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Research Article

Investigation of the Predictive Role of Secondary School Students' Social Anxiety on Science Motivation

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Abstract: This study examined the relationship between secondary school students' social anxiety and their science motivation, as well as the predictive power of social anxiety on science motivation. Data were collected from 454 students using a relational survey model and analyzed with Pearson correlation and multiple linear regression. The findings revealed a high-level and negative correlation between students' social anxiety and their science motivation. This suggests that higher social anxiety is strongly associated with decreased motivation for science learning. Regression analyses showed that all subdimensions of social anxiety significantly and negatively predicted science motivation and its components. Additionally, social anxiety and science motivation differed according to several sociodemographic variables. Results indicated the critical influence of social-emotional factors on students' engagement in science learning and revealed that reducing social anxiety may play an important role in increasing science motivation.

***Keywords*:** science motivation, social anxiety, school students

1. Introduction

The first studies in the field of anxiety were carried out towards the end of the 1940s and it was conceptualized by Freud. Freud defined anxiety as an undesirable mood (Barlow, 2022). In the following years, various scientists made different definitions for the concept of anxiety. Anxiety, which causes worry and distress in a person, is a state of emotion that makes one think something bad will happen (American Psychiatric Association, 2022). Akan (2024) explained anxiety as the biological and psychological responses of the person to stimuli from the inner or outer world. According to McLoughlin et al. (2024), in the person, the feeling of anxiety is a result of a threat that originates from external factors. This threat often targets fundamental motives such as control, competence, and self-esteem. When it was analyzed theoretically, Barlow (2022) attributed anxiety to social factors, Čekrlija et al. (2023) to the feeling of inferiority, Riskind (2024) to unconscious unreasonable ideas, Maricic et al. (2023) to personal failures, McWilliams (2019) to the contradiction between the feeling of fear and pented-up impulses, and Beck (2021) to the way events are perceived for that individual. Myers and DeWall (2021) suggest that every person experience anxiety, the absence of anxiety will affect the lives of individuals, and in case, there is anxiety at the focal point, some behavioral disorders may occur in individuals. Anxiety can be described as a developing complex situation intended for situations that may threaten individuals that can come to the forefront with their behavioral, cognitive, physical, and emotional aspects.

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According to the psychoanalyst theory, it is emphasized that anxiety is fundamentally experienced unconsciously, but physical consequences such as anxiety, stress, and fear that the individual feels may occur. To handle anxiety as pathological or normal, it is necessary to focus primarily on the importance and magnitude of external danger elements. Since anxiety is evaluated through environmental conditions, it is inevitable for every person to be anxious in certain parts of their lives (Öztürk, 2008). In the direction of learning theories, anxiety arises through conditioning. The generalization of anxiety is reached thanks to the correlation between the painful stimulus and the neutral stimulus. Pathologically and normally, it is necessary to analyze the severity and duration variables at the point of evaluating anxiety. Violence and excessive anxieties are regarded as pathological, and the significance of dangers is not questioned. However, anxiety that is short-term and proportional to the importance of the danger is stated as normal anxiety. According to Öztürk (2008), the basis of the situation that causes the emergence of anxiety is how individuals perceive the elements in their environment. Due to some perceptions that show alterations between cultures, one group feels comfortable in the same social environment, while another group may experience anxiety. Social anxiety is described in Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) diagnoses as "when an individual is attracted to the attention of other individuals/strangers or is subjected to examination, social or physical performance decline, and long and uninterrupted anxiety (American Psychiatric Association, 2022). According to Antony and Swinson (2008), social anxiety is the emergence of tendencies such as feeling fear/anxiety, being disturbed in social places, and feeling nervous. While some individuals can experience anxiety mildly, the same anxiety could be experienced at higher levels in others. Unless this situation continues prominently and continuously, social anxiety disorder is not diagnosed unless it causes distress and clinical disorders in the individual (Sertelin-Mercan, 2016). People with social anxiety do not want to enter social environments as they are afraid of being criticized by others, being disgraced, failing, and being funny. They are afraid of eating, talking, writing, and communicating in public. Also, individuals with social anxiety are super sensitive to being criticized (Subaşı, 2007). Adolescents with high social anxiety have more difficulties in academic and social areas than others (Teachman & Allen, 2007). Common problems that are frequently mentioned; not being able to speak in front of the community, not being able to be assertive, not being able to enter social environments, decrease in academic success, not being able to meet new people, not being able to participate in cultural and sports activities, hesitation in taking the right to speak, not being able to communicate with the opposite sex (Sertelin-Mercan, 2016). Accordingly, anxiety can be considered an emotional response that occurs when an individual perceives a threat. However, the types of anxiety differ significantly in terms of the context in which they arise and the effects they have on the individual. For example, generalized anxiety disorder is characterized by persistent and uncontrollable worry about many aspects of daily life. This disorder requires no specific social trigger. Another type of anxiety, exam anxiety, is limited to specific situations involving performance evaluations and is triggered only by the perception that academic success is under threat. In contrast, social anxiety is characterized by intense fear, shame, and avoidance behaviors in social situations where the individual will be evaluated by others. The most fundamental characteristic distinguishing social anxiety from other types of anxiety is its origin in the expectation of social evaluation. This is particularly evident in school environments where social interactions are intense, especially for adolescent students. Therefore, social anxiety is not merely an emotional response but a critical psychosocial variable that directly impacts students' academic engagement, classroom performance, and motivation. In this context, examining the nature of social anxiety that distinguishes it from other types of anxiety strengthens the importance of the research and makes it necessary to understand the effects of social anxiety on academic motivation.

A literature review in this area reveals that there are many different types of anxiety. Concepts such as obsessive-compulsive disorder, panic disorder, agoraphobia, post-traumatic stress disorder, specific phobia, and social anxiety are prominent in this area. This research specifically evaluates the concept of social anxiety.

2. Literature review

2.1 *Science motivation*

Motivation is defined by Ryan and Deci (2000a) as acting to do something. Motivation, which is a very important factor for individuals to achieve success, is considered an internal state that is effective in the emergence of individuals' behaviors and guides their behaviors. When examined in an educational framework, it is expressed as an effective

provision for the issues that individuals need, question, and attract their attention. When examined in an educational framework, it is expressed as an effective provision for the issues that individuals need, question, and attract their attention. Motivation is considered by Kaplan and Maehr (2007) as an effective factor in teaching and learning, like many areas of life. The realization of the importance of motivation for the individual today has been effective in the students who were considered a machine and responded to their needs in the past, to be individuals who can make their own decisions, and shape their daily lives with their goals. During the learning process, students who can constantly concentrate their attention on their interests, focus on the current issue, constantly strive, and do not give up their insistent attitude in the face of difficulties positively have a high level of motivation. Yenice et al. (2012) state that, despite the knowledge and acceptance of the effects of motivation on learning and behaviors, it is stated that in general terms, how it is used in an instructional design and how it is used in the process is not known enough. Motivation is expressed by Schunk et al. (2020) as a power that forces individuals to perform an activity, stands out, especially at the beginning of the activity, and maintains its effect in the continuation of the activity. Along with this power, which is effective in the initiation of the learning process, there are quite important tasks that should be undertaken by teachers. In a quality teaching process, learners are taught how to remember what they have learned, how to approach it with a thought, how to learn, and how to motivate themselves. This also reveals the relationship between learning strategy and motivation. When the factors that affect motivation are evaluated, it is seen that the methods and strategies used at the point of realization of learning are significant. Emphasizing the limitedness of traditional teaching methods, it has been demonstrated that approaches that focus on students at the center will be much more beneficial. Developing learning environments in which students actively participate and learning strategies that students will benefit from throughout their lives in addition to their school life is considered an important requirement. At this point, the concept of self-regulated learning came to the fore. This emerging concept provides convenience for individuals that they can use it for their entire lives. No matter how high a person has academic intelligence, it is exceedingly difficult for him to be successful unless he is aware of his affective abilities (Kahyaoğlu & Saraçoğlu, 2018). After all, it is not expected that an individual who does not have an intense interest and desire to learn will be able to fully grasp any subject. In fact, according to the research, motivation is accepted as an important affective component that affects many variables such as creativity, learning style, and academic achievement (Dede & Yaman, 2008), but Köksal (2014) states that there is no significant relationship between motivation and cognitive learning factors. When the literature was examined, different definitions of motivation were encountered. While Aslan and Doğan (2020) define motivation as using and activating the internal energy of the individual in a task-oriented manner, according to Robinson and McIlroy (2021) motivation is the process that is effective in the initiation and maintenance of goal-oriented activity. Watters and Ginns (2000) defined motivation as a complex psychological structure that tries to explain the behavior and efforts of individuals in different activities. According to another definition, motivation is a force that initiates the behaviors necessary to fulfill a need and expresses the internal factors that activate the individual and the external factors that encourage the individual to perform the behavior. Based on these definitions, it can be said that motivation is generally a complex psychological process that initiates and maintains a goal, task, or activity and tries to explain all behaviors and efforts that ensure its successful completion. The degree of attention and effort of students in various occupations that will or may not be desired by teachers in learning and teaching environments is related to their motivation.

