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Investigation of Secondary School Students' Self-Regulation Strategies, Motivational Beliefs and Science Related Inquiry Learning Skills Perception

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Abstract

The aim of this study is to identify secondary school students' self-regulation strategies, motivational beliefs and science related inquiry learning skills perception levels, to reveal the relationship between them and to examine them regarding different variables. In this study, a quantitative research method was used. The study included 1127 students from secondary schools in Istanbul, Turkey. "Personal Information Form" developed by researchers, Pintrinch and De Groot (1990) produced the "Motivated Strategies for Learning Questionnaire," which Üredi adapted to Turkish (2005) and Balım and Taşkoyan (2007) established the "Science Related Inquiry Learning Skills Perception" scale (2007)" was used in study. The data were analyzed with SPSS 16. Independent Sample t-Test, ANOVA and Pearson Correlation technique was used in data analysis. It was concluded that the secondary school students' self-regulation skills, motivational beliefs and science related inquiry learning skills perception levels were high, there was a medium positive relationship between them, and It has been determined that the gender variable is in favor of female students, the class variable is in favor of lower-level classes, and the planning variable is in favor of students who like planning. Activities to increase students' self-regulation and motivational belief and science related inquiry learning skills perception levels are recommended. or tap here to enter text.

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Introduction

In today's world, where developments in science and technology are increasing day by day, it's apparent that improvement studies are carried out in education systems in many countries, including Turkey. With the new trends in education, learning has become an active process; It has become important to raise individuals who can inquiry, has critical and creative thinking skills, takes responsibility, be planned and are self-confident. There can be many factors that affect the learning process. In recent years, it has become known that besides mental factors, affective factors also affect learning (Zimmerman, 2000). In many studies on education, it's apparent that self-regulation strategies, motivations, and inquiry learning skills are effective in students' learning. The fact that the learner takes an active role at all stages of the learning process has highlighted the emphasis on such concepts as 'learning to learn' and 'self-regulation'. Zimmerman (2002) defines self-regulation as a process. This process necessitates more than just metacognitive skills and knowledge. It also involves emotional and behavioral processes, as well as the ability to control them with a flexible sense of self-efficacy.

Pintrich (2000) defined self-regulation as an active and usable process in which students establish their own learning aims and try to organize their cognition, motivation, and behavior. In this context, self-regulation can be expressed as the synthesis of emotions, thoughts, and actions that individuals create to move from their current state to the desired state. Two factors affect the self-regulated learning process. These factors are self-regulation strategies and motivational beliefs. Self-regulation strategies: they cover the metacognitive strategies for planning, monitoring, and changing students' cognitions, as well as controlling the effort spent on performing a task in the learning-teaching process and the strategies they use to learn, remember, and understand the material (Pintrich & De Groot 1990). The practice of self-regulation strategies significantly affects learning and academic performance (Sağırlı et al., 2010).

Another concept that is thought to be effective in learning is motivational beliefs that help encourage and maintain self-regulated learning (Pintrich, 1999). Motivational beliefs are expressed as students' opinions, judgments, and values about objects, events, or subject areas (Boekaerts, 2002). That's why it's important to identify the factors affecting student motivation and to make learning-teaching processes more effective. Self-regulated learning is developed and sustained by interdependent factors, and in this context, student motivation is a critical component (Zumbrunn et al., 2011). Considering this information, it can be expected that students' motivational beliefs and self-regulation skills are related to each other.

Another of the concepts discussed within the scope of the study is science related inquiry learning skills perception. The vision of science education is to raise individuals who research and inquiry, produce

information and use it appropriately in life, make effective decisions, solve problems, be open to cooperation, have communication skills, self-confident, and learn lifelong (MEB, 2018). One of the methods applied to realize this vision is inquiry-based learning. In this context, contemporary Science Teaching programs (MOE, 2018 & NGSS, 2013) suggest and use inquiry-based learning methods. Inquiry-based learning is the process of solving problems by asking questions, researching, and analyzing information. Newly gained knowledge is transformed into useful information in this process (Perry & Richardson 2001). Thus, students are allowed to express and explore their strategies and concepts.

"Inquiry learning skills", on the other hand, are expressed by John Dewey as asking questions about the subject to be learned, searching for answers, producing, and creating new information while collecting information about any subject, discussing the foundation and experiences, and reflecting on the newly obtained information (Taşkoyan, 2008). Inquiry skills, such as self-regulation and motivation, can also give clues about the students in the learning process. The inquiry learning skill increases the student's motivation and creativity, improves analytical and critical thinking skills, and facilitates the comprehension of questions as a whole in the context of cause and effect (Öztürk et al., 2017). In this respect, it is important to examine students' science related inquiry skills perceptions.

In the literature, secondary school (Harrison & Prain, 2009; Pintrich & De Groot, 1990), high school (Affuso et al., 2022; Van Grinsven & Tillema, 2006) and university (Liebeendörferet et al., 2022) studies investigating students' self-regulation strategies and motivational beliefs are available. In addition, secondary school (Işık & Yenice, 2013; Öner & Özdem Yılmaz, 2019; Williams et al., 2017), high school (Harrison, 2014) and university (Vajoczki et al., 2011) studies investigating the inquiry learning skills of students are available. When reviewing the research in the literature, it's been established that the studies on self-regulation and motivational beliefs are mostly related to the mathematics lesson, are associated with achievement, and are mostly conducted with high school and university students.

