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Factors Predicting Middle School Pupils' Learning Orientations: A Multilevel Analysis

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Abstract
Investigating on what school- and student-level factors are related to pupils' learning orientations was the main purpose of this study. The study used a sample of 2917 middle school pupils across Turkey. The Test of Science Related Attitude, Learning Approach Questionnaire and the Achievement Motivation Questionnaire were utilised as data collection tools. Analysis revealed that there were significant differences in pupils' learning orientations with respect to both meaningful learning orientation and rote learning orientation. When learning and motivational factors were examined it was found that performance goal orientation and learning goal orientation positively contributed to both meaningful learning and rote learning orientations. Upon examination of sub-dimensions of attitudes toward science, it was determined that the adaptation of scientific attitudes and leisure interest in science made positive and significant contributions to meaningful learning orientation while enjoyment of science lessons contributed to students' meaningful learning orientation negatively. With respect to rote learning orientation, both adaptation of scientific attitudes and enjoyment of science lessons negatively contributed.

Keywords: Students' Learning Orientations, Attitude Toward Science, Motivational Goal Orientation, Hierarchical Linear Modeling (HLM), Student and School Level Factors

1. Introduction

1.1 Introduce the Problem

Objectives of science education include improving scientific process skills, imparting life skills by adopting a research and investigation approach while discovering the nature, bringing in the skill to solve problems that might come about in daily life, helping students understand how scientific information is created and through which processes and how it is used in different situations, arising curiosity and interest on natural events, and developing positive attitude towards science. Science education programmes with a holistic approach are structured so that learners are responsible for their own learning and actively participate in the learning process through researching, investigating, and transforming information to product learning is encouraged and guiding. Learning approach of students is one of the important factors whereby science education achieves its targets

(MoNE, 2018). Learning orientation is categorized as meaningful learning orientation or rote learning orientation (Bou Jaoude, 1992; Cavallo, 1996; Cavallo, Rozman, & Potter, 2004; Cavallo, Rozman, Larabee, & Ishikawa, 2001).

Students with a rote learning orientation tend to read up on a topic on science (for instance electrical circuits) carefully from the text book, read and memorise passages word by word and remember the entire subject and concepts. When they are asked to define concepts and answer certain questions based on information, they give correct answers. For instance, they can list materials required to construct install an electric circuit. However, they cannot use information they have learned to solve problems. Such students also cannot sufficiently answer open-ended questions that require transferring information learned to new situations. This learning orientation is labelled rote learning orientation (Mayer, 2002). Students with meaningful learning orientations read a science subject (for instance electrical circuits) carefully from text book and understand. In contrast, students' with meaningful learning orientations read up on a science topic with understanding. They remember the entire subject and concepts. Such students can use information they learned to solve problems, create possible solutions, and transfer information they learned to new situations. This learning orientation is labelled meaningful learning orientation (Mayer, 2002).

In constructivist learning environment learners mentally combine new information with existing information to organize them in a meaningful manner. In rote learning which is the direct opposite, the goal is to add new information to existing information stored in the memory. Meaningful learning is accepted to be an important purpose in education (Ahmed and Ahmad, 2017; Hamm & Robertson, 2010, Hasnoor, Ahmad and Nordin, 2013, Mayer, 2002). Promoting *retention* and promoting *transfer,* which indicates meaningful learning when achieved, are two of the most significant educational goals. *Retention* could be described as the aptitude recall material sometime later close to the manner it was introduced in instruction. *Transfer* could be described as the aptitude to use information learned to figure out new issues, respond to new problems, or assist with capturing new material (Meyer, 2002; Mayer & Wittrock, 1996). According to Biggs (1987), regarding relationship of students with learning, it is possible to mention two elements: learning motivation and environmental influence (as cited in Ahmed and Ahmad, 2017), namely the learning environment is a critical factor in this regard. Bandura drew Motivational goals from social cognitive theory. According to Bandura, goal-setting constitutes an important motivational process. Peers or academic achievement could impact motivation goals of students (Pintrich & Schunk, 2002).

Vision of the new science program is to make all students science literate. Therefore, the new science curriculum supports a constructivist learning environment and teaching based on questioning. Suggested activities in science curriculum encourage students to research and learn ways of gathering information in a student-centered learning environment. Meaningful learning orientation and determination of its predicting factors are important in terms of development of analysis and synthesis skills towards such purposes by students and integrate their learnings to daily life.