Motivation is divided into two types: internal and external to explain the sustainability of behavior. While the desire and interest to realize our intrinsic motivation comes from within, in extrinsic motivation, this desire is realized depending on environmental expectations. Intrinsic motivation is more effective than extrinsic motivation in learning, and these two types of motivation are in a negative relationship with each other (Mendler, 2000). Intrinsic motivation has a very important place in the science education of individuals. Intrinsic motivation, which is seen as an important component of the affective context for the science course, is considered a diagnostic criterion for individuals, as well as a high cognitive infrastructure. Motivation, which is an affective factor influencing the learning process of students in science education and the quality of this process, has a very important place in science teaching as it is related to many variables. Motivation according to the studies done; cognitive structures such as attitude towards science and science achievement (Tuan et al., 2005), structuring and conceptual change of knowledge (Palmer, 2005), metacognitive reasoning, and the use of strategies, interest in science (Glynn & Koballa, 2006), are related to variables that are of great importance in science learning such as self-efficiency and task value (Köksal & Taşdelen, 2008) in making science-oriented repetition and organization. Also, students' motivation for learning science; self-efficiency is influenced by

factors such as science learning value, learning strategies, learning goals, and learning environment (Tuan et al., 2005). Another important variable in science learning, which is in relation to many variables and is influenced by many variables, is mental risk-taking. Studies consider risk-taking as an intrinsic motivation factor and argue that taking risks in a measured way is effective in increasing the motivation of individuals (Beghetto, 2009). Although mental risk-taking behavior is seen as a related variable for intrinsic motivation, when the literature is examined, there is no research on how much intrinsic motivation explains this behavior for individuals. In this context, significant contributions will be made to the literature by explaining the relationship ratio between these two concepts, which are seen as important variables for students to achieve success in science lessons.

2.2 *Research on social anxiety and science motivation*

In studies conducted to determine the age range of onset of social anxiety, the following findings were found; Teachman and Allen (2007) stated that social anxiety starts around the age of 7.3; Boyd et al. (1990) found that the possibility of social anxiety emerging in the 11-17 age range is a more common situation. Also, Kessler et al. (2005) found that the prevalence of social anxiety decreases significantly in the twenties and becomes almost negligible in later years. Beesdo-Baum et al. (2012) found that social anxiety begins between the ages of 12 and 15. Furthermore, Scaini et al. (2014) found that the onset of social anxiety coincides with adolescence, based on their meta-analysis. Studies have shown that social anxiety begins in childhood or puberty, along with differences in the start time and age of onset. Some studies found that social anxiety differs according to gender and that female students have higher social anxiety than male students (Biggs et al., 2011; Ohayon & Schatzberg, 2010). Boyd et al. (1990) stated that the prevalence of social anxiety was 1%-2.3%, while it was found that the prevalence among all anxieties was 1/4. According to the results of the research conducted by Baptista et al. (2011), the prevalence of social anxiety among Brazilian university students was found to be 11.6%. Fenigstein et al. (1975) showed that parental attitudes (authoritarian, negligent, rejecting, overprotective, etc.) and the sense of satisfaction an individual feels with his sense of self can be a determinant of how much or less social anxiety he has. At the same time, parental attitudes also affect the individual's self-respect. It has been stated that children who grow up with rejection, overprotection, or excessive authority can quickly become embarrassed and bored, and social anxiety can occur. Kashdan and Roberts (2004) found during research that people with high social anxiety experience more negative sensations. In some studies, it has been observed that the parents of individuals with social anxiety exhibit attitudes that do not show unconditional positive acceptance, protect and watch over more than necessary, and feel a sense of guilt. In a research conducted by Bayramkaya et al. (2005), it is observed that the prevalence of social anxiety in adolescents was 14.4%. According to a research conducted by Demirtaş (2009), it was concluded that there is a significant and positive relationship between shyness and the need for the approval of irrational attitudes. According to studies made in Turkey with university students, it is understood that there are differences among university students with social anxiety disorder incidence of 10% to 22% (Dilbaz, 2002). In the research conducted by Gültekin and Dereboy (2011) with seven hundred university students, it was found that female students had more social anxiety than male students, and it was stated that the social role of women can be considered as the desired attitude to be socially phobic in women. The university period corresponds to the last stage of puberty, and in this period, the individual may impose himself/herself as an autonomous person and show it to others. The individual, who considers the impressions he leaves on others important and whose social relations develop faster with the university environment, may experience social anxiety and social anxiety disorder may begin to manifest if he cannot meet the important expectations about himself. When the literature is analyzed, it is seen that social anxiety disorder is positively associated with many problems in individuals such as low quality of life (Gültekin & Dereboy, 2011), depression level (La Greca & Harrison, 2005), low self-esteem (Abdollahi & Abu Talib, 2016), and low social skills (Scanlon et al., 2020). Also, Van Zalk et al. (2011) stated that social anxiety disorder affects interpersonal relationships; they showed that individuals with social anxiety establish friendships with people with the same problem and these relationships make them more socially anxious over time. Kashdan and McKnight (2010) indicate that this irrational fear of negative criticism stems from the effort to make a good impression on someone and the thought that this effort will fail. Therefore, individuals with social anxiety focus on negative evaluations without considering the objective comments in their social environment (Kashdan & McKnight, 2010). Some qualitative and quantitative studies conducted in the field of social anxiety show that perceived parental rejection in childhood causes social anxiety in individuals in their adulthood (Giaouzi & Giovazolias, 2015). Similarly, some studies show that parental rejection is a