Only a few studies have been carried out to determine the self-regulation, motivational beliefs of secondary school students. On the other hand, in the studies on science related inquiry learning skills perception carried out with secondary school students; It's apparent that he focuses on the inquiry learning skill or perception, and the effects of the methods, techniques, and strategies discussed in the teaching process. However, it has been observed that studies mostly examine the relationship between inquiry learning skills and learning styles, problem-solving, perception, motivation, and attitude, and only one study was found in which the science related inquiry learning skills perception of secondary school students was determined. No study was found in which the relationship between "self-regulation strategies", "motivational beliefs" and "science related inquiry learning skills perception" was examined together. Thus, it is considered that this work will

contribute to the literature relating to examining the self-regulation and motivational beliefs studies, mostly related to the mathematics lesson, relating to different variables and by adding the inquiry learning skills dimension for the Science lesson.

This study aims to determine secondary school students' self-regulation strategies, motivational beliefs, and science related inquiry learning skills perception levels, reveal the relationship between them and examine them relating to different variables, based on the question of how there is a relationship between motivation, self-regulation strategies, and science related inquiry learning skills perception to learning. For this purpose, answers were sought to the following questions:

1. What are secondary school students' self-regulation strategies, motivational beliefs, and science-related inquiry learning skills perception levels?
2. Is there a significant relationship between secondary school students' self-regulation strategies, motivational beliefs, and science-related inquiry learning skills perception levels?
3. Do secondary school students' self-regulation strategies, motivational beliefs, and science-related inquiry learning skills perception levels differ significantly according to the gender variable?
4. Do secondary school students' self-regulation strategies, motivational beliefs, and science-related inquiry learning skills perception levels differ significantly according to the grade variable?
5. Do secondary school students' self-regulation strategies, motivational beliefs and science-related inquiry learning skills perception levels differ significantly according to the variable of liking to plan?

Method

Research Model

This research is a quantitative study designed in the relational screening model for the comparison of secondary school students' self-regulation strategies, motivational beliefs, and science-related inquiry learning skills perceptions (Karasar, 2008).

Research Sample

The participants of the research are 6^{th}, 7^{th}, and 8^{th} grade students who are studying at five different public secondary schools in Istanbul, Turkey and have low socio-economic level living conditions. Participants were chosen by a simple random sampling method. In this regard, participants in the research consisted of 287 (25.5%) 6^{th} grade, 385 (34.2%) 7^{th} grade, and 455 (40.4%) 8th-grade students, with 549 (48.7%) females and 578 (51.3%) males, for a total number of 1127 students.

Data Collection Tools

The first of these data collection instruments is the "Personal Information Form," which was developed by the researchers after consulting with science education experts. This form is made up of secondary school students' data on the demographic such as "gender", "grade" and the question "whether they like to plan or not". The second data collection instrument in the study is the "Motivated Strategies for Learning Questionnaire" (MSFLQ), consisting of 44 items, developed by Pintrinch and De Groot (1990) and adapted into Turkish by Üredi (2005), was used. The measurement instrument consists of two dimensions: "Self-regulation strategies" (SRS) and "Motivational beliefs" (MB). Self-regulation strategies measurement instrument; scientific strategy use (13 items) and self-regulation (9 items); motivational beliefs measurement instrument; It consists of three sub-dimensions: self-efficacy (9 items), intrinsic value (9 items), and exam anxiety (4 items). Cronbach alpha values for the sub-dimensions of scientific strategy use were 0.82 in the study of adapting the measurement instrument to Turkish, 0.84 in self-regulation, 0.92 in self-efficacy, 0.88 in intrinsic value, and 0.81 in exam anxiety (Üredi, 2005). The Cronbach alpha Coefficient obtained from the analysis of the data within the scope of this study of the measurement instrument was calculated as 0.83 for the Self-Regulation Strategies (SRS) scale and 0.81 for the Motivational Beliefs (MB) scale.

Another data collection instrument used is the "Science Related Inquiry Learning Skills Perception" scale (SRILSP) developed by Balım and Taşkoyan (2007). The measurement instrument consists of 22 items in total, including 3 sub-dimensions: positive perceptions, negative perceptions, and perceptions of questioning the accuracy. The reliability of the factors belonging to the scale is 0.73, 0.67, and 0.71, respectively. Cronbach's alpha reliability for the entire scale is 0.84. The scale's Cronbach's alpha reliability coefficient was found to be 0.77 in this investigation.

Data Analysis

Statistical solutions for measuring instruments were made with the SPSS 16.0 package program. Before starting the analysis, the Kolmogorov-Smirnov test was used to determine the normality of the distribution of the data, and the skewness and kurtosis values of the scores were checked at the same time. According to the result of the Kolmogorov-Smirnov test, it was observed that the data provided a normal distribution since the significance value was less than .05, but the skewness and kurtosis values were between +2.0 and -2.0, according to George and Mallery (2010). In this context, parametric tests were utilized. Accordingly, in the analysis of the data, the Independent Sample t-Test for gender, One-Way Analysis of Variance (ANOVA) according to grade levels, and the Pearson Correlation Coefficient technique to reveal the relationship between dependent variables were calculated.