The literature contains numerous studies exploring the relationship among learning orientation, motivational goal, science achievement, attitude toward science, and also there are studies discussing factors predicting these variables (Hacıeminoğlu, 2016; Bou Jaoude, 1992; Cavallo, 1996; Cavallo et al., 2001; Cavallo, Rozman, Blickenstaff and Walker 2003; Cavallo et al., 2004; Chan and Lai, 2008; Guo and Leung, 2021; Ho and Hau, 2008; Kaplan and Midgley, 1997; Kizilgunes, Tekkaya and Sungur, 2009; Kang, Scharmann, Noh and Koh, 2005; Ozkal, 2007). In the study Özkal (2007) conducted with 1152 eight graders, the author studied the extent to which attitude towards science, epistemological beliefs, prior knowledge, perceptions of constructivist learning environment and gender predicted learning orientation of pupils. The results were analyzed using multiple regression analysis. Attitude towards science, prior knowledge, epistemological beliefs and constructivist learning environment contributed significantly to both meaningful learning orientation and rote learning orientation. Among these variables what predicted learning orientation more was attitude towards science for both meaningful learning orientation and rote learning orientation. Purpose of the study Chan and Lai (2008) conducted with 1381 Hong Kong secondary students attending schools in rural and urban areas was to propose a structure model that demonstrated the relationship between learning goal orientation mastery, goal orientation, and learning strategies. Results of this study demonstrated that while academic achievement learning had a positive relationship with goal orientation and performance goal orientation, it had a negative relationship with performance avoidance goal orientation. In addition, while meaningful learning orientation (deep strategy) has a positive relationship with academic achievement, rote learning orientation had a negative relationship with academic achievement. Path analysis results showed that learning goal orientation and meaningful learning had a strong relationship with $\beta = 0.80$ value. While the relationship of performance-approach goals with rote learning strategy was moderately weak with $\beta = 0.24$ value, the same with meaningful learning strategy was insignificant with $\beta = 0.03$ value. On the other hand, while performance avoidance goal had a moderate level of relationship with rote learning orientation with $\beta = 0.43$ value, it had a moderate negative level of relationship with academic success with $\beta = -0.34$ value. Boz, Yerdelen-Damar and Belge-Can (2018) studied the relationship between learning approach, constructivist learning environment perceptions of 245 students at 6th, 7th, and 8th grades of secondary schools and their science achievements using structural equation modeling. While there was no direct relationship between gender and meaningful learning approach, there was a direct relationship between gender and rote learning. They found that male students preferred rote learning more than female students. No direct relationship was established between science achievements of students and meaningful learning approaches they used. However, a significant negative relationship was found between science achievements of students and their memorization based learning approaches. There was a significant positive relationship between constructivist learning environment perceptions of students and meaningful learning approaches they used and this relationship had a large effect size. One of the studies on this subject in recent years was conducted by Guo and Leung (2021). Purpose of the study was to create a relationship model between learning orientations, motivational goals, and mathematics successes of 532 Chinese students attending 5^{th} and 6^{th} grades in two separate regions. Structural Equation Modelling was used to propose the model regarding the variables. Results showed that the relationship between learning orientations, motivational goals, and mathematical successes of Chinese students studying in two different regions was similar. Results revealed that students' both meaningful and rote learning orientation was positively related to learning goal orientation and achievement in both samples. In addition, learning goal orientation was positively correlated with rote learning approaches of students in both samples. Findings Jiang and Liu (2005) (as cited in Guo and Leung, 2021) and Ho and Hau (2008) support these findings. It is considered that the reason why students in two different regions preferred memorization, meaning surface learning strategy was based on the cultural structure. In Chinese education system "memorization with understanding" (Ho & Hau, 2008; Leung, 2001) is considered to be an important teaching method. In addition, the proverb: "You can understand the book when you read it many times," motivates students to learn by memorizing. Thus, students displayed a positive attitude towards rote learning orientation and there was a positive relationship between their learning goal orientations and rote learning approach. On the other hand, the two groups (Han and Mia) have differences in terms of variables predicting meaningful learning orientations. While meaningful learning orientations of students in Han region were predicted by performance-approach goal orientation, it had not significant contributions to meaningful learning orientations of students in Mia region. In terms of cultural structure, students in Han region believe that if they would believe in everything in the books without using critical thinking, it is better to not read those books at all. Thus, they use meaningful learning orientation to achieve success with performance approach goal orientation. Another explanation of this consequence is that competition had a positive impact on learning processes of studentsint Han region. Students had to adjust to this competitive education system to be successful and internalized these exams. People living in Mio mountain area might be affected from such highly competitive imperial examinations to a lesser extent. Families of students in Mio region brought their children in a cooperative approach rather than competitive approach.

Such variables are mostly discussed in terms of student level variables while there are a small number of studies discussing in terms of school or classroom level variables. In addition, a few number of studies on variables predicting learning orientation were determined while studying students' learning orientation with nested data structure is important for education studies. Thus the aim of this study was to explore the school- and student-level factors are associated with student' learning orientations. The specific research questions were:
(1) Are there any differences among schools in terms of pupils' learning orientations?

(2) Which school-level factors are related to pupils' learning orientations?
(3) Which student-level factors are related to pupils' learning orientations?
(4) Whether school level factors predict pupils learning orientations and the strength of relations between pupils' learning orientations and student level factors with respect to learning orientations?

2. Method

2.1. Sample and Design of This Study

The overall design of this study is principally correlational and includes a cross-sectional survey. In order to describe the characteristics of a population, survey type of research is conducted by asking a set of questions. Besides, the relationships among two or more factors are determined using correlational type of research without any manipulations Fraenkel and Wallen (2003). This study used the convenience sampling method with sample that was formed of 2917 middle school pupils in different schools and cities of Turkey.

2.2. Instruments

Characteristics of the instruments were described in Table 1.

Table 1: Characteristics of the instruments

	Developed and used by	**Translated**	**Type and number of items**	**Reliability**
The Test of Science Related Attitude (TOSRA)	Fraser (1978)	Arisoy (2007)	5-point Likert-type 40 items and four dimensions	Cronbach alpha coefficients 0.78 (Fraser ,1978)
Adaptation of scientific attitudes	I like using new methods I have not used before in science classes			0.68
Enjoyment of science lessons	If there were no science classes, the school would have been more fun			0.83
Leisure interest in science	I like going to science museum on the weekends			0.84
Career interest in science	After I graduate from school, I would like to work with people making scientific discoveries			0.80
Learning Approach Questionnaire	Bou Joude (1992) and Cavallo and Schafer (1994)	Caliskan (2004)	4-point Likert scale 22 items and two dimensions (11 items for each dimensions)	0.81 (MLO) 0.76 (RLO)
Meaningful learning orientation (MLO)	I try to associate what I learn on one subject with what I learn on another			Hacıeminoğlu, Yilmaz-Tuzun & Ertepinar (2009) 0.77 (MLO)
Rote learning orientation (RLO)	I usually learn by memorizing, I repeat until I can remember all			Hacıeminoğlu, Yilmaz-Tuzun & Ertepinar (2009) 0.71 (RLO)
Achievement Motivation Questionnaire	Cavallo et al. (2004)	Caliskan (2004)	5-point Likert scale 14 items three dimensions	0.94(LGO) 0.82(PGO) 0.89 (SE)
Learning-goal orientation (LGO)	One of my main goals in this class is to learn something new whatever grade I receive			0.83
Performance-goal orientation (PGO)	One of my main goals in this class is to be more successful than other students			0.73
Self-efficacy (SE)	I have the necessary skills to solve problems like those we see in			0.75

	class	
School Background Information	OECD Publications (2004, p.316)	Hacıeminoğlu, Ertepinar, Yilmaz-Tuzun &Cakir (2015), Hacıeminoğlu (2019)
	School SES, parents' highest educational level, ability grouping between science classes, quality of school's physical infrastructure, and quality of school's educational resources were used as school level variables for this study.	

2.3. Data analyses

In this nested structure data sets students were nested in schools. Thus, in order to analyze the relationship between school-level factors and student-level factors and students' learning orientations, Hierarchical Linear Modeling (HLM) was utilized as data analyses technique. In case a traditional linear model was used to analyze these hierarchical data, some of the basic assumptions would be violated, staring from the independence of observation (Raudenbush and Bryk, 2002). Thus for authors to determine relations within hierarchical-structured data, Hierarchical Linear Modeling would be a more reliable statistical method (Hacıeminoğlu, 2019; Raudenbush and Bryk, 2002).