strong predictor of social anxiety in children and young adults (Brook & Schmidt, 2008). Also, it is found that higher levels of parental anxiety, rejection, and over-control are also associated with higher levels of social anxiety in individuals of the same age group. Consistent with these findings, some retrospective studies have shown that adults with high social anxiety rate their parents as less warm, less merciful, and caring parents than adults with low levels of social anxiety (Morris, 2001). Correlatively, it is stated that rejection behaviors such as being criticized, humiliated, and ignored by parents will contribute to the expectation of negative evaluation from others and be constantly afraid of this in social environments (Gulley et al., 2014). Chiu et al. (2021) have consistently shown that social anxiety is associated with decreased friendship quality, increased peer rejection, and social exclusion in adolescents. As a result of the research conducted by La Greca and Harrison (2005); it has been determined that friendship relationships and quality romantic relationships have a protective aspect against social anxiety. Erath et al. (2007) investigated the factors associated with social anxiety during adolescence; they found that there was a high correlation between social anxiety and increased peer victimization, and decreased peer acceptance. Also, it was found that there is a relationship between negative social success expectations and social withdrawal, and social anxiety (Sübaşı, 2010). Silgado et al. (2010) showed in their research that participants with high levels of social anxiety had significantly higher perfectionism score averages. On the other hand, it was found statistically significant that the perfectionism score predicted the social anxiety score. Calsyn et al. (2005) found that people with high social anxiety have less social support than other people, as a result of their comparative research. Some researchers (Mercer & DeRosier, 2008) also found that acceptance by their friends and teachers is an important determinant of an individual's adaptation in middle childhood and later in life. According to the same research findings, peer rejection and teacher preference findings were also predicted among the reasons for students' aggression (Sübaşı, 2010). Another research conducted by Dilmaç and Yücesoy (2019) examined the relationship between social appearance anxiety and non-rational beliefs, which are defined as concern for the evaluation of physical appearance for others and are a form of social anxiety and concluded that as the more irrational beliefs of university students increases the more their social appearance anxiety increases. Sübaşı (2009) states that peer relationships have an important role in the formation of emotional development in adolescence. Thus, positive peer interaction makes individuals happy while also ensuring their well-being. While this situation is supported by the results of the research La Greca and Harrison (2005) conducted, a negative correlation was found between depression and social anxiety and high-quality friendship relationships. On the other hand, McDonald et al. (2010), in situations with low friend support, found a positive correlation between rejection sensitivity and social anxiety. There is a positive correlation observed between rejection sensitivity and social anxiety and depression in other studies (Sübaşı, 2009). Some researchers found that there is a two-way relationship between problematic peer relationships and social anxiety. These researchers also stated that social anxiety is experienced because of problematic peer interaction; they state that the existence of social anxiety in the individual has a side that reduces positive social interaction, restricts social relations, and causes problems in communication between individuals. La Greca and Lopez (1988) stated that this situation decreases positive friendships and increases negative friendships; states that while at the same time it causes an increase in social anxiety and social exclusion. De Los Reyes and Prinstein (2004) also support that negative peer relationships are an important factor in increasing social anxiety and depression. Other studies investigating the relationship between peer relationships and social anxiety also found a negative correlation between peer acceptance and social anxiety. On the other hand, Vernberg et al. (1992) are other researchers who found a significant and positive correlation between adolescents' social anxiety level and interpersonal relationship rejection. Teachman and Allen (2007) found in their research that close peer communication and lack of social acceptance were associated with fear of negative evaluation. Erath et al. (2007) predicted that adolescents with a high level of social anxiety have obedient and avoidant behaviors that facilitate their exposure to bullying by their peers. According to Storch et al. (2005), exposure of individuals to bullying increases their social fears even more. Beidel et al. (2000), of their research examining the characteristics of children with high social anxiety, determined that these children experienced social fears, general fears, unwillingness, inhibition, excessive emotional reactivity, and loneliness. Additionally, they listed the situations that create the most fear for these students as follows; reading aloud in the classroom, performing an activity in the field of music or physical education, starting and maintaining a conversation, writing on the board, ordering a meal at a restaurant, dancing, answering a question in class, collaborating with other students, playing with other students, and being subjected to an exam. To better understand the effects of social anxiety, valuable insights can be gained from case studies based on traditional student experiences. La Greca and Lopez (1998) emphasized the prevalence of social

anxiety among secondary school students and specifically identified this anxiety as a fear of negative evaluation. One example is a 12-year-old student who avoided speaking, saying, "*My friends will laugh if I say it wrong*." This behavior demonstrates that social anxiety is not merely an emotional response but a cognitive process that directly limits a student's academic engagement. Beidel et al. (1999) similarly stated that students experiencing social anxiety intensely avoid performance-based tasks in the classroom, and that even simple interactions such as giving a presentation or asking a teacher a question can be triggering. The literature reports that social anxiety is not limited to academic tasks but can also manifest prominently in daily social interactions. For example, Beidel et al. (1999) observed a 13-year-old student avoiding ordering in the school cafeteria, only to experience facial flushing and vocal tremors when it was his turn to order. This demonstrates that social anxiety can lead to significant difficulties by weakening an individual's sense of self-efficacy in even the simplest social interactions. Furthermore, Storch et al. (2005) found that students with high levels of social anxiety were more likely to experience peer bullying. The study reported that a 14-year-old student chose to remain silent in the classroom out of fear of making mistakes, and this behavior was perceived as a sign of "weakness" by his classmates and was ridiculed. Accordingly, literature reports have shown that social anxiety in school-aged students is not merely a temporary emotional state but also a comprehensive psychosocial problem that profoundly impacts social participation, academic motivation, achievement, and peer relationships. In this context, the literature revealing the concrete effects of social anxiety clearly emphasizes that research addressing students' learning motivation should consider social anxiety as a critical variable.

On the other hand, in terms of science motivation, Tuan et al. (2005) have developed the Students' Motivation Toward Science Learning (SMTSL) questionnaire (self-efficacy, active learning strategies, science learning value, performance goal, achievement goal, and learning environment stimulation) consisting of six subscales to measure students' science motivation. Another research by Yenice et al. (2012) is the determination of motivation levels for learning science. In the research, the motivation levels of secondary school students toward learning science have been examined according to various variables, and the factors motivating students to learn science have been determined. As a result of the research conducted with 663 primary school students, it has been determined that students' science motivation levels were high. Also, it has been stated in the research that the motivation for learning science does not vary according to gender but demonstrated significant differences according to the variables of class level, weekly science and technology lesson duration, and the number of books at home. According to the research, it has been determined that there is a moderate level, positive and significant relationship between students' level of motivation (evaluated based on students' exam marks) towards science and their science achievement. It has been determined by Karakaya et al. (2018) that the variables of gender, grade level, and science class affect the motivation of middle school students. Yıldırım and Karataş (2018) have conducted another research investigating secondary school students' science motivation according to various variables. According to the results of the research in which 1,629 students participated, there is no significant difference between the motivation levels of secondary school students according to the variables of teacher gender, length of service, having a study room at home, and having a computer at home. According to the results of the research in which 1,629 students participated, there is no significant difference in the motivation levels of secondary school students for variables such as teacher gender, length of service, having a study room, and having a computer at home. There is a significant difference in motivation in terms of variables such as internet usage, science class success score, taking part in scientific activity, type of teaching material, frequency of using technological applications, level of liking the science teacher, and reading and watching publications related to science. Also, it was determined by the researchers that there was a significant decrease in their science motivation when the age level of middle school students increased. It has been determined that there is high their motivation for active learning environments such as research, performance, communication, collaborative work, and students' bets and their science motivation apart from the students' science motivation. On the other hand, Balçın and Çavuş (2020) examined the differentiation of perception towards the ARCS motivation model, which is based on the synthesis of Attention (A), Relevance (R), Confidence (C) and Satisfaction (S) categories, in terms of various variables. According to the results of the research, it has been stated that the ARCS motivation model is quite effective in the teaching activities of the students in a science course. Furthermore, research shows that students' perceptions of motivational teaching practices do not differ significantly for science lessons according to gender and the frequency of using smart boards but differ in terms of other variables. It is clear that active learning environments significantly differentiate the perception of science motivation although students' science motivation is affected by various variables (number of books read at home, grade