Ethical

Voluntary participation and informed consent were provided for all participants during the study process, and there was no manipulation in the study.

Results

The findings of the 1st sub-problem "What are secondary school students' "SRS," "MB," and "SRILSP" levels?" are indicated in Table 1.

Table 1. "SRS", "MB" and "SRILSP" Average scores

Scales/Dimensions and Sub-Dimensions	N	$\bar{X}$	Sd	SH_x	Min.	Max.
Scientific strategy use	1127	5.38	0.99	0.03	1.00	7.00
Self-regulation	1127	4.77	0.91	0.03	1.00	7.00
SRS	1127	5.08	0.86	0.03	1.00	7.00
Self-efficacy	1127	5.50	1.12	0.03	1.67	7.00
Intrinsic value	1127	5.70	0.90	0.03	1.56	7.00
Exam anxiety	1127	4.00	1.75	0.05	1.00	7.00
MB	1127	5.07	0.78	0.02	1.41	7.00
Positive perceptions	1127	3.98	0.72	0.02	1.00	5.00
Negative perceptions	1127	2.44	0.90	0.03	1.00	5.00
Perceptions of questioning the accuracy	1127	3.86	0.82	0.02	1.00	5.00
SRILSP	1127	3.52	0.51	0.02	1.00	5.00

When the findings in Table 1 are viewed, it's apparent that the "SRS" scores of secondary school students ($\bar{X}$=5.08) are at a high level. When the sub-dimensions of the "SRS" were studied, it was discovered that students had a high level of "Scientific strategy use" ($\bar{X}$=5.38) and "Self-regulation" ($\bar{X}$=4.77). The "MB" scores of secondary school students ($\bar{X}$=5.07) are extremely high. When the sub-dimensions of "MB" were examined, it was determined that the students had a high level of "Self-efficacy" ($\bar{X}$=5.50) "Intrinsic values" ($\bar{X}$=5.70) and moderate "Exam anxiety" ($\bar{X}$=4.00). The "SRILSP" scores of secondary school students ($\bar{X}$=3.52) are at a high level. When the sub-dimensions of "SRILSP" were examined, it was determined that the students had a high level of "Positive perceptions" ($\bar{X}$=3.98) and "Perception of questioning their accuracy" ($\bar{X}$=3.86) and they had a low level of "Negative perception" ($\bar{X}$=2.44).

The findings of the 2nd sub-problem as "Is there a significant relationship between secondary school students "SRS," "MB" and "SRILSP" levels?" are indicated in Table 2.

Table 2. The relationship between "SRS", "MB", "SRILSP" scores

Variables	N	r	p
SRS MB	1127	.624**	.000
SRS SRILSP	1127	.409**	.000
MB SRILSP	1127	.349**	.000

When the findings in Table 2 are viewed, it's apparent that there are a moderately positive and significant relationship secondary school students' between "SRS" and "MB" scores (r=.624; p<.01); between "SRS" and "SRILSP" scores (r=.409; p<.01) and between "MB" and "SRILSP" scores (r=.349; p<.01).

The findings of the 3rd sub-problem as "Do secondary school students' "SRS," "MB" and "SRILSP" levels differ significantly according to the gender variable?" are indicated in Table 3 and Table 5.

Table 3. Independent sample t-test results of "SRS" scores by gender variable

Scale and Sub-Dimensions	Gender	N	$\bar{X}$	Sd	SH_x	t-Test		
						t	Sd	p
Scientific strategy use	Female	549	5.51	0.90	0.04	4.32	1125	.000
	Male	578	5.26	1.05	0.04			
Self-regulation	Female	549	4.82	0.85	0.04	1.50	1125	.132
	Male	578	4.74	0.96	0.04			
SRS	Female	549	5.16	0.79	0.03	3.26	1125	.001
	Male	578	5.00	0.92	0.04			

When the findings in Table 3 are viewed, it's apparent that there is a statistically significant difference between the average "SRS" total scores of secondary school students according to the gender variable ($t_{(1125)}$=3.26; p<.05). When the sub-dimensions of the "SRS" were studied, the average scores of secondary school students related to the sub-dimension of "Scientific strategy use" show a statistically significant difference ($t_{(1125)}$=4.32; p<.05). This difference has been determined to be in favor of female secondary school students. In addition, there is no significant difference in the sub-dimension "Self-regulation" ($t_{(1125)}$=1.50; p>05). Although no significant difference was detected, it was observed that the average scores of female secondary school students were higher than those of male students in the "Self-regulation" sub-dimension (Female=4.82; Male=4.74).