3. Results

One-way ANOVA random effects model was employed for the first research question of if there are any differences in pupils' learning orientation among schools. According to the results, a significant ($p< .005$) variation exists among schools in terms of their meaningful learning orientation (X^2 = 58.46470, df = 22) and Rote learning orientation (X^2 = 73.64767, df = 22). The results also suggested that factors at school level might explain the differences among learning orientations of pupils. The intraclass correlation (ICC), represents the proportion of variance in Y among schools and suggests that about 1.3% of the variance in meaningful learning orientation and 2% of the variance in rote learning orientation are among schools.

Means-as-outcome model was carried out for the second research question of which of the school level factors are related to pupils' learning orientation. The model was first run with all five factors for pupils' meaningful learning orientation (*medium level school socio economic status, high level school socio economic status,* undergraduate education level *as a highest educational level of mother and father, and quality of school's educational resources*) however, *high level school socio economic status,* undergraduate education level *as a highest educational level of mother and father, and quality of school's educational resources* were removed from the final analysis for not being significant. Chi-square statistic was employed to determine the level of variance of the pupils' meaningful learning orientation when medium level school socio economic status was controlled. Chi-square statistic χ^2 was found to be 50.58164 (df=21, $p< .05$). This finding suggested that all variation in the intercepts could not be explained by this school level factor. However, even when medium level school socio economic status was controlled, schools still varied significantly in their pupils' meaningful learning orientation averages. Regarding the pupils' rote learning orientation, the model was initially run with all five factors, but *medium level school socio economic status,* undergraduate education level *as a highest educational level of father, and quality of school's educational resources* were removed from the final analysis for not being significant. Chi-square statistic was conducted to determine whether the pupils' rote learning orientation means varied significantly when medium level school socio economic status was controlled. Chi-square statistic χ^2 was found to be 41.73450 (df=21, $p< .05$). Based on this finding it could be argued that this school level factor did not account for all the variation in the intercepts. However, even after high level school socio economic status and mother's education level were controlled, schools still varied significantly regarding their pupils' rote learning orientation averages.

Random Coefficient Model was employed for the third research question on which of the student level factors helped to explain the difference in students' learning orientation. The building strategy proposed by Raudenbush and Bryk (2002) was utilized. The final Random Coefficient Model for students' meaningful learning orientation included eleven student level factors which were *science achievement, students' reading articles or books regarding science, students' searching internet sites regarding science, students' watching documentary film*, *students sharing their ideas about science subjects with their families, students' performance goal orientation, learning goal orientation, self-efficacy, adaptation of scientific attitudes, enjoyment of science lessons, and students' leisure interest in science.* None of these eleven student level factors were determined to be randomly varying. Thus, all of the factors found to be non-randomly varying were covered in the model as fixed. Variance among the school means τ_{00}= 0.0073 was found to be statistically significant (p< .005) with a chi-square statistic of 115.08168. Including school-level factors in the model could explain this significant difference (variability) among schools. By incorporating such student level factors (science achievement, reading articles or books regarding science, benefit from internet sites regarding science, watching documentary film, sharing their ideas about science subjects with their families, performance goal orientation, learning goal orientation, self-efficacy, adaptation of scientific attitudes, enjoyment of science lessons, students' leisure interest in science) as predictors of meaningful learning orientation, within school variance was decreased by 47.3%. Thus, it could be argued that such factors explain about 47% of the student level variance in meaningful learning orientation.

The final Random Coefficient Model for students' rote learning orientation encompassed nine student level factors: grade 7, grade 8, *science achievement, gender, students' performance goal orientation, learning goal orientation, self-efficacy, adaptation of scientific attitudes, and enjoyment of science lessons.* Among such nine student level factors, none of them were found to be randomly varying. Thus, all of the factors that were found to be non-randomly varying, were included in the model as fixed. Variance among the school means τ_{00}= 0.0054 had a chi-square statistic of 87.83827 and was found to be statistically significant (p< .005). Including school-level factors in the model could explain this significant difference (variability) in schools. Incorporating these student level factors (Grade level, science achievement, gender, performance goal orientation, learning goal orientation, self-efficacy, adaptation of scientific attitudes, enjoyment of science lessons) as predictors of rote learning orientation, within school variance was decreased by 21.2%. Thus, it could be argued that such factors explain about 21% of the student level variance in rote learning orientation.

Intercepts and Slopes as Outcomes Model was employed to answer the research question of whether school level factors predict student learning orientations and investigate the strength of connections between learning orientation of students and student level factors regarding meaningful and rote learning orientation. In this model, a design was prepared with the coefficients (slopes) of the factors to explain the variance regression equations have across classes. The coefficient indicates the amount of effect a factor has on the endogenous factor. Those Level-2 factors that are critically related with Level-1 factors are defined as cross-level interactions. In this model each Level-1 Beta value will be associated with only one Level-2 equation.

This research question encompassed three previous research questions. The first model was the Analysis of Variance Model which was explained the differences in students' learning orientation among schools (Research Question 1). School level factors in the Means as Outcomes Model was used to model the variability of learning orientation of students (Research Question 2). None of the student level factors were ascertained to be randomly varied in the Random Coefficient Model (Research Question 3). Thus, this coefficient could not be modeled with school level factors. Therefore, only the intercept was modeled.

Lastly, the full final Intercepts and Slopes as Outcomes Model was studied and the equations for the final full model were demonstrated in Table 2.

Table 2: The equations for the final full model

Outcome Factors	Equations *Level 1(Students level):*	Equations *Level 2 (School level) Model:*
Meaningful Learning Orientation	$Y_{ij} = \beta_{0j} + \beta_{1j}$(SCIENGRA) β_{2j}(READINGB) + β_{3j}(INTERNET) + β_{4j}(DOCUMENT) + β_{5j}(SHARINGI) + β_{6j}(PERFGOAL) + β_{7j}(LEARNGOA) + β_{8j}(SELFEFFI) + β_{9j}(ADOPTATI) + β_{10j}(ENJOYMEN) + β_{11j}(LEISURE) + r_{ij}	$\beta_{0j} = \gamma_{00} + \gamma_{01}$ (MEDINCSC) + u_{0j} $\beta_{1j} = \gamma_{10}$ $\beta_{2j} = \gamma_{20}$ $\beta_{3j} = \gamma_{30}$ $\beta_{4j} = \gamma_{40}$ $\beta_{5j} = \gamma_{50}$ $\beta_{6j} = \gamma_{60}$ $\beta_{7j} = \gamma_{70}$ $\beta_{8j} = \gamma_{80}$ $\beta_{9j} = \gamma_{90}$ $\beta_{10j} = \gamma_{100}$ $\beta_{11j} = \gamma_{110}$
Rote Learning Orientation	$Y_{ij} = \beta_{0j} + \beta_{1j}$(GRADE7) + β_{2j}(GRADE8) + β_{3j}(SCIENGRA) + β_{4j}(GENDER) + β_{5j}(PERFGOAL) + β_{6j}(LEARNGOA) + β_{7j}(SELFEFFI) + β_{8j}(ADOPTATI) + β_{9j}(ENJOYMEN) + r_{ij}	$\beta_{0j} = \gamma_{00} + \gamma_{02}$ **(**HIGHINCS) + γ_{03} (MOTUNDRG) + u_{0j} $\beta_{1j} = \gamma_{10}$ $\beta_{2j} = \gamma_{20}$ $\beta_{3j} = \gamma_{30}$ $\beta_{4j} = \gamma_{40}$ $\beta_{5j} = \gamma_{50}$ $\beta_{6j} = \gamma_{60}$ $\beta_{7j} = \gamma_{70}$ $\beta_{8j} = \gamma_{80}$ $\beta_{9j} = \gamma_{90}$