level (age), parents' education level, etc.). Also, motivation is seen as very important for success. Barlia (1999) has investigated the importance of motivation factors that support students' learning for a conceptual change in science, and as a result, they have emphasized the need for teachers to consider motivation factors while teaching students. Considering the current studies mentioned, it could be said that students' science motivation is an important variable that will affect their science learning. Considering the current studies mentioned, it could be said that students' science motivation is an important variable that affects their science learning. In this context, it has been deemed important to present the literature on the practices that can increase student motivation in science learning, and these studies are included in the following paragraphs. In this context, it is considered important to submit the literature on practices that can increase student motivation in science education and these studies are included in the following paragraphs. Within the studies aimed at increasing students' science motivation, Mamlok-Naaman (2011) has observed the teaching approach as the most important component in increasing students' science motivation, and "How Can We Motivate High School Students Against Science?" he sought answers to the questions of why some students did not pursue important career in scientific disciplines and how to develop these students' interest in science. Considering the studies conducted with the students, the researcher has observed that it may be correct to use a historical approach in science teaching, believing that those who do not have an orientation towards science will develop their attitudes and interests towards science. Sani et al. (2018) have investigated an experimental method that demonstrates the effect of a brain-based learning approach on students' science motivation. As a result of the research, they have determined that motivation is statistically different between the control group in the experimental group and suggested that brain-based learning could be an alternative implementation to increase students' motivation. On the other hand, Tremblay-Wragg et al. (2019) investigated the effect of using diversified teaching strategies in university students' lessons on student motivation, and as a result, they observed that strategy diversification in lessons increased student motivation. Considering all these, it could be said that teaching methods in which active learning strategies are generally used increase students' science motivation levels. However, for these strategies to achieve a high level of success in increasing student motivation, it has been deemed important to know other variables related to science motivation, which may affect the process before or during the implementation phase. Çeliker et al. (2015) have conducted a research on variables related to motivation in science education. Accordingly, research is conducted on secondary school students to learn science, provided that their scientific creativity and motivation levels are examined in terms of some variables. As a result of the research, a significant and positive relationship has been found between the students' motivation levels and their scientific creativity levels. Another result of the research is that student motivation does not change according to the place where the lesson is taught. Another research by Taş (2016) aimed to determine the relationship between cognitive, behavioral, affective, and active participation in science, learning environment perception, and motivational factors. It has aimed to determine the relationship between cognitive, behavioral, affective, and active participation in science, perception of the learning environment, and motivation factors in another research by Taş (2016). A total of 315 students studying in the 6th- and 7th-grades participated in the research. Four hierarchical multiple regression analyzes were performed on the dependent variables of cognitive, behavioral, emotional, and active participation in the research. The results have shown that most of the variables of perception of the learning environment positively predicted participation components and motivation factors also have some different predictive effects on participation components. Weiss and Fortus (2017) have investigated the relationship between science teachers' teaching and students' science motivation and school culture using the achievement goal theory. They have developed a self-assessment research that evaluated the use of practices that emphasized science mastery goals of teachers based on the goals and using data from 95 teachers. Thereafter they used this research and hierarchical liner modeling analyses to examine the mastery goals of 35 science teachers in each of their goal dimensions, their students' decline in their classroom, their continuing science motivation, and their mastery goals in their schools. As a result of the research, it has been stated that the decrease in students' science motivation might be due to a decreasing emphasis on mastery goals by science teachers and the school. Another research on variables affecting motivation has been conducted by Shin et al. (2017). In the research, the importance of career-related motivation in science motivation has been investigated. The effect of academic year and gender on motivation is another problem of the research. As a result of the research, it has been observed that career motivation has direct effects on various motivational factors such as classroom motivation, learning needs, autonomy, and self-efficacy in learning science. Schulze and Lemmer (2017) have conducted research to investigate the relationship between the family experiences of students, science motivation, and achievements. As a result of the research, it has been observed that

family experiences were significantly associated with three motivational factors (self-efficacy, active learning, and achievement goals) and it has been suggested that schools should increase family experiences to increase students' motivation and achievement towards science learning. Research has been conducted by Kışoğlu (2018) to examine the motivation of science high school students to learn biology and their attitudes towards biology lessons. According to the research, the highest correlation between subscales of motivation and attitude scales has been found between intrinsic motivation and interest subscales and intrinsic motivation and pleasure subscales. Kahyaoğlu and Saraçoğlu (2018) state that science motivation is an important predictor of secondary school students' perceptions of scientific inquiry skills. Considering all the research, the science motivation of students could be significantly differentiated in terms of many variables such as classroom level, teacher, science lesson learning environment, and using technology although the motivation of students towards science learning is high in general. Also, it could be said as a common result of the research that students' science motivation can be increased if active learning processes are put to work and if the affective factors of the students are taken into consideration. On the other hand, considering the studies in which motivation in learning science is related, it is seen that the studies focus on the variables of interest and attitude. It has been observed that there are quite a limited number of studies on variables that are to individuals' science motivation.

On the other hand, according to self-determination theory, motivation is considered in two main dimensions: intrinsic and extrinsic motivation. This theoretical distinction significantly impacts students' learning strategies, engagement levels, enduring learning tendencies, and scientific outcomes in the context of science (Ryan & Deci, 2000a). Intrinsic motivation is directly linked to students engaging in an activity when they find it inherently interesting and engaging. In the context of science, a student with intrinsic motivation is driven to experiment, conduct research, ask questions, and explore because the subject is inherently engaging. These students are eager to develop their scientific process skills while also aiming to deeply understand conceptual relationships. Ryan and Deci (2020b) demonstrated that intrinsic motivation enhances children's academic self-efficacy, curiosity, and desire to learn, and is a key factor shaping scientific literacy, conceptual understanding, and long-term scientific interest. Similarly, Glynn et al. (2011) reported that intrinsic motivation is a key factor shaping scientific literacy, conceptual understanding, and long-term scientific interest. Accordingly, intrinsic motivation not only enables students to participate more actively in the learning process, but also plays an important role in creating a permanent and in-depth learning experience. Extrinsic motivation is defined as an individual's motivation to perform an activity based on external factors such as rewards, grades, social approval, teacher expectations, or family pressure. In science classes, students motivated by extrinsic motivation typically focus on exam success, prefer superficial learning strategies, and complete tasks solely out of a sense of obligation. Pintrich and Schunk (2014) stated that extrinsic motivation has the potential to direct student behavior in the short term, but its effectiveness in promoting lasting learning is limited. Students with this type of motivation have been observed to use science process skills only when necessary. Therefore, while extrinsic motivation may provide short-term performance-based success, unlike intrinsic motivation, it fails to foster deep learning and foster long-term academic interest. When the science education literature compares the effects of intrinsic and extrinsic motivation on learning, it shows that intrinsic motivation promotes scientific learning more positively and sustainably. The effects of extrinsic motivation, on the other hand, are mostly temporary and focused on performance rather than enhancing the quality of learning. This theoretical framework demonstrates how different sources of scientific motivation have different effects on students' science learning outcomes and highlights the importance of the motivation variable on which the study focuses. It also provides a strong foundation for understanding the relationship between psychosocial factors, such as social anxiety, and motivation, thus supporting the rationale for the study.

2.3 *Importance and propose of research*

Students' motivations for learning science are affected by various variables (number of books read at home, class level (age), parental education level, etc.), but active learning environments significantly differentiate the perception of motivation for learning science. Also, motivation is seen as very important for success. Based on all this, it can be said that teaching methods using active learning strategies in general increase students' science motivation levels. Therefore, this research aims to examine whether there is a relationship between the social anxiety levels of secondary school students and science motivation levels and to investigate the contribution of social anxiety in predicting science motivation. Also, it is aimed to examine the situations in which students' motivation levels for social anxiety and science learning differ according to gender, class, the number of siblings, living space, mother's education level, and father's

education level. Accordingly, the problem sentence of the Research (RQ) was determined as "Is there a statistically significant relationship between the science motivation and social anxiety level of secondary school students?". The subproblems of the research were as following to:

1. RQ1. Do social anxiety levels of secondary school students predict their science motivation?
2. RQ2. Is there a significant difference in the social anxiety levels for demographic characteristics (gender, class, number of siblings, living space, mother's education level, father's education level) of secondary school students?
3. RQ3. Is there a significant difference in science motivation levels for demographic characteristics (gender, class, number of siblings, living space, mother's education level, father's education level) of secondary school students?

3. Method

3.1 *Model of research*

In the research, a relational screening model was used to examine the relationship between the social anxiety levels of secondary school students and their science motivation levels. It is a survey model in which more than two variables experience change together in the relational survey model and the degree of this change is determined. In this case, the relationship between the variables can be fully independent or in the form of mutual or partial dependence on each other. Because this model aims to reveal the natural relationships between variables, the researcher cannot make any controlled interventions on the variables. Therefore, the researcher focuses solely on describing the current situation as it is. Therefore, standardizing the application process of measurement tools is crucial to prevent external influences from interfering with relationships.