Table 4. Independent sample t-test results of "MB" scores by gender variable

Scale and Sub-Dimensions	Gender	N	X̄	Sd	SH_x	t-Test		
						t	Sd	p
Self-efficacy	Female	549	5.59	1.10	0.05	2.546	1125	.011
	Male	578	5.41	1.14	0.05			
Intrinsic value	Female	549	5.81	0.84	0.04	3.946	1125	.000
	Male	578	5.60	0.94	0.04			
Exam anxiety	Female	549	3.99	1.78	0.08	0.185	1125	.853
	Male	578	4.01	1.71	0.07			
MB	Female	549	5.13	0.72	0.03	2.572	1125	.010
	Male	578	5.01	0.84	0.04			

When the findings in Table 4 are viewed; It's apparent that to be a statistically significant difference between secondary school students' total average scores of "MB" according to the gender variable ($t_{(1125)}$=2.572; p<.05). When the sub-dimensions of the "MB" were studied, the average scores of secondary school students related to the sub-dimensions of "Self-efficacy" ($t_{(1125)}$=2.546; p<.05) and "Intrinsic value" ($t_{(1125)}$=3.946; p <.05) show a statistically significant difference. This difference has been determined to be in favor of female secondary school students. Furthermore, there is no noticeable difference in the sub-dimension "Exam anxiety" ($t_{(1125)}$=0.185; p >05).

Table 5. Independent sample t-test results of "SRILSP" scores by gender variable

Scale and Sub-Dimensions	Gender	N	X̄	Sd	SH_x	t-Test		
						t	Sd	p
Positive perceptions	Female	549	4.08	0.69	0.30	4.508	1125	.000
	Male	578	3.88	0.73	0.30			
Negative perceptions	Female	549	2.36	0.89	0.04	2.928	1125	.003
	Male	578	2.52	0.90	0.04			
Perceptions of questioning	Female	549	3.95	0.81	0.03	3.860	1125	.000
the accuracy	Male	578	3.76	0.81	0.03			
SRILSP	Female	549	3.56	0.49	0.02	3.151	1125	.002
	Male	578	3.47	0.51	0.02			

When the findings in Table 5 are viewed, It's apparent that there is a statistically significant difference between the "SRILSP" total average scores of secondary school students according to the gender variable ($t_{(1125)}$=3.151; p<.05). When the sub-dimensions of the "SRILSP" were studied, it was discovered that; Similarly, secondary school students' "Positive perceptions" ($t_{(1125)}$=4.508; p<.05), "Negative perceptions" ($t_{(1125)}$=2.928; p<.05) and "Perceptions of questioning the accuracy" ($t_{(1125)}$=3.860; p<.05) the average scores of the sub-dimensions show that there is a statistically significant difference between them. It was determined that this difference was in favor of female secondary school students in "SRILSP", "Positive perceptions"

and “Perceptions of questioning the accuracy”, and in favor of male students in “Negative perceptions” scores.

The findings of the 4th sub-problem as “Do secondary school students’ “SRS,” “MB” and “SRILSP” levels differ significantly according to the grade variable?” are indicated in Table 6 and Table 8.

Table 6. ANOVA Results of “SRS” scores by grade level

N, X and SD Values					ANOVA Results				
Scale and Sub-Dimension	**Group**	**N**	**X̄**	**Sd**	**Var. K.**	**K.T.**	**K.O.**	**F**	**p**
Scientific strategy use	6.Grade	287	5.59	.95	Between	28.614	14.307	14.912	.000
	7.Grade	385	5.44	.96	Within	1078.377	.959		
	8.Grade	455	5.20	1.01	Total	1106.991			
	Total	1127	5.38	.99					
Self-regulation	6.Grade	287	4.92	.87	Between	13.447	6.723	8.287	.000
	7.Grade	385	4.81	.93	Within	911.914	.811		
	8.Grade	455	4.66	.90	Total	925.361			
	Total	1127	4.77	.91					
SRS	6.Grade	287	5.26	.822	Between	20.323	10.12	13.922	.000
	7.Grade	385	5.12	.859	Within	820.402	.730		
	8.Grade	455	4.92	.870	Total	840.725			
	Total	1127	5.08	.864					

When the findings in Table 6 are viewed, there is seen that to be a statistically significant difference between the “SRS” total average scores of secondary school students according to the grade variable [F(2-1124) = 13.922; p<.05]. When the sub-dimensions of the “SRS “were studied, it was discovered that; Similarly, secondary school students’ average scores on the sub-dimensions of “Scientific strategy use” [F(2-1124) = 14.912; p<.05] and “Self-regulation” [F(2-1124)=8.287; p<.05] it can be seen that the difference between them is statistically significant.

According to the results of Levene’s test applied to determine between which groups the difference is; Since the average group variances of total SRS (L=.641; p>.05) and sub-dimensions (L=2.755; L=1.191; p>.05) were found to be homogeneous, the Tukey HSD test, one of the post-hoc analysis techniques, was used. The results of the post-hoc analysis show that it was determined that the “SRS” and its sub-dimensions “Scientific strategy use” and “self-regulation” scores of the 6th and 7th grade secondary school students were significantly higher than the scores of the 8th-grade students.