The final Intercepts and Slopes as Outcomes Model included the factors significantly related to meaningful learning orientation and rote learning orientation of students. The final estimations of fixed effects acquired from Intercepts and Slopes as Outcomes Model were displayed in Table 2. An explanation about Tables 2 and 3 was given below.

Table 3: Final Estimation of Fixed Effects of Final Full Model for Intercepts and Slopes as Outcomes Model for Learning Orientation dimensions

Learning Orientation dimensions	Fixed Effect	*Coefficient*	*Standard Error*	*t-ratio*	**p-value**
Meaningful Learning Orientation	Overall mean Meaning Learning Orientation, γ_{00}	3.041	0.017	169.528	0.000
	MEDINCSC, γ_{01}	0.003	0.001	2.550	0.019
	SCIENGRA, γ_{10}	0.022	0.007	3.124	0.002
	READINGB, γ_{20}	0.050	0.018	2.789	0.006
	INTERNET, γ_{30}	0.042	0.016	2.509	0.012
	DOCUMENT, γ_{40}	0.035	0.017	1.956	0.050
	SHARINGI, γ_{50}	0.069	0.017	4.016	0.000
	PERFGOAL, γ_{60}	0.098	0.010	9.743	0.000
	LEARNGOA, γ_{70}	0.382	0.015	24.074	0.000
	SELFEFFI, γ_{80}	0.170	0.014	11.712	0.000
	ADOPTATI, γ_{90}	0.086	0.015	5.490	0.000
	ENJOYMEN, γ_{100}	-0.033	0.014	-2.332	0.020
	LEISURE, γ_{110}	0.085	0.014	5.994	0.000

Rote Learning Orientation	Overall mean Rote Learning Orientation, γ_{00}	2.482	0.014	171.159	0.000
	HIGHINCS, γ_{01}	0.006	0.002	2.735	0.013
	MOTUNDRG, γ_{02}	-0.010	0.002	-3.652	0.002
	GRADE7, γ_{10}	-0.067	0.017	-3.788	0.000
	GRADE8, γ_{20}	-0.187	0.041	-4.526	0.000
	SCIENGRA, γ_{30}	-0.039	0.008	-4.866	0.000
	GENDER, γ_{40}	-0.103	0.017	-6.088	0.000
	PERFGOAL, γ_{50}	0.189	0.011	16.134	0.000
	LEARNGOA, γ_{60}	0.105	0.018	5.747	0.000
	SELFEFFI, γ_{70}	-0.089	0.016	-5.324	0.000
	ADOPTATI, γ_{80}	-0.131	0.017	-7.335	0.000
	ENJOYMEN, γ_{90}	-0.052	0.013	-3.776	0.000

3.1. For meaningful learning orientation;

For meaningful learning orientation, as stated before, the results from Means as Outcomes Model were described in the final full Intercepts and Outcomes Model. According to the results, a significant and positive relationship between medium level school socio economic status and meaningful learning orientation was determined (γ_{01}= 0.003, se= 0.001). In addition, the final full Intercepts and Slopes as Outcomes Model included the results from the Random Coefficient Model.

The Science grade- Meaningful Learning Orientation slope coefficients (γ_{10}= .022, se= .007) suggested a significant and positive relationship between science achievement of students and their meaningful learning orientation. Students with higher science achievements had more meaningful learning orientations than other students.

The Students' *reading articles or books regarding science* - Meaningful Learning Orientation slope coefficients (γ_{20}= .050, se= .018) suggested a significant and positive relationship between students' *reading articles or books regarding science* and their meaningful learning orientation. The students that were *reading articles or books regarding science* had more meaningful learning orientation.

The Students' benefit from internet sites regarding science - Meaningful Learning Orientation slope coefficients (γ_{30}= 0.042, se= .016) suggested a significant and positive relationship between that students' benefit from internet sites regarding science and their meaningful learning orientation. The students that used internet sites about science had more meaningful learning orientation.

The Students' watching documentary film- Meaningful Learning Orientation slope coefficients (γ_{40}= 0.035, se=.017) suggested a significant and positive relationship between watching documentary film by students and their meaningful learning orientation. The students that were watching documentary films had more meaningful learning orientation.

The Students' *sharing their ideas about science subjects with their families* - Meaningful Learning Orientation slope coefficients (γ_{50}= .069, se= .017) indicated a significant and positive relationship between students' *sharing their ideas about science subjects with their families* and their meaningful learning orientation. The students that were *sharing their ideas about science subjects with their families* had more meaningful learning orientation.

The Performance goal orientation- Meaningful Learning Orientation slope coefficients (γ_{60}= 0.098, se= .010) suggested a significant and positive relationship between students' performance goal orientation and their meaningful learning orientation. Students that had performance goal orientation had more meaningful learning orientation.

The Learning goal orientation- Meaningful Learning Orientation slope coefficients (γ_{70}= 0.382, se= .015) suggested a significant and positive relationship between students' learning goal orientation and their meaningful learning orientation. Students that had learning goal orientation had more meaningful learning orientation.

The Self-efficacy- Meaningful Learning Orientation slope coefficients (γ_{80}= 0.170, se= .014) suggested a significant and positive relationship between students' self-efficacy and their meaningful learning orientation. Students that had high self-efficacy had more meaningful learning orientation.