In this context, scale administrations were conducted during weekday class hours to minimize student cognitive fatigue, in accordance with a plan made with the school administration where the study was conducted. These administrations were conducted during the first two periods of the day to minimize student cognitive fatigue. The administrations were conducted in the classroom, under the supervision of the researcher and relevant subject teachers. An individual and quiet administration schedule was maintained to prevent students from being affected by social interaction or external pressures. The schools where the measurements were taken were public middle schools with similar regional and socio-cultural characteristics, and the administration process was conducted using standardized instructions across all classes. The administration of the measurement instruments took an average of 20-25 minutes, and no intervention or guidance was administered. Thus, possible external variables that could affect the internal validity of the measurements were controlled.

On the other hand, because the data collection tools used in this study were self-report-based, some biases are likely to emerge. Various methodological control mechanisms were employed throughout the implementation process to minimize the systematic impact of such biases on the measurement results. Before administering the scale, students were clearly informed that their responses were anonymous, would not be shared with their teachers or families, and would be used solely for scientific purposes. This information is a measure intended to reduce social desirability pressure and increase students' willingness to respond sincerely. It was also made clear that there were no "right" or "wrong" answers to any questions. It was emphasized that the study was solely focused on students reflecting on their own experiences. During the data cleaning process, overly consistent response sets and monotonous marking patterns that could indicate self-report bias were checked.

3.2 *Universe and sampling*

The universe of the research consists of a total of 10,045 students who continued their education in secondary education institutions in a province in eastern Turkey in the 2018-2019 academic year. In calculating the sample volume required to represent the universe it was used the equation proposed by Salant and Dillman (1994) was used. The sufficient sample size was calculated as 454. Accordingly, the distribution of the socio-demographic characteristics of the middle school students in the research is shown in Table 1 as a percentage and frequency.

Table 1. Distribution of students by sociodemographic characteristics

Demographic features		*N*	%
Gender	Female	206	45
	Male	252	55
	Total	458	100.0
Grade	5th-grade(1)	106	23.1
	6th-grade(2)	117	25.5
	7th-grade(3)	120	26.2
	8th-grade(4)	115	25.1
	Total	458	100.0
Number of siblings	Only child(1)	13	2.8
	One sibling(2)	45	9.8
	Two siblings(3)	105	22.9
	Three siblings(4)	142	31.0
	Four siblings and over(5)	153	33.4
	Total	458	100.0
Living space	Village(1)	134	29.3
	District(2)	282	61.6
	City(3)	37	8.1
	Metropolis(4)	3	0.7
	Abroad(5)	2	0.4
	Total	458	100.0
Education status of the mother	Not literate(1)	105	22.9
	Primary school(2)	164	35.8
	Elementary school(3)	125	27.3
	High school(4)	49	10.7
	Associate degree(5)	5	1.1
	Bachelor's degree(6)	6	1.3
	Master's degree(7)	4	0.9
	Total	458	100.0
Education status of the father	Not literate(1)	30	6.6
	Primary school(2)	130	28.4
	Elementary school(3)	162	35.4
	High school(4)	104	22.7
	Associate degree(5)	11	2.4
	Bachelor's degree(6)	16	3.5
	Master's degree(7)	5	1.1
	Total	458	100.0

52.7% of the students in the research are male, 26.2% are in 7th-grade, 25.5% are in 6th-grade, 25.1% are in 8th-grade, 23.1% are in 5th-grade. 33.4% of them have four or more siblings, 61.6% spent most of their life in the district, 35.8% of their mothers had a primary school graduate and 35.4% of their fathers had a secondary school graduate.

3.3 *Data collection tools*

The questionnaire form prepared for data collection in the research consists of 3 parts.

3.3.1 *Socio-demographic information form*

In this section, there are 6 questions to get information about the gender of the students, the education class they attend, the number of siblings, the living space, the education level of the mother, and the education status of the father.

3.3.2 *Social anxiety scale for adolescents*

The scale was developed by La Greca and Lopez (1998) and adapted to Turkish by conducting a validity and reliability research by Aydın and Sütçü (2007). The scale consists of 18 expressions and 3 subscales and is a 5-point Likert-scale measurement tool. The subscales of the scale are Fear of Negative Assessment (FNA), Fear and Anxiety

in New Social Situations (F-ANSS) and feeling Fear and Discomfort in General Social Situations (F-DGSS). In the research of Aydın and Sütçü (2007), the internal consistency coefficient of the scale was 0.88, 0.83 for the FNA subscale, 0.68 for the F-ANSS subscale, and 0.71 for the F-DGSS subscale. In this research, the Cronbach Alpha reliability coefficient of the overall scale was found to be 0.821, and the Cronbach alpha reliability coefficients of the subscales were obtained as 0.750 for the FNA subscale, 0.748 for the F-ANSS subscale, and 0.709 for the F-DGSS subscale. High scores taken from the Social Anxiety Scale for Adolescents (SASA) and its subscales indicate that adolescents have a high level of social anxiety.

3.3.3 *Science Motivation (SM) scale*

The scale was introduced to the literature by Dede and Yaman (2008) after a validity and reliability study. The scale consists of 23 items and 5 subscales in total. The scale items are of the 5-point Likert type. The subscales of the scale are "Motivation for Research (SMR)", "Motivation for Performance (SMP)", "Motivation for Communication (SMC)", "Motivation for Cooperative Work (SMCW)", and "Motivation for Participation (SMPA)". On the scale, items 17 and 18 are reverse coded. The reliability coefficient of the scale was determined as 0.80 in the research of Dede and Yaman (2008). In this research, the Cronbach alpha reliability coefficient of the overall scale was found to be 0.849, and the Cronbach alpha reliability coefficients of the subscales were determined as 0.715, 0.718, 0.658, 0.715, and 0.693, respectively.

Versions of the measurement instruments adapted for the Turkish sample were chosen because they demonstrate high sensitivity to cross-cultural measurement invariance for affective constructs such as social anxiety and motivation to learn science. Scale items for psychological constructs may not exhibit the same factor structure and item functioning across cultures. Therefore, the study only identified linguistic, conceptual, and structural equivalence processes for the Turkish cultural context. Moreover, measurement instruments with retested statistical fit indices were used on the Turkish sample. It was determined that both internal and external validity of the measurement instruments were strengthened by reducing culture-related conceptual and item biases.

3.4 *Collection and analysis of data*

The data obtained in the research were collected through questionnaire forms. The data collection study was carried out with students studying in four secondary education institutions in Şanlıurfa province of Turkey in the 2018-2019 academic year. SPSS 20 statistical program was used to analyze the data of the research. The distribution of the sociodemographic characteristics of the middle school students in the research is shown by percentage and frequency. The reliability of scales and their subscales were checked with the Cronbach Alpha reliability coefficient. The control of the normal distribution of the scores obtained by the students from the scales in the research was performed by kurtosis and skewness values. If kurtosis and skew values are between -1.5 and +1.5, it can be stated that the data are normally distributed (Tabachnick & Fidell, 2013). The differentiation status of the students in the research according to their sociodemographic characteristics was investigated by an independent samples *t*-test (for paired groups) and one-way analysis of variance (for groups of three or more). As a result of the one-way analysis of variance, the differentiation of the scores obtained from the subscales that were found to be statistically significant according to the groups was examined with the Tukey test (Levene $p > 0.05$), one of the post hoc tests. Pearson Correlation analysis was used to examine the relationships among the scales' subscales. In the analysis of the data obtained in the research, it was evaluated according to the 95% confidence level. In this part of the research, the descriptive statistics of the students' scores from the scales and the relationships between the subscales were examined. Also, the differentiation of the scores of the students from the scales and subscales for the socio-demographic characteristics of the students was determined.

4. Results

4.1 *Descriptive statistics of the scores the students obtained from the scales*

The descriptive statistics of the scores the students received from SASA and its subscales are shown in Table 2.