Table 7. ANOVA Results of "MB" scores by grade level

N, X and SD Values					ANOVA Results				
Scale and Sub-Dimensions	**Group**	**N**	**X̄**	**Sd**	**Var. K.**	**K.T.**	**K.O.**	**F**	**p**
Self-efficacy	6.Grade	287	5.68	1.02	Between	12.051	6.025	4.812	.008
	7.Grade	385	5.42	1.17	Within	1407.527	1.252		
	8.Grade	455	5.46	1.13	Total	1419.577			
	Total	1127	5.50	1.12					
Intrinsic value	6.Grade	287	5.89	.78	Between	23.736	11.868	14.973	.000
	7.Grade	385	5.77	.92	Within	890.923	.793		
	8.Grade	455	5.53	.94	Total	914.660			
	Total	1127	5.70	.90					
Exam anxiety	6.Grade	287	4.00	1.70	Between	.359	.180	.059	.943
	7.Grade	385	3.98	1.82	Within	3436.859	3.058		
	8.Grade	455	4.02	1.72	Total	3437.28			
	Total	1127	4.00	1.74					
MB	6.Grade	287	5.19	.73	Between	6.074	3.037	4.926	.007
	7.Grade	385	5.06	.81	Within	692.863	.616		
	8.Grade	455	5.06	.80	Total	698.937			
	Total	1127	5.07	.79					

When the findings in Table 7 are viewed, there is determined to be a statistically significant difference between secondary school students' "MB" total average scores according to the grade variable [F(2-1124)=4.926; p<.05]. When the sub-dimensions of the "MB" were studied, it was discovered that; Similarly, secondary school students' average scores on the sub-dimensions of "Self-efficacy" [F(2–124)=4.812; p<.05] and "Intrinsic Value" [F(2–124)=14.973; p<.05] It's apparent that there is a statistically significant difference, in "Exam anxiety" [F(1-124)=.059; p>.05] sub-dimensions, but there is no statistically significant difference. According to the results of Levene's test applied to determine between which groups the difference is; Since the average group variances of total MB (L=2.493; p>.05) were determined to be homogeneous, the Tukey HSD test, one of the post-hoc analysis techniques, and Since the average group variances of "Self-efficacy" (L=3.453; p<.05) and "Intrinsic Value" (L=8.145; p<.05) were not determined homogeneously, Tamhane test one of the post-hoc analysis techniques were used. According to the results of post-hoc analysis; it was determined that the "MB" scores of the students studying in the 6th grade of secondary school were significantly higher than the scores of the students studying in the 8th grade, and the "Self-efficacy" scores of the students studying in the 7th and 8th grades were significantly higher. Furthermore, the "Intrinsic Value" scores of 6th and 7th grade secondary school students were found to be much higher than the results of 8th grade students.

Table 8. ANOVA Results of "SRILSP" scores by grade level

N, X and SD Values					ANOVA Results				
Scale and Sub-Dimensions	**Group**	**N**	**X̄**	**Sd**	**Var. K.**	**K.T.**	**K.O.**	**F**	**p**
Positive perceptions	6.Grade	287	4.10	.75	Between	5.665	2.833	5.485	.004
	7.Grade	385	3.96	.70	Within	580.456	.516		
	8.Grade	455	3.92	.71	Total	586.122			
	Total	1127	3.98	.72					
Negative perceptions	6.Grade	287	2.39	.98	Between	1.327	.663	.813	.444
	7.Grade	385	2.46	.90	Within	917.161	.816		
	8.Grade	455	2.48	.86	Total	918.487			
	Total	1127	2.39	.86					
Perceptions of questioning the accuracy	6.Grade	287	3.99	.74	Between	12.112	6.056	9.145	.000
	7.Grade	385	3.89	.84	Within	744.354	.662		
	8.Grade	455	3.74	.82	Total	756.466			
	Total	1127	3.86	.56					
SRILSP	6.Grade	287	3.60	.47	Between	2.933	1.466	5.682	.004
	7.Grade	385	3.53	.51	Within	290.077	.258		
	8.Grade	455	3.47	.51	Total	293.010			
	Total	1127	3.52	.98					

When the findings in Table 8 are viewed, it is determined to be a statistically significant difference between secondary school students' "SRILSP" average scores according to the grade variable [F(2-1124)=5.682; p<.05]. When the sub-dimensions of the "SRILSP "were studied, it was discovered that; Similarly, the average scores of secondary school students in the sub-dimensions of "Positive perceptions" [F(2-1124)=5.485; p<.05] and "Perceptions of questioning the accuracy" [F(2-1124)=9.145; p<.05] It's apparent that there is a statistically significant difference. "Negative perceptions" [F(2-1124)=.813; p>.05] sub-dimensions, however, the difference is not statistically significant. According to the results of Levene's test applied to determine between which groups the difference is; Since the average group variances of total "SRILSP" (L=2.434; p>.05) and "Positive perceptions" (L=.480; p>.05) were determined to be homogeneous, the Tukey HSD test, one of the post-hoc analysis techniques, and since the average group variances of "Perceptions of questioning the accuracy" (L=3.325; p<.05) were not determined homogeneously, the Tamhane test, one of the post-hoc analysis techniques, were performed. It was determined that the "SRILSP "scores of the 6th grade secondary school students were significantly higher than the 8th grade students' scores, and the "Positive Perceptions" scores were significantly higher than the 7th and 8th grade students' scores. Furthermore, it was found that 6th and 7th grade secondary school students "perceptions of questioning the accuracy" were significantly higher than the scores of 8th grade students.