The *adaptation of scientific attitudes* - Meaningful Learning Orientation slope coefficients (γ_{90}= 0.086, se= .015) suggested a significant and positive relationship between students' *adaptation of scientific attitudes* and their meaningful learning orientation. Students with high level of *adaptation of scientific attitudes* had bemoretter meaningful learning orientation.

The *enjoyment of science lessons* - Meaningful Learning Orientation slope coefficients (γ_{100}= -.033, se= .014) suggested a significant and negative relationship between students' *enjoyment of science lessons* and their meaningful learning orientation. Students with high levels of *enjoyment of science lessons* had more meaningful learning orientation.

The *students' leisure interest in science* - Meaningful Learning Orientation slope coefficients (γ_{110}= .085, se= .014) suggested a significant and positive relationship between students' *leisure interest in science* and their meaningful learning orientation. Students having high *leisure interest in science* had more meaningful learning orientation.

3.2. For rote learning orientation;

For rote learning orientation, as stated before, the results from Means as Outcomes Model were reported in the final full Intercepts and Outcomes Model. The results presented a significant and positive relationship between high level school socio economic status and rote learning orientation (γ_{01}= 0.006, se= 0.002); but the results revealed a significant and negative relationship between undergraduate education level *as a highest educational level of mother and* rote learning orientation (γ_{01}= -0.010, se= 0.002). In addition, the final full Intercepts and Slopes as Outcomes Model included the results from the Random Coefficient Model.

The Grade- Rote learning orientation *slope* coefficients suggested that students from different grades had significantly different Rote learning orientations. Rote learning orientation scores of students from seventh grades (γ_{10}= -0.067, se= .017) and eighth grades (γ_{20}= -0.187, se= .041) were significantly higher than the rote learning orientation scores of students from sixth grades.

The Science Grade-Rote learning orientation slope coefficients (γ_{30}= -0.039, se= .008) suggested a significant and negative relationship between students' science achievement and their rote learning orientation. Students having lower rote learning orientation had higher science achievement scores than the other students.

The Gender- Rote learning orientation slope coefficients (γ_{40}=-0.103, se= .017) indicated that females had more Rote learning orientation.

The Performance goal orientation- Rote learning orientation slope coefficients (γ_{90}= 0.189, se= .011) suggested a significant and positive relationship between students' performance goal orientation and their rote learning orientation. Students having performance goal orientation had more rote learning orientation.

The Learning goal orientation- Rote learning orientation slope coefficients (γ_{90}= 0.105, se= .018) suggested a significant and positive relationship between students' learning goal orientation and their students' rote learning orientation. Students with learning goal orientation had also rote learning orientation.

The Self-efficacy- Rote learning orientation slope coefficients (γ_{100}= -0.089, se= .016) suggested a significant and negative relationship with students' self-efficacy and their rote learning orientation. Students with high self-efficacy had low levels of rote learning orientation.

The *adaptation of scientific attitudes* - Rote learning orientation slope coefficients (γ_{100}= -0.131, se= .017) suggested a significant and negative relationship between students' *adaptation of scientific attitudes* and their rote learning orientation. Students with high level of *adaptation of scientific attitudes* had low level of rote learning orientation.

The *enjoyment of science lessons* - Rote learning orientation slope coefficients (γ_{100}= -0.052, se= .013) suggested a significant and negative relationship between students' *enjoyment of science lessons* and their rote learning orientation. Students with high level of *enjoyment of science lessons* had low level of rote learning orientation.

The final estimation of variance components obtained from the full final Intercepts and Slopes as Outcomes Model is displayed in Table 4.

Table 4: Final Estimation of Variance Components for Intercepts and Slopes as Outcomes Model for Learning Orientation dimensions

Learning Orientation dimensions	Random Effect	*Variance Component*	*df*	*Chi-square* χ^2	**p-value**
Meaningful Learning Orientation	School mean, u_{0j}	0.00563	21	103.78393	0.000
	Level-1 Effect, r_{ij}	0.14896			
Rote Learning Orientation	School mean, u_{0j}	0.00266	21	50.38586	0.000
	Level-1 Effect, r_{ij}	0.20213			

It can be concluded that medium level school socio economic status accounts for 23.6% of the variance in school differences in mean Meaningful Learning Orientation. However, significant differences still remain (χ^2= 103.78, p< .005) between schools. In addition, high level school socio economic status and *undergraduate education level* as a highest educational level of mother account for 51.1% of the variance in school differences in mean Rote Learning Orientation. However, significant differences still remain (χ^2= 50.38, p< .005) between schools.

4. Conclusion and Discussion

This study provides a general overview about learning orientations of students and the predictive variables associated with their learning orientations. Results of the One-Way ANOVA with random effects in HLM analysis disclosed important differences in learning orientations of students among schools. Various factors including schools, classrooms, teachers, and students are among sources of differences among schools in terms of learning orientations of students. This study investigated factors concerning schools and students and discussed results.

HLM analysis revealed that there were significant differences in students' learning orientations among schools with respect to both meaningful learning orientation and rote learning orientation. When school level factors were examined, it was determined that while medium level of school socio economic status significantly contributed to the students' meaningful learning orientation, high level of school socio economic status significantly contributed to the students' rote learning orientation.

Such results revealed that learning orientations of students were related to socioeconomic statuses of schools, but that this relationship was not directly proportional. Characteristics that would contribute to meaningful learnings of students were found at schools with medium level of school socio economic status. Students at schools with high levels of school socio economic status preferred rote learning orientation. In Turkey students at 8th year of secondary education take a centrally administered exam known as high school entrance exam to enroll at special quality high schools. At schools in regions with high socioeconomic status, families expect their children to be succeed at the high school entrance exam given in the final year of secondary education. School principals and teachers declared that families pressure them to a large extent on this subject. Teachers mentioned that families perceived activities such as role play they organize in classes to encourage meaningful learning as playing games and requested them to work on tests to prepare for the exam. School administration and in turn, teachers encourage students to solve many multiple-choice questions to prepare students for this multiple-choice exam in line with such requests and expectations. It is considered that while students work on such multiple-choice questions, they orient towards rote learning. These conclusions are supported by the studies of Aydın and Cakiroglu (2010), Cetin ve Unsal (2019), Gecer and Ozel (2012), Gelbal ve Kellecioğlu, (2007); Gundogdu, Kızıltas and Cimen (2010), Hasnoor, Ahmad and Nordin (2013), Kırıkkaya (2009), Unsal (2015). Families of students at schools with medium level of school socio economic status apply less pressure on school administration and teachers and teachers find the opportunity to organize activities to encourage students towards meaningful learning orientation as foreseen by the program and prepare students for the exam.