Table 2. Descriptive statistics of the scores obtained from SASA and its subscales

Dimension	*N*	Max	Min	$\bar{x}$	Std.	Kurtosis	Skewness
FNA	458	7	35	20.39	6.64	-0.051	-0.618
F-ANSS	458	5	25	12.94	4.79	0.264	-0.375
F-DGSS	458	6	30	17.51	5.31	0.120	-0.421
SASA	458	18	90	50.86	13.64	0.039	0.149

N: The number of participants, $\bar{x}$: Arithmetic mean, Max: Maximum, Min: Minimum, Std.: Standard deviation

According to Table 2, the average of the scores the students obtained from the FNA subscale is 20.39 ± 6.64; the average of the scores they got in the F-DGSS subscale was 12.94 ± 4.79; the average of the scores they got in the F-ANSS subscale was 17.51 ± 5.31; the average of the scores they got from SASA was found to be 50.86 ± 13.64. Also, it can be stated that the data show a normal distribution since the kurtosis and skewness values of the scores obtained from SASA and its subscale are between -1.5 and +1.5. The descriptive statistics of the scores obtained by the students from the science motivation scale and its subscale are shown in Table 3.

Table 3. Descriptive statistics of scores obtained from SM and its subscales

Dimension	*N*	Max	Min	$\bar{x}$	Std.	Kurtosis	Skewness
SMR	458	6	30	22.94	4.61	-0.938	0.973
SMP	458	5	25	19.91	4.37	-1.102	1.030
SMC	458	5	25	19.15	4.17	-0.891	0.931
SMCW	458	4	20	15.68	3.27	-0.833	0.833
SMPA	458	3	15	12.41	2.84	-1.082	1.042
SM	458	23	115	90.11	13.49	-0.999	1.056

N: The number of participants, $\bar{x}$: Arithmetic mean, Max: Maximum, Min: Minimum, Std.: Standard deviation

According to Table 3, the average of the scores they got from the SMR subscale was 22.94 ± 4.61; the average of the scores they got in the SMP subscale was 19.91 ± 4.37; the average of the scores they got from the SMC subscale was 19.15 ± 4.17; the average of the scores they got from SMCW subscale was 15.68 ± 3.27; the average of the scores they got in SMPS subscale was 12.41 ± 2.84; the average of the scores they got from SM was found to be 90.11 ± 13.49. In addition, it can be stated that the data show a normal distribution since the kurtosis and skewness values of the scores taken from the SM scale and its subscale are between -1.5 and +1.5. After this stage, the results related to RQ1 are presented in the following sections.

4.2 *RQ1: Do social anxiety levels of secondary school students predict their science motivation?*

Here, the Pearson correlation coefficient test was used to examine the relationship between the scores of the students obtained from SASA and its subscale, and the results obtained are shown in Table 4.

Table 4. The results of the Pearson correlation coefficient test between SASA, SM, and their all subscale

Scale		FNA	F-DGSS	F-ANSS	SASA	SMR	SMP	SMC	SMCW	SMPA	SM
FNA	*r*	1	0.50**	0.52**	0.86**	-0.64**	-0.62**	-0.62**	-0.20**	-0.60**	-0.79**
	p		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F-DGSS	*r*		1	0.42**	0.76**	-0.57**	-0.55**	-0.53**	-0.18**	-0.54**	-0.70**
	p			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F-ANSS	*r*			1	0.79**	-0.60**	-0.57**	-0.58**	-0.20**	-0.58**	-0.75**
	p				0.000	0.000	0.000	0.000	0.000	0.000	0.000
SASA	*r*				1	-0.75**	-0.72*	-0.72**	-0.24**	-0.71**	-0.92**
	p					0.000	0.000	0.000	0.000	0.000	0.000
SMR	*r*					1	0.51**	0.59**	0.14**	0.53**	0.80**
	p						0.000	0.000	0.002	0.000	0.000
SMP	*r*						1	0.39**	0.16**	0.57**	0.77**
	p							0.000	0.002	0.000	0.000
SMC	*r*							1	0.14**	0.51**	0.73**
	p								0.002	0.000	0.000
SMCW	*r*								1	0.12**	0.35**
	p									0.009	0.000
SMPA	*r*									1	0.76**
	p										0.000
SM	*r*										1
	p										

**$p < 0.001$ and *$p < 0.005$
Note: SASA = Social Anxiety Scale for Adolescents; FNA = Fear of Negative Assessment; F-DGSS = Fear in Different Gender Social Situations; F-ANSS = Fear in Adult/New Social Situations. SM = Science Motivation; SMR, SMP, SMC, SMCW, and SMPA are subscales of the Science Motivation scale, representing distinct motivational dimensions (e.g., reward, performance, competence, curiosity, and personal agency, respectively; precise labels should be referenced from the original scale used in the Methods section)

Pearson correlation analysis exhibited the positive correlation relationship between FNA and F-DGSS ($r_{(458)} = 0.50$, $p < 0.001$), F-ANSS ($r_{(458)} = 0.52$, $p < 0.001$), and SASA ($r_{(458)} = 0.864$, $p < 0.001$) was significant. Also, FNA had a negative and significant correlation with SMR ($r_{(458)} = -0.64$, $p < 0.001$), SMP ($r_{(458)} = -0.62$, $p < 0.001$), SMC ($r_{(458)} = -0.62$, $p < 0.001$), SMCW ($r_{(458)} = -0.20$, $p < 0.001$), SMPA ($r_{(458)} = -0.60$, $p < 0.001$) and SM ($r_{(458)} = -0.79$, $p < 0.001$). Besides, the correlations from Table 4 exhibit the following distribution. There was a positive correlation and significant relationship between F-DGSS and F-ANSS ($r_{(458)} = 0.42$, $p < 0.001$), and SASA ($r_{(458)} = 0.76$, $p < 0.001$). F-DGSS had a negative and significant correlation relationship SM ($r_{(458)} = -0.70$, $p < 0.001$) and its all subscale (SMR ($r_{(458)} = -0.57$, $p < 0.001$), SMP ($r_{(458)} = -0.55$, $p < 0.001$), SMC ($r_{(458)} = -0.53$, $p < 0.001$), SMCW ($r_{(458)} = -0.53$, $p < 0.001$), SMCW ($r_{(458)} = -0.18$, $p < 0.001$), SMPA ($r_{(458)} = -0.54$, $p < 0.001$)). There was a positive correlation and significant relationship between F-ANSS and SASA ($r_{(458)} = 0.79$, $p < 0.001$). Also, F-ANSS had a negative and significant correlation relationship with SM ($r_{(458)} = -0.75$, $p < 0.001$) and its all subscale (SMR ($r_{(458)} = -0.60$, $p < 0.001$), SMP ($r_{(458)} = -0.57$,