The findings of the 5th sub-problem as "Do secondary school students' "SRS," "MB" and "SRILSP" levels differ significantly according to the variable of liking to plan?" are indicated in Table 9 and Table 11.

Table 9. Independent sample t-test results of "SRS" scores according to the variable like to plan

Scale and Sub-Dimensions	Group	N	$\bar{X}$	Sd	SH_x	t-Test		
						t	Sd	p
Scientific strategy use	Yes	908	5.53	0.92	0.03	10.57	1125	.000
	No	219	4.78	1.05	0.07			
Self-regulation	Yes	908	4.88	0.86	0.03	7.78	1125	.000
	No	219	4.36	0.98	0.07			
SRS	Yes	908	5.20	0.80	0.03	10.20	1125	.00
	No	219	4.57	0.92	0.06			

When the findings in Table 9 are viewed; It is determined to be a statistically significant difference between the "SRS" total average scores of secondary school students according to the variable of liking to plan ($t_{(1125)}$=10.20; p<.05). When the sub-dimensions of the "SRS "were studied, it was discovered that, similarly, the average scores of the secondary school students in the sub-dimensions of "Scientific strategy use" ($t_{(1125)}$=10.57; p<.05) and "Self-regulation" ($t_{(1125)}$=7.78; p>05) there is a statistically significant difference between them. It has been determined that this difference is in favor of those who like to plan.

Table 10. Independent sample t-test results of "MB" Scores according to the variable like to plan

Scale and Sub-Dimensions	Group	N	$\bar{X}$	Sd	SH_x	t-Test		
						t	Sd	p
Self-efficacy	Yes	908	5.63	1.06	0.04	8.271	1125	.000
	No	219	4.95	1.20	0.08			
Intrinsic value	Yes	908	5.87	0.79	0.03	13.093	1125	.000
	No	219	5.04	1.02	0.07			
Exam anxiety	Yes	908	3.93	1.76	0.06	-2.878	1125	.004
	No	219	4.30	1.66	0.11			
MB	Yes	908	5.14	0.75	0.02	6.462	1125	.000
	No	219	4.76	0.88	0.06			

When the findings in Table 10 are viewed; It is determined to be a statistically significant difference between "MB" total average scores of secondary school students according to the variable of liking to plan ($t_{(1125)}$=6.462; p<.05). When the sub-dimensions of the "MB" were studied, it was discovered that, similarly, secondary school students' "Self-efficacy" ($t_{(1125)}$=8.271; p<.05), "Intrinsic value" ($t_{(1125)}$=13.093; p<.05) and "Exam anxiety" ($t_{(1125)}$=-2.878; p<.05) the average scores of the sub-dimensions show that there is a statistically significant difference between them. It has been determined that this difference is in favor of secondary school students who like to plan in the "MB" total average scores, "Self-efficacy" and "Intrinsic value". In addition, it's apparent that the average score of "Exam anxiety" is in favor of secondary school students who do not like to plan.

Table 11. Independent sample t-test results of "SRILSP" scores according to the variable of likes to plan

Scale and Sub-Dimensions	Group	N	$\bar{X}$	Sd	SH_x	t-Test		
						t	Sd	p
Positive perceptions	Yes	908	4.06	0.69	0.02	7.877	1125	.000
	No	219	3.64	0.77	0.05			
Negative perceptions	Yes	908	2.37	0.91	0.03	-5.295	1125	.000
	No	219	2.73	0.82	0.06			
Perceptions of questioning the accuracy	Yes	908	3.96	0.77	0.03	9.229	1125	.000
	No	219	3.41	0.88	0.06			
SRILSP	Yes	908	3.57	0.48	0.02	6.584	1125	.000
	No	219	3.32	0.58	0.04			

When the findings in Table 11 are viewed; It is determined to be a statistically significant difference between secondary school students' "SRILSP" total average scores according to the variable of liking to plan ($t_{(1125)}$= 6.584; p<.05). When the sub-dimensions of the "SRILSP" were studied, it was discovered that; Similarly, secondary school students' "Positive perceptions" ($t_{(1125)}$=7.877; p<.05), "Negative perceptions" ($t_{(1125)}$=5.295; p<.05) and "Perceptions of questioning the accuracy" ($t_{(1125)}$)=9.229; p<.05) the average scores of the sub-dimensions show that there is a statistically significant difference between them. It has been determined that this difference is in favor of secondary school students who like to plan in the "SRILSP" total scores, "Positive perceptions" and "Perceptions of questioning the accuracy", and in favor of the students who do not like to plan in the "Negative perceptions" scores.