However, undergraduate education level as the highest educational level of mother significantly and negatively contributed to the students' rote learning orientation. Students whose mothers did not have university education had lesser rote learning orientation. While in recent years in Turkey parents increasingly assume childcare jointly, it is mothers that care for the children more. When data was examined, it could be noted that most of the mothers who did not have university education were not employed. Thus, it was considered that mothers found more time to contact teachers and cared for education of their children. The other school level factors such as quality of school's educational resources did not significantly contribute to the model related to students' learning orientation. Facilities schools had such as instructional materials, science laboratory equipment and materials, computers for instruction, library materials, and audio-visual resources did not make significant contributions to students' learning orientations. On the other hand these variables made significant contributions to students' attitude towards science as indicated in the study of Hacıeminoğlu (2019).

When characteristics variable (grade level, science achievement, gender) among student level variables were examined, it was seen that students' science achievement had significant and positive contribution to both students' meaningful and rote learning orientation. Successful students preferred which learning orientation they need among meaningful and rote learning orientations in order to achieve success as supported by the studies of Ahmed and Ahmad , (2017), Guo and Leung, (2021). While other student characteristics variables did not significantly contribute to the students' meaningful learning orientation, grade level and gender negatively contributed to the students' rote learning orientation. As class level increased, rote learning scores of students decreased. In addition, there was a significant difference between girl and boy students in favor of girl students regarding rote learning orientation as opposed to the study of Kılıç and Sağlam (2010). In one of the meta-analysis with conducted by Severiens and Ten Dam (1994) revealed and supported our finding that while females widely used rote learning approach, males used deep learning approach. On the contrary, there are some studies indicating no significant difference between gender and learning orientations (Cavallo, 1994; Wilson, Smart and Watson, 1996).

When Learning and Motivational factors were examined it was found out that interestingly, performance goal orientation and learning goal orientation positively contributed to the students' both meaningful learning and rote learning orientations. One of the main targets of students with learning goal orientation was to understand what was in fact happening during science activities. One of the main targets of a student with performance goal orientation was to get good grades and be more successful than other students (Pintrich and Shunk, 2002). Literature review demonstrated that students with performance goal orientations mostly preferred rote learning orientation while students with learning goal orientations preferred meaningful learning orientation (BouJaoude, 1992; Cavallo et al., 2003; Cavallo et al., 2004; Chan and Lai, 2008; Guo and Leung, 2021; Ho and Hau, 2008; Kizilgunes, Tekkaya and Sungur, 2009; Kaplan and Midgley, 1997; Kang, Scharmann, Noh and Koh, 2005). Learning goal orientation came forward as a consequence of a situation rather than a personality characteristic of students. These two orientations could not be separated from each other with a sharp line as two opposing poles.

On the contrary, a person could display both performance goal orientation and learning goal orientation even in the same situation. Thus, students have learning goal orientations when they were dealing with a work that they liked while they could have performance goal orientationd in situations such as performance tests. In the process of activities conducted in science classes, they might make an effort to learn new information while also they might want to come forward by voicing their opinions. Following discussion of the activity they might ask their teachers with equal enthusiasm if a question on the subject would come or what kind of questions would come in the exam (Svinicki, 2005). As it could be seen in this example, performance goal orientation and learning goal orientation could not be separated from each other with a sharp line and both approaches positively contribute to the students' both meaningful learning and rote learning orientation as supported by the studies of Svinicki (2005) and Guo and Leung (2021). In the light of arrangements in goal orientation theory, performance goal orientation was separated into two as performance-approach and performance-avoidance goals (Darnon, Harackiewicz, Butera, Mugny and Quiamzade, 2007; Elliot & Church, 1997; Middleton and Midgley, 1997). Purpose of those with performance-approach goal orientation was to receive high grades and pass their peers rather than learning while purpose of students with performance-avoidance goals was to avoid making mistakes and appear incompetent (Pintrich and Shunk, 2002; Svinicki, 2005). Performance approach orientations of students in competitive environments had a significant contribution to their meaningful learning orientations (King, McInerney, & Watkins, 2012). Results of this study that was conducted in recent years demonstrate similarities with results of our study. In Turkey students have to take an exam to enroll at a specialized high school which creates a competitive environment among students. In addition, the understanding of 'the more you repeat the better you learn' in our education system directs our students to learn by memorizing. Results of study made by Hacıeminoğlu, Yilmaz-Tuzun & Ertepinar (2009) reflected that approach performance orientations and rote learning orientation were negatively correlated with self-efficacy. Purpose of students with approach performance orientation was to receive higher grades rather than learning, thus they could prefer rote learning orientation and because they do not understand the subject well, their self-efficacy would be low. Related to and supporting such results, this study established that self-efficacy made a positive and significant contribution to meaningful learning while it contributed to students' rote learning orientation negatively.

Upon examination of sub-dimensions of attitude toward science, it was determined that adaptation of scientific attitudes and leisure interest in science made positive and significant contribution to meaningful learning orientation of students while enjoyment of science lessons contributed to students' meaningful learning orientation negatively. With respect to students' rote learning orientation, both adaptation of scientific attitudes and enjoyment of science lessons negatively contributed to the students' rote learning orientation. Ozkal (2007) conducted a study explaining 8th grade stdudents' predictors of learning orientation. Similarly, results revealed that attitude towards science is the best predictor of both meaningful and rote learning approaches as supported by BouJaoude (1992). However, career interest in science did not contribute to either meaningful learning or rote learning orientation of students.

When items of adaptation to science attitude sub-dimension were studied, it was noted that the more positive attitudes students had against repeating tests to control whether same results were achieved every time, using new and unused methods in tests, being curious about the world they live in, valuing unexpected results as much as expected results in science classes, the higher meaningful learning orientations they had. On the other hand, students that had negative attitudes against such behaviors, found learning information on new ideas boring, and declared making new discoveries was unimportant had high rote learning orientation levels.

