALES	1	239	4.38	.60	4	797	19.241	.000	1>3, 1>4 1>5, 2>3 2>4, 2>5
	2	334	4.24	.58					
	3	108	4.02	.68					
	4	77	3.83	.67					
	5	44	3.79	.66					

Note: 1=Every day, 2=Two days apart, 3=One day per week, 4=Just before the exam, 5=Never

Table 8 reveals that the mean scores of all scales and overall SALES increased as the frequency of students studying in science courses increased. Furthermore, Table 7 indicates that ANOVA reveals statistical differences between the Learning Goal Orientation scale [$F_{(4-797)}$=12.361; p<.01], Task Value scale [$F_{(4-797)}$=18.393; p<.01], Self-efficacy scale [$F_{(4-797)}$=11.524; p<.01], Self- regulation scale [$F_{(4-797)}$=19.639; p<.01], and overall SALES [$F_{(4-797)}$=19.241; p<.01] of the students' mean scores statistically significant at .01 level regarding in terms of the students' studying frequency in the science courses. In order to see the rationale of these differences the Scheffe test (Learning Goal Orientation scale, Self-efficacy scale, and overall SALES) and the Tamhane test (Task Value scale and Self-regulation scale) were performed. For all scales and overall SALES's scores, this analysis shows that there were statistically significant differences between the scores of students who studied every day and those who studied once a week, between the scores of students who studied every day and those who studied only just before the exam, and between the scores of students who studied every day and those who never studied, in favour of the students who studied every day; between the mean scores of students who studied two days apart and those who studied just before the exam, in favour of the students studied two days apart. Furthermore, statistically

significant differences were found between the mean scores of students who studied two days apart and those who did never study, in favour of the students who studied two days apart in all scales except the Task Value scale and SALES overall scores. In addition, it was found that there were statistically significant differences between the scores of students who studied every day and those who studied two days apart, in favour of the students who studied every day for the Task Value scale. There were statistically significant differences between the scores of students who studied two days apart and those who studied one day per week, in favour of those who studied two days apart for the overall SALES.

CONCLUSION, DISCUSSION AND SUGGESTIONS

The present study, conducted with secondary school students, examines the effects of many variables on students' perceptions of engagement in science learning. Essentially, some findings support the results of previous studies, but new contributions have been made to science learning.

In the study, the effect of the gender variable was examined and it was revealed that secondary school students' perceptions of engagement differ according to gender. It was concluded that female students are statistically significantly higher on all scales and overall SALES engagement than male students in science courses. This finding is in contrast to some studies in the literature (Velayutham et al, 2012). It has been suggested in the past that boys may have a greater inclination and aptitude towards science and mathematics than girls and that cultural expectations, particularly gender stereotypes, may play a role in this discrepancy (Meece et al., 2006; Pajares &Valiante, 2001). However, the opposite result that emerged in this study is essential because it indicates that these cultural norms have begun to collapse.

Furthermore, except for the Learning Goal Orientation scale, it was observed that grade level was not statistically significant in students' perceptions of engagement in science courses in all scales and overall SALES. According to a post-hoc comparison, in the Learning Goal Orientation scale, there were significant differences between the 5th grade and the other grades in favour of the 6th, 7th, and 8th grades. In improving students' motivation, Learning Goal Orientation focuses more on understanding, learning and mastering their tasks (Ames, 1992; Dweck & Leggett, 1998). It is thought that the reason why the average of 5th-grade students is low in the Learning Goal Orientation scale is that the students cannot specialize in this field sufficiently since they are at the beginning of the secondary school process. This result is similar to the result obtained by Tang and Neber (2008). In Tang and Neber's (2008) study, a significant difference was detected only in the Effort Goal sub-scale of the Goal Orientation scale of 10th and 12th-grade students.

The other conclusion of the study relates to the effect of parents' education levels. According to this conclusion, students' perceptions of engagement in science learning did not show a statistically significant difference according to the educational levels of their parents. It is observed that as the education level of the student's parents increases (up to high school education), there is generally a regular increase in the mean score of all scales and overall SALES of the students. However, it was determined that there was a slight decrease in some scales (except Learning Goal Orientation scale in mother's education; Task Value scale and Self-efficacy scale in father's education) and overall SALES average values of students whose parents were university graduates. This result is similar to the study conducted by Örücü (2019).

In the study, students were asked whether they received tutor support from a peer, parents, sister or brother, and more than half of them stated that they received any tutor support in science learning. Although all the scales and overall SALES' mean scores of students with tutor support were higher than those without tutor support, a statistically significant difference was not found between the mean scores of students with and without tutor support in students' perceptions of engagement in science learning.

In the study, students were asked whether experiments were carried out in science courses and found that more than half of the students had done so. It was observed that the overall SALES' mean scores of the students who experimented were higher than those of the students who did not experiment in all the scales of SALES. It was concluded that the difference was statistically significant at the 0.01 level in all scales and overall SALES except the Learning Goal Orientation scale.

Additioanally, in the study, students were asked how often they studied science courses. According to the findings, as the frequency of students studying science increases, there is an increase in all scales and overall SALES' mean scores. As a result, as students' frequency of studying in science increases, their perceptions of engagement also increase. It has been observed that students who study every day have the highest motivation beliefs and self-regulation skill levels. This case shows us how important it is to study science regularly every day. It seems important to encourage students to increase the frequency of studying in science classes.

In conclusion, this study contributes to the relevant literature by investigating the effects of some variables on secondary school students' perceptions of engagement in science learning. The study concluded that secondary school students' gender, grade level (on only the Learning Goal Orientation scale), experimentation (only in all scales and overall SALES except the Learning Goal Orientation scale), and study frequency significantly influenced perceptions of engagement in science learning. Furthermore, the study concluded that the education level of the parents of the students and tutor support had positive effects, although they were not significant.

Finally, some suggestions have been made to researchers and science teachers. For science teachers, the essential thing in this regard is to help students gain the habit of studying regularly. Teachers should conduct experiments in science classes and have students do them. These recommendations can be helpful for science teachers in guiding their students to develop the perceptions of engagement necessary to engage in science learning. To further enhance the validity of the results, it is suggested that future researchers undertake qualitative research on the variables that impact students' motivation beliefs and self-regulation skills, which were quantitatively analyzed in this study. For this, semi-structured interviews can be conducted with as many students as possible. Moreover, researchers could conduct longitudinal studies to understand how and why some variables change (e.g. grade level, gender and experimenting) in the students' perceptions of engagement.

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