$p < 0.001$), SMC ($r_{(458)} = -0.58$, $p < 0.001$), SMCW ($r_{(458)} = -0.20$, $p < 0.001$), SMPA ($r_{(458)} = -0.58$, $p < 0.001$)). SASA presented a high-level negative correlation with SM ($r_{(458)} = -0.92$, $p < 0.001$) and its all subscale (SMR ($r_{(458)} = -0.75$, $p < 0.001$), SMP ($r_{(458)} = -0.72$, $p < 0.005$), SMC ($r_{(458)} = -0.53$, $p < 0.001$), SMCW ($r_{(458)} = -0.72$, $p < 0.001$), SMPA ($r_{(458)} = -0.71$, $p < 0.001$)) apart from SMCW ($r_{(458)} = -0.24$, $p < 0.001$). SMR exhibit a positive correlation with SMP ($r_{(458)} = -0.51$, $p < 0.001$), SMC ($r_{(458)} = -0.59$, $p < 0.001$), SMCW ($r_{(458)} = -0.14$, $p < 0.001$), SMPA ($r_{(458)} = -0.53$, $p < 0.001$), and SM ($r_{(458)} = -0.80$, $p < 0.001$). SMP showed a positive correlation with SMC ($r_{(458)} = -0.39$, $p < 0.001$), SMCW ($r_{(458)} = -0.16$, $p < 0.001$), SMPA ($r_{(458)} = -0.57$, $p < 0.001$), and SM ($r_{(458)} = -0.77$, $p < 0.001$). SMC offered a positive correlation with SMCW ($r_{(458)} = -0.14$, $p < 0.001$), SMPA ($r_{(458)} = -0.51$, $p < 0.001$), and SM ($r_{(458)} = -0.73$, $p < 0.001$). SMC offered a positive correlation with SMCW ($r_{(458)} = -0.14$, $p < 0.001$), SMPA ($r_{(458)} = -0.51$, $p < 0.001$), and SM ($r_{(458)} = -0.73$, $p < 0.001$). SMCW indicated a positive correlation with SMPA ($r_{(458)} = -0.12$, $p < 0.001$), and SM ($r_{(458)} = -0.35$, $p < 0.001$). Finally, SMCP represented a high positive correlation with SM ($r_{(458)} = -0.76$, $p < 0.001$). The correlation coefficient is used to find and interpret a linear relationship between two numerical measurements. Accordingly, in interpreting the correlation coefficient obtained from Table 4 the absolute value of the correlation coefficient between 0.70-1.00 indicates a high level, 0.70-0.30 indicates a medium level, and 0.30-0.00 indicates a low level of correlation. The highest significant correlation that can be obtained from Table 4, at the levels of $p < 0.001$ and $p < 0.005$ was found as 0.92, while the lowest was found as 0.12. Table 4 presented a high-level negative and significant correlation between the SASA and SM. Also, a low-level correlation was observed between SMCW and SASA, SM, and their subscale. The results of the multiple regression analysis performed to examine the effect of the scores from the subscales of the students' social anxiety scale on the scores of science motivation are shown in Table 5 and Figure 1.

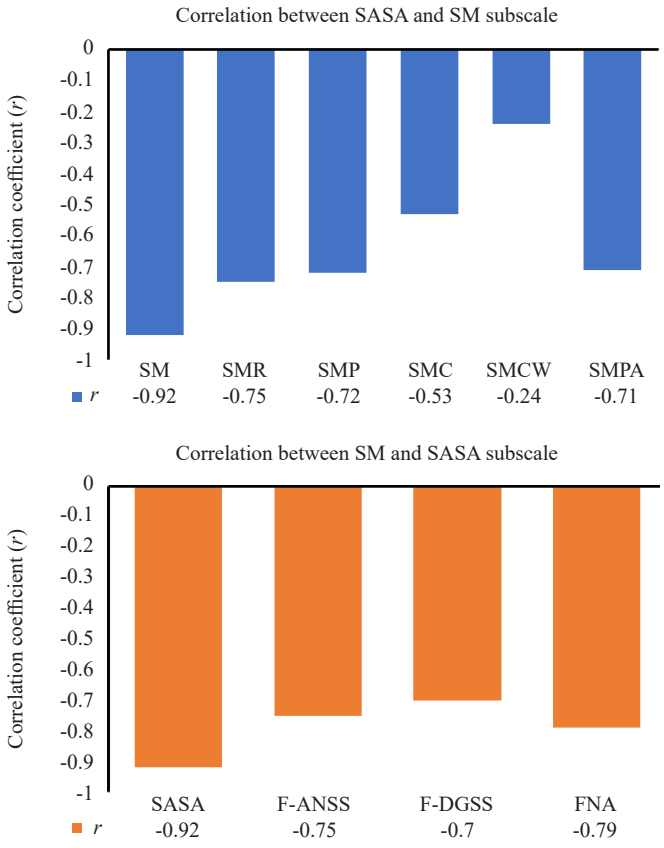

Figure 1. Correlation structures between SASA, SM, and their subscales

The very high negative correlation between SASA and SM at $r = -0.92$ from the correlation findings obtained in

this study clearly demonstrates that social anxiety exerts a strong pressure on motivation for science learning. This level of correlation demonstrates that social anxiety is not merely a contributing variable but a key determinant of scientific motivation. Findings in the literature that social anxiety reduces classroom participation behaviors and undermines academic self-confidence support these results (Beidel et al., 2000).

Table 5. Regression analysis results regarding SM

Independent variable	Nonstandard coefficient		β	t	p	Tolerance	VIF
	B	Std.					
Constant	136.81	0.93	-	145.69	0.000	-	-
FNA	-0.86	0.04	-0.42	-18.89	0.000	0.626	1.598
F-DGSS	-0.89	0.06	-0.31	-15.06	0.000	0.710	1.409
F-ANSS	-0.99	0.05	-0.39	-18.24	0.000	0.692	1.444

Note: VIF = Variance Inflation Factor. $R = 0.925$, $R^2 = 0.854$, $p < 0.001$

In addition, a standard multiple regression analysis was performed to predict the SM by using FNA, F-DGSS, and F-ANSS. Table 5 shows the regression analysis between the subscale scores of the SASA and the total scores of SM. Accordingly, the β and p values given in Table 5 showed that all subscales made statistically significant contributions to the model ($p < 0.001$). As a result of the analysis, it was found that a significant regression model $F_{(3,454)} = 895.15$, $p < 0.001$, and 85.4% of the variance in the dependent variable (SM) were explained by the independent variables (FNA, F-DGSS, and F-ANSS). Accordingly, FNA, F-DGSS, and F-ANSS explain the science motivation negatively and significantly. Here, β, t, and p values, namely FNA, F-DGSS, and F-ANSS, for each independent variable were found as $\beta = -0.42$, $t_{(454)} = -18.89$, $p < 0.001$, $pr^2 = 0.44$, $\beta = -0.31$, $t_{(454)} = -15.06$, $p < 0.001$, $pr^2 = 0.33$ and $\beta = -0.39$, $t_{(454)} = -18.24$, $p < 0.001$, $pr^2 = 0.42$, respectively. In multiple regression analysis, the general equation is $\hat{Y} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_p X_p$. From here, the regression equation was obtained as follows: SM = 136.81 + [-0.86 FNA] + [-0.89 F-DGSS] + [-0.99 F-ANSS]. Also, in Table 5, tolerance values for all variables are greater than 0.10, and variance increase factors are less than 10. This result shows that there is no multicollinearity problem in regression analysis. The results of the multiple regression analysis conducted to examine the effect of the students' scores from the subscales of SASA on their SM scores regarding research are shown in Table 6.

Table 6. Regression analysis results regarding SMR

Independent variable	Nonstandard coefficient		β	t	p	Tolerance	VIF
	B	Std. error					
Constant	35.94	0.55	-	64.77	0.000	-	-
FNA	-0.24	0.02	-0.35	-9.01	0.000	0.626	1.598
F-DGSS	-0.25	0.03	-0.26	-7.11	0.000	0.710	1.409
F-ANSS	-0.27	0.03	-0.31	-8.81	0.000	0.692	1.444

$R = 0.754$, $R^2 = 0.656$, $p < 0.001$

Table 6 shows the Multiple Regression Analysis Results between SMR and the subscale scores of the SASA.

Accordingly, when β and p significance values are examined for the effect of the subscales of SASA on the model, it was seen that FNA, F-DGSS, and F-ANSS have statistically significant contributions ($p < 0.001$). The analysis presented a significant regression model $F_{(3,454)} = 198.90$, $p < 0.001$. 75.4% ($R^2_{adjusted} = 0.754$) of the variance in the dependent variable (SMR) was found to be explained by the independent variables (FNA, F-DGSS, and F-ANSS). Accordingly, FNA, F-DGSS, and F-ANSS explain the SMR variable negatively and significantly. Accordingly, β, t, and p values for each independent variable were $\beta = -0.35$, $t_{(454)} = -9.01$, $p < 0.001$, $pr^2 = 0.15$ for FNA, $\beta = -0.26$, $t_{(454)} = -7.11$, $p < 0.001$, $pr^2 = 0.10$ for F-DGSS and $\beta = -0.31$, $t_{(454)} = -8.48$, $p < 0.001$, $pr^2 = 0.13$ for F-ANSS. From here, the regression equation was obtained as SMR = 35.94 + [-0.24 FNA] + [-0.25 F-DGSS] + [-0.27 F-ANSS]. Also, in Table 6, tolerance values for all variables are greater than 0.10, and variance increase factors are less than 10. This result shows that there is no multicollinearity problem in regression analysis.