Leisure interest in science that was one of the sub-dimensions of attitude variable made positive and significant contribution to meaningful learning orientations of students while it did not contribute to rote learning orientation of students. Another result of this study that supported these results was that out of school activities of students (reading articles or books regarding science, searching from internet sites regarding science, watching documentary film, sharing their ideas about science subjects with their families) positively contributed to the students' meaningful learning orientation, while it did not significantly contribute to students' rote learning orientation. Upon studying of items in leisure interest in science dimension, it was determined that out of school activities such as joining science club or society, reading science books during school break, making science experiments at home, making science discussions with friends after school, working at science laboratory on school breaks, listening to science programs on the radio, going to science museum on the weekends, reading science articles on the newspaper made positive contributions to meaningful learning orientations of students. Results of the study supported each other. This result demonstrates significance of out of school learning environment in terms of having meaningful learning orientation as supported by Jeffery-Clay (1998). Jeffery-Clay (1998) indicated that out-of-school learning environments such as museums allow students to move freely and explore. In this proses they encourage group interaction and sharing. With the said out of school learning activities, students make more meaningful learnings while sharing what they learn with their family and friends positively support their meaningful learning.

As demonstrated in study of Boz, Yerdelen-Damar, Belge-Can (2018), there is a significant relationship with large effect size between perception of constructivist learning environment and meaningful learning orientations, as supported by the results of the studies by Dart, Burnett, Boulton-Lewis, Campbell, Smith & McCrindle (1999), Dart, Burnett, Purdie, Boulton-Lewis, Campbell, & Smith (2000), Eley (1992), Karagiannopoulou and Christodoulides (2005), Ozkal, Tekkaya, Cakiroglu and Sungur (2009), Uysal (2010), Yerdelen-Damar and Aydın (2015). Variables such as reading articles or books regarding science, searching from internet sites regarding science, watching documentary film, sharing their ideas about science subjects with their families examined in this study were supportive of constructivist learning environment. Thus, these results in the literature support that these variables are significant predictors of meaningful learning orientations of students.

References

Ahmed, A. & Ahmed, N. (2017). Comparative analysis of rote learning on high and low achievers in graduate and undergraduate programs. *Journal of Education and Educational Development, 4*(1), 111-129.

Arısoy, N. (2007). Examining 8th grade students' perception of learning environment of science classrooms inrelation to motivational beliefs and attitudes. Unpublished Theses in Middle East Technical University, Ankara, Turkey.

Aydın, S. & Çakıroğlu, J. (2010). İlköğretim fen ve teknoloji dersi öğretim programına ilişkin öğretmen görüşleri: Ankara örneği. *İlköğretim Online*, *9*(1), 301-315 (in Turkish).

Bou Jaoude, S. B. (1992). The relationship between high school students' learning strategies and the change in their misunderstandings during a high school chemistry course. *Journal of Research in Science Teaching, 29* (7), 687–699.

Boz, Y., Yerdelen-Damar, S., & Belge-Can, H. (2018). Investigation of relations among middle school (junior high school) students' gender, learning approaches, perceptions of learning environment and science achievement. *Elementary Education Online, 17*(3), 1268-1282.

Caliskan, İ. S. (2004). *The effect of inquiry-based chemistry course on students' understanding of atom concept, learning approaches,motivation, self-efficacy, and epistemological beliefs.* Unpuplished master thesis, The Middle East Technical University, Ankara.

Cavallo, A. M. L. (1994). Do females learn biological topics by rote more than males? *The American Biology Teacher, 56* (6), 348-352.

Cavallo, A. M. L. (1996).Meaningful learning reasoning ability and student's understanding and problem of genetics topics. *Journal of Research in Science Teaching*, *38*, 625-656.

Cavallo, A. M. L., Rozman, M., Larabee, T., & Ishikawa, C. (2001). *Shifts in male and female students' learning, motivation, beliefs, and scientific understanding in inquiry-based college physics course.* Paper presented at the annual conference of the National Association for Research in Science Teaching, St. Louis, MO.

Cavallo, A. M. L., Rozman, M., Blickenstaff, J., & Walker , N. (2003). Learning, reasoning, motivation, and epistemological beliefs. *Journal of College Science Teaching, 33,* 18-23.

Cavallo, A. M. L., Rozman, M., & Potter, W. H. (2004). Gender differences in learning constructs, shifts in learning constructs, and their relationship to course achievement in a structured inquiry, yearlong collage physic course for life science majors. *School Science and Mathematics, 104*(6), 288-301.

Cavallo, A. M. L., & Schafer, L. E. (1994). Relationships between student's meaningful learning orientation and their understanding of genetic topics. *Journal of Research in Science Teaching, 31*(4), 393-418.

Chan, K. W., & Lai, P. Y. (2008). Revisiting the trichotomous achievement goal framework for Hong Kong secondary students: A structural model analysis. *The Asia Pacific Education Researcher, 16*(1), 11–22.