Discussion and Conclusion

In this study, regarding the first sub-problem, it's apparent that secondary school students get high scores in both the 'Scientific strategy use' and 'Self-regulation' sub-dimensions of the "SRS." Similarly, it was seen that they got high scores in both the 'Self-efficacy' and 'Intrinsic Value" sub-dimensions of the "MB" scale, and they got moderate scores in the 'Exam anxiety' dimension. When both scales are evaluated in general, it's possible to say secondary school students have high self-regulation skills and motivational beliefs. In many studies conducted, results similar to the findings of the research were obtained (Mutweleli, 2014). In the study carried out, it is thought that the use of new teaching methods and techniques applied in the developing and changing world conditions causes the students' self-regulation skills to be high. Studies investigating the effectiveness of different teaching methods and techniques on self-regulation skills support this view (Schraw et al., 2006; Sletten, 2017). The fact that secondary school students have high self-regulation skills may suggest that they can easily apply cognitive strategies such as remembering, summarizing, and categorizing the information they have learned. Zimmerman and Schunk (2007) stated that students with self-regulation skills can repeat, elaborate, organize, know how to plan, and direct their mental processes, are willing to participate in academic studies, conduct their studies by focusing on processes, make evaluations, and thus prepare for a better learning environment. In the learning process, students should be

motivated to use cognitive and metacognitive strategies as well as to practice these strategies. Zimmerman (2002) stated that it is possible to improve motivation if the individual can use a high level of self-regulation strategy. For this reason, the high "MB" scores of the students obtained as a result of the study; can be considered that motivational beliefs are related to self-regulation skills, and it suggests that students come to the lessons with interest and enthusiasm. The fact that students have a high level of self-efficacy, according to the study's findings, and intrinsic value orientation indicates that these students have self-confidence in what they can achieve and are interested in the lesson. It can be said that students' having high motivational beliefs is an important factor in coping with negativities such as exam anxiety. The learning process is greatly influenced by motivation and the success achieved at the end of this process (Linnenbrink & Pintrich, 2002).

Studies have determined that there are positive and significant relationships between self-regulation and motivational beliefs and academic achievement (Malpass et al., 1999; Pintrich & De Groot, 1990). For this reason, it can be said that the high self-regulation skills and motivational beliefs of students are very important in the learning process. When the scores of secondary school students from the "SRILSP" scale are examined, it's apparent that they got high scores in both of the sub-dimensions of 'Positive perceptions' and 'Perceptions of Questioning the Accuracy" and low scores in the sub-dimension of 'Negative perceptions'. When the scale is evaluated in general, it can be said that secondary school students' inquiry learning skills perception of science is high. Studies were conducted in which the effects of students' science related inquiry skills and perception levels on different variables were examined (Işık & Yenice, 2013). In the study carried out, the reason why middle school students have a high perception of science related skills is that, with the Science Curriculum that came into effect in 2018, the activities that will improve the inquiry learning skills of secondary school students are given enough space.

Regarding the second sub-problem, it was discovered that the overall scores of secondary school students "SRS," "MB," and "SRILSP" have a moderately positive and significant relationship. In line with these results, it can be said that there is a significant relationship in the same direction between the "SRS", "MB", and "SRILSP" scores of secondary school students. This may suggest that secondary school students with self-regulation skills increase their motivation for the lesson along with their questioning skills. This finding supports the statement by Zimmerman (1990) that learners with developed self-regulation skills approach educational tasks by questioning and researching, unlike their passive classmates, with confidence, motivation, and a sense of readiness. In another study, Wolters (1999) investigated the relationship between students' self-regulation skills, motivational strategies, and academic achievement in a group of 88 secondary school students. The study showed that student motivation is a key role in self-regulated learning practices. The research suggests that there is a positive relationship between students' self-regulation strategies and their motivational beliefs and science related inquiry learning skills. It is thought that students who have developed self-regulation skills and can set their own learning goals will be interested, willing, and highly motivated toward the lesson, and these students will be inclined to research, question, and learn new things. As a result, it is important to positively improve students' self-regulation and inquiry learning skills during the educational and training process.

Regarding the third sub-problem, female students scored higher than male students on the "SRS" scale, as well as the "Scientific strategy use" and "Self-regulation" sub-dimensions. Similarly, in both the "Self-efficacy" and "Intrinsic Value" sub-dimensions of the "MB" scale, female students scored higher than male students, and they did not get different scores in the 'Exam anxiety' dimension. When the scores they got from the "SRILSP" scale were examined, it was seen that female student scored higher than male students in both the 'Positive perceptions' and 'Perceptions of Questioning the Accuracy" sub-dimensions and lower scores in the 'Negative perceptions' sub-dimension. When all three scales are evaluated in general, it can be said that female secondary school students have higher "SRS", "MB", and "SRILSP" scores than male students. According to studies, female students have more self-control strategies and motivational beliefs than male students (Dadlı, 2015; Erdoğan & Şengül, 2014; Peklaj & Pecjak, 2002) and inquiry learning skills than male students (Işık & Yenice, 2013). Similar to the findings obtained from the study, in the study conducted by Peklaj and Pecjak (2002) with 181 secondary school students, it was determined that self-regulation strategies and motivational beliefs had a significant difference in favor of female students. In addition, in the study conducted by Işık and Yenice (2013), it was determined that there were significant differences in favor of female students between gender and inquiry skill scores of secondary school students.

Unlike the findings, in another study, Mutweleli (2014) determined that self-regulation strategies and motivational beliefs were in favor of male students. Contrary to the findings obtained from the study, there are also studies in the literature stating that there is no difference between male and female students relating to motivational beliefs (Almarashdeh, 2012). In his study, Martin (2003) states that female students value school more than male students, they focus more on learning, they are more successful and patient in planning, implementing, and managing work. To be able to question the learning process, students need to express their views boldly and confidently and be motivated to learn. In this context, the fact that female students are more planned and programmed, organized, communicate more easily, are more interested in science and more willing to question than male students, have higher self-regulation strategies, motivational beliefs and inquiry learning skills than male students can be considered as the reason.