Çetin, A., & Ünsal, S. (2019). Merkezi sınavların öğretmenler üzerinde sosyal, psikolojik etkisi ve öğretmenlerin öğretim programı uygulamalarına yansıması. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 34*(2), 304-323. (in Turkish).
Darnon, C., Harackiewicz, J. M., Butera, F., Mugny, G., & Quiamzade, A. (2007). Performance-approach and performance avoidance goals: When uncertainty makes a difference. *Personality and Social Psychology Bulletin, 33*(6), 813–827.
Dart, B., Burnett, P., Boulton-Lewis, G., Campbell, J., Smith, D., & McCrindle, A. (1999). Classroom learning environments and students' approaches to learning. *Learning Environments Research, 2*, 137-156.
Dart, B., Burnett, P., Purdie, N., Boulton-Lewis, G., Campbell, J. & Smith, D (2000). Students' conceptions of learning, the classroom environment, and approaches to learning. *The Journal of Educational Research, 94*(3), 263-270.
Eley, M. G. (1992). Differential adoption of study approaches within individual students. *Higher Education,23*(3), 231-254.
Elliot, A. J., & Church, M. (1997). A hierarchical model of approach and avoidance achievement motivation. *Journal of Personality and Social Psychology, 72*, 218-232.
Fraser, J. B. (1978). Development of a test of science-related attitudes, *Science Education, 62*(4), 509-515.
Fraenkel, J. R., & Wallen, N. E. (2003). *How to design and evaluate research in education* (5th ed.). Boston: McGraw Hill.
Geçer, A. & Özel, R. (2012). İlköğretim fen ve teknoloji dersi öğretmenlerinin öğrenme-öğretme sürecinde yaşadıkları sorunlar. *Kuram ve Uygulamada Eğitim Bilimleri*, *12*(3), 1-26 (in Turkish).
Gelbal, S. &Kelecioğlu, H. (2007). Öğretmenlerin ölçme ve değerlendirme yöntemleri hakkındaki yeterlik algıları ve karşılaştıkları sorunlar. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 33, 135-145(in Turkish).
Guo, M. & Leung, F. K.S. (2021). Achievement goal orientations, learning strategies, and mathematics achievement: A comparison of Chinese Miao and Han students. *Psychology in the Schools, 58*, 107–123.
Gündoğdu, K., Kızıltaş, E. & Çimen, N. (2010). Seviye belirleme sınavına (SBS) ilişkin öğrenci ve öğretmen görüşleri (Erzurum il örneği). *İlköğretim Online*, *9*(1), 316-330 (in Turkish).
Hacıeminoğlu, E., Yilmaz-Tuzun, O., & Ertepinar, H. (2009). Investigating elementary students' learning approach, motivational goals and achievement in science. *Hacettepe University Journal of Education, 37*, 72-83.
Hacıeminoğlu, E., Ertepinar, E., Yilmaz-Tuzun, O., & Cakir, H. (2015). Students and school characteristics related to elementary school students' nature of science views. Education 3-13: *International Journal of Primary, Elementary and Early Years Education,43*(6), 700-721. doi:10.1080/03004279.2013.865655
Hacıeminoğlu, E. (2016). Elementary school students' attitude toward science and related variables. *International Journal of Environmental & Science Education, 11*(2), 35-52.
Hacıeminoğlu, E. (2019). Student and School Level Variables related to Elementary School Students' Attitudes towards Science. *Eurasian Journal of Educational Research, 80* (2019), 59-88.
Hamm, S., & Robertson, I. (2010). Preferences for deep-surface learning: A vocational education case study using a multimedia assessment activity. *Australasian Journal of Educational Technology, 26*(7), 951-965.
Hasnoor, H. N., Ahmad, Z., & Nordin, N. (2013). The Relationship between learning approaches and academic achievement among intec students. *Social and Behavioral Sciences, 90*, 178-186.
Ho, I. T., & Hau, K. T. (2008). Academic achievement in the Chinese context: The role of goals, strategies, and effort. *International Journal of Psychology, 43*(5), 892–897.
Jeffery-Clay, K. R. (1998). Constructivism in museums: How museums create meaningful learning environments. *Journal of Museum Education*, 23 (1), 3-7.
Kang, S., Scharmann, L. C., Noh, T., & Koh, H. (2005). The influence of students' cognitive and motivational variables in respect of cognitive conflict and conceptual change. *International Journal of Science Education, 27,* 1037–1058.
Kaplan, A., & Midgley, C. (1997). The effect of achievement goals: Does level of perceived academic competence make a difference? *Contemporary Educational Psychology, 22,* 415-435.
Karagiannopoulou, E. & Christodoulides, P. (2005). The impact of Greek University students perceptions of their learning environment on approaches to studying and academic outcomes. *International Journal of Educational Research, 43*, 329-350.
Kılıç, D. & Sağlam, N. (2010). Investigating the effects of gender and school type on students' learning orientations. *Procedia Social and Behavioral Sciences, 2,* 3378–3382.
Kırıkkaya, E. B. (2009). İlköğretim okullarındaki fen öğretmenlerinin fen ve teknoloji programına ilişkin görüşleri. *Türk Fen Eğitimi Dergisi*, *1*(6), 133-148 (in Turkish).
King, R. B., McInerney, D. M., & Watkins, D. A. (2012). Competitiveness is not that bad… at least in the East: Testing the hierarchical model of achievement motivation in the Asian setting. *International Journal of Intercultural Relations, 36*(3), 446–457.

Kizilgunes, B., Tekkaya, C., & Sungur, S. (2009). Modeling the relations among students‟ epistemological beliefs, motivation, learning approach, and achievement. *The Journal of Educational Research,102*(4), 243-255.

Leung, F. K. S. (2001). In search of an East Asian identity in mathematics education. *Educational Studies in Mathematics, 47*(1), 35–51.

Mayer, R. E. (2002). Rote versus meaningful learning. *Theory into practice, 41*(4), 226-232.

Mayer, R.E., & Wittrock, M.C. (1996). Problem-solving transfer. In D.C. Berliner & R.C. Calfee (Eds.), *Handbook of educational psychology* (pp. 47-62). New York: Macmillan.

Middleton, M., & Midgley, C. (1997). Avoiding the demonstration of lack of ability: An underexplored aspect of goal orientation. *Journal Educational Psychology*, *89*, 70-718.

Ministry of National Education of Turkey (MONE) (2018). Elementary school science and
technology curriculum [On-line].” http://ttkb.meb.gov.tr/ (in Turkish).

Organisation for Economic Co-Operation and Development (2004). *Learning for tomorrow's world: First results from PISA 2003*. Paris: OECD Publications.

Ozkal, K. (2007). Scientific epistemological beliefs, perceptions of construct learning environment and attitude towards science as determinants of students approaches to learning. Unpuplished master thesis, The Middle East Technical University, Ankara.

Özkal, K., Tekkaya, C., Çakıroglu, J., & Sungur, S. (2009). A conceptual model of relationships among constructivist learning environment perceptions, epistemological beliefs, and learning approaches. *Learning and Individual Differences, 19*, 71-79.

Pintrinch, P., & Schunk, D. (2002). *Motivation in education.* Merrill Prentice Hall.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models:Applications and data analysis methods.* CA: Sage Publications, Inc.

Severiens, S. E., & Ten Dam, G. T. (1994). Gender differences in learning styles: A narrative review and quantitative meta-analysis. *Higher Education*, *27*(4), 487-501.

Svinicki, M. D. (2005). *Öğrencinin Amaca Yönelimi, Motivasyon ve Öğrenme*. Orta Doğu Teknik Üniversitesi Öğrenme ve Öğretmeyi Geliştirme Merkezi (Translated from Individual Development and Educational Assessment Center – IDEA Center)

Unsal, S.(2015) *Öğretmenlerin mesleki imajlarına ilişkin görüşleri ve mesleki imaja etki eden faktörler*. Yayımlanmamış Doktora Tezi Gaziantep Universitesi Eğitim Bilimleri Enstitüsü, Gaziantep (in Turkish).

Uysal, E. (2010). *A modelling study: The interrelationships among elementary students' epistemological beliefs, learning environment perceptions, learning approaches and science achievement*, Unpublished Doctoral Thesis, Middle East Technical University, Ankara.

Yerdelen-Damar, S., & Aydın, S. (2015). Relations of Approaches to Learning with Perceptions of Learning Environment and Goal Orientations. *Education & Science/Egitim ve Bilim, 40*(179), 269-293

Wilson, K. L., Smart, R. M., and Watson, R. J. (1996). Gender differences in approaches to learning in first year psychology students. *British Journal of Educational Psychology*, 66, 59-71.