Regarding the fourth sub-problem, it's apparent that secondary school students get lower scores as their grade level increases in both the "SRS" scale's 'Scientific strategy use' and 'Self-regulation' sub-dimensions. Similarly, students get lower scores the higher their grade level in both the 'Self-efficacy' and 'Intrinsic Value" sub-dimensions of the "MB" scale. In the 'exam anxiety' dimension, it was determined that there was no difference between their scores, but they had moderate test anxiety at all grade levels. When the scores they got from the "SRILSP" scale were examined, it's apparent that in both the 'Positive perceptions' and 'Perceptions of questioning the accuracy' sub-dimensions, the students get lower scores as the grade level increases, while there is no difference between their scores in the 'Negative perceptions' sub-dimension. When all three scales are evaluated in general, it can be said that as the grade level of secondary school students increases, their "SRS", "MB" and "SRILSP" scores decrease. In parallel with the findings, there are studies in the literature showing that as the grade level increases, students' self-regulation strategies and motivational beliefs (Erdoğan & Şengül, 2014) and inquiry learning skills (Işık & Yenice, 2013) decrease. In line with the results obtained from the study, Erdoğan and Şengül (2014) reported in their research with

secondary school students that as the grade level increases, their metacognitive self-regulated learning skills decrease. In contrast to the findings of the study, there are studies in the literature that indicate there is no significant difference in self-regulation skills between grade levels (Almarashdeh, 2012; Zimmerman & Martinez Pons, 1990). In their study, Zimmerman and Martinez Pons (1990) revealed that 11th-grade students who attend different grade levels use self-regulation strategies more effectively than 8th-grade students. In our country, students are preparing for the high school entrance examination in 8th grade. Because they mostly focus on test techniques while preparing for the exam, their time to do research, conduct experiments in which they actively participate in the process, and participate in environments where they can make inquiries is limited. For this reason, students' self-regulation, inquiry learning skills, and motivation are negatively affected by exam anxiety. In addition, as the grade levels of the students increase, the expectations of the students about the learning process increase, and they are expected to switch from concrete concepts to abstract concepts. It is thought that students have difficulty questioning abstract concepts to concrete concepts. For these reasons, it is thought that the result of the study was that the students' self-regulation strategies, motivational beliefs, and inquiry learning skills decreased as the grade levels progressed.

Regarding the fifth sub-problem, it's apparent that secondary school students get high scores in favor of those who like to plan in both sub-dimensions of the "SRS" scale: 'Scientific strategy use' and "Self-regulation'. Similarly, it's apparent that students get high points in favor of those who like to plan in both the 'Self-efficacy' and 'Intrinsic Value" sub-dimensions of the "MB" scale, and high points in favor of those who do not like to plan in the 'Exam anxiety' dimension. When the scores they got from the "SRILSP" scale were examined; It's apparent that in both the 'Positive perceptions' and 'Perceptions of questioning the accuracy' sub-dimensions, the students got high scores in favor of those who like to plan, and in the 'Negative perceptions' sub-dimension, they got high scores in favor of those who do not like to plan. When all three scales are evaluated in general, it can be said that secondary school students who like to plan have high "SRS", "MB" and "SRILSP" scores. Although there was no study like the study carried out, it was determined in the literature that planning is related to students' self-regulation strategies and motivational beliefs (Martin, 2003; Pintrich, 2000; Uykun, 2021; Zimmerman, 2002) and their level of inquiry learning skills (Erkol & Şahintepe, 2020) is indicated. In his study in which he identified the "factors affecting the learning motivation of secondary school students" Uykun (2021), determined that the ability of students to make their plans is one of the factors under the theme of self-regulation that affects their learning motivation.

Zimmerman (2002) states that one of the main stages of the self-regulated learning model is planning. It is stated in the literature that individuals with self-regulation skills can set their own goals, be active in the learning process, control and regulate their motivation, and plan time and resources (Pintrich, 2000). Erkol and Şahintepe (2020) observed that students were able to plan better with inquiry-based learning activities. It can be said that this result of our study is due to the high self-regulation skills of the students who know and love to plan, the parallel increase in their motivation for learning, and the fact that they perform all these skills by questioning in learning environments.

Recommendations

In line with the findings obtained from the study, the following recommendations are presented:

- To determine which characteristics of students, affect their self-regulation skills, motivational beliefs, and inquiry learning skills perception for science, a multidimensional perspective can be gained by making use of qualitative data such as observation and interviews, as well as quantitative data.
- Qualitative research on why and how gender affects students' self-regulation skills, motivational beliefs, and inquiry learning skills perception for science can be conducted and the results discussed.
- Students learning levels can be increased by enabling them to participate more in activities aimed at increasing their self-regulation, motivational belief, and inquiry levels.
- In addition to planning, the effects of different variables on self-regulation skills, motivational beliefs, and inquiry learning skills perception for science can be investigated.

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