Table 7. Regression analysis results regarding Motivation for Science Participation (MSP)

Independent variable	Nonstandard coefficient		β	t	p	Tolerance	VIF
	B	Std. error					
Constant	31.72	0.55	-	57.40	0.000	-	-
FNA	-0.22	0.02	-0.33	-8.18	0.000	0.626	1.598
F-DGSS	-0.24	0.03	-0.26	-6.84	0.000	0.710	1.409
F-ANSS	-0.24	0.03	-0.29	-7.47	0.000	0.692	1.444

$R = 0.723$, $R^2 = 0.520$, $p < 0.001$

A standard multiple regression analysis was performed to predict MSP variables using FNA, F-DGSS, and F-ANSS subscale. Table 7 present the results of the multiple regression analysis conducted to examine the effect of the students' scores from the subscales of SASA on MSP. In Table 7, it is seen that the social anxiety subscale scores of the students explain 52.0% of the variance regarding MSP. Accordingly, considering the β and p significance values, it is seen that FNA, F-DGSS, and F-ANSS subscales have statistically significant contributions to the model ($p < 0.001$). The significant regression model was obtained following as $F_{(3,454)} = 165.94$, $p < 0.001$. Also, 72.3% ($R^2_{adjusted} = 0.723$) of the variance in MSP was found to be FNA, F-DGSS, and F-ANSS subscales. Accordingly, FNA, F-DGSS, and F-ANSS subscales predict MSP negatively and significantly. Accordingly, β and t values for each independent variable were calculated as given below: $\beta = -0.33$, $t_{(454)} = -8{,}18$, $p < 0.001$, $pr^2 = 0.128$ for FNA, $\beta = -0.26$, $t_{(454)} = -6.84$, $p < 0.001$, $pr^2 = 0.093$ for F-DGSS and $\beta = -0.29$, $t_{(454)} = -7.47$, $p < 0.001$, $pr^2 = 109$ F-ANSS. From here, the regression equation was obtained as MSP = 31.72 + [-0.22 FNA] + [-0.24 F-DGSS] + [-0.24 F-ANSS]. Also, in Table 7, tolerance values for all variables are greater than 0.10, and variance increase factors are less than 10. This result shows that there is no multicollinearity problem in regression analysis. The results of the multiple regression analysis conducted to examine the effect of the students' social anxiety subscales on the scores of SMC are shown in Table 8.

In Table 8, it is seen that students' social anxiety subscale scores explain 51.8% ($R^2_{adjusted} = 0.518$) of the variance related to the SMC. Accordingly, the β and p significance values from standard multiple regression analysis showed that FNA, F-DGSS, and F-ANSS subscales had a statistically significant contribution to the model ($p < 0.001$). The result of the analysis yielded a significant regression model as follows: $F_{(3,454)} = 164.97$, $p < 0.001$. The β and t values for FNA, F-DGSS, and F-ANSS variables are $\beta = -0.34$, $t_{(454)} = -8.40$, $p < 0.001$, $pr^2 = 0.134$, $\beta = -0.23$, $t_{(454)} = -6.07$, $p < 0.001$, $pr^2 = 0.038$ and $\beta = -0.30$, $t_{(454)} = -7.86$, $p < 0.001$, $pr^2 = 0.119$, respectively. From here, the regression equation is as stated below; SMC = 30.426 + [-0.21 FNA] + [-0.20 F-DGSS] + [-0.24 F-ANSS]. In addition, Table 8 showed that tolerance values for all variables were greater than 0.10 and variance increase factors were less than 10. This result shows that there is no multicollinearity problem in regression analysis. Table 9 shows the results of the multiple regression analysis conducted to examine the effect of the students' social anxiety subscales on the scores of SMCW.

Table 8. The multiple regression analysis results regarding SMC

Independent variable	Nonstandard coefficient		β	t	p	Tolerance	VIF
	B	Standard error					
Constant	30.42	0.528	-	57.62	0.000	-	-
FNA	-0.21	0.026	-0.34	-8.40	0.000	0.629	1.598
F-DGSS	-0.20	0.034	-0.23	-6.07	0.000	0.710	1.409
F-ANSS	-0.24	0.031	-0.30	-7.86	0.000	0.692	1.444

$R = 0.722$, $R^2 = 0.518$, $p < 0.001$

Table 9. Regression analysis results regarding SMCW

Independent variable	Nonstandard coefficient		β	t	p	Tolerance	VIF
	B	Standard error					
Constant	18.681	0.581	-	32.12	0.000	-	-
FNA	-0.054	0.028	-0.11	-1.91	0.056	0.626	1.598
F-DGSS	-0.053	0.037	-0.07	-1.42	0.154	0.710	1.409
F-ANSS	-0.069	0.034	-0.11	-2.04	0.042	0.692	1.444

$R = 0.244$, $R^2 = 0.059$, $p < 0.05$

In Table 9, it was seen that the social anxiety subscale scores of the students explain 5.9% ($R^2_{adjusted} = 0.059$) of the variance regarding SMCW. Accordingly, the β and p significance values showed that only F-ANSS had a statistically significant contribution to the model ($p < 0.05$). Regression analysis provided a meaningful model as $F_{(3,454)} = 9.54$, $p < 0.05$. Accordingly, the expression $\beta = -0.11$, $t_{(454)} = -2.04$, $p < 0.05$, $pr^2 = 0.009$ can be written for F-ANSS. The regression equation is SMCW = 18.681 + [-0.069 F-ANSS]. In addition, Table 9 showed that tolerance values for all variables were greater than 0.10 and variance increase factors were less than 10. This result shows that there is no multicollinearity problem in regression analysis. Table 10 exhibits the results of the multiple regression analysis between MSP and FNA, F-DGSS and F-ANSS variables.

Table 10. The multiple regression analysis results regarding MSP

Independent variable	Nonstandard coefficient		β	t	p	Tolerance	VIF
	B	Standard error					
Constant	20.04	0.36	-	55.18	0.000	-	-
FNA	-0.13	0.01	-0.30	-7.35	0.000	0.626	1.598
F-DGSS	-0.15	0.02	-0.25	-6.57	0.000	0.710	1.409
F-ANSS	-0.17	0.02	-0.32	-8.14	0.000	0.692	1.444

$R = 0.716$, $R^2 = 0.509$, $p < 0.001$

Accordingly, when the β and p significance values of the subscales are examined, it was seen that FNA, F-DGSS, and F-ANSS had a statistically significant contribution to the model ($p < 0.001$). The analysis results presented a meaningful regression model as $F_{(3,454)} = 158.99$, $p < 0.001$. It was also found that 71.6% ($R^2_{adjusted} = 0.716$) of the variance in MSP was explained by FNA, F-DGSS, and F-ANSS. Accordingly, FNA, F-DGSS, and F-ANSS predict MSP negatively and significantly. The β, t, and p values were calculated to be $\beta = -0.30$, $t_{(454)} = -7.35$, $p < 0.001$, $pr^2 = 0.106$ for FNA, $\beta = -0.25$, $t_{(454)} = -6.57$, $p < 0.001$, $pr^2 = 0.0087$ for F-DGSS and $\beta = -0.32$, $t_{(454)} = -8.14$, $p < 0.001$, $pr^2 = 0.127$ for F-ANSS. The regression equation was found as follows, MSP = 20.04 + [-0.13 FNA] + [-0.15 F-DGSS] + [-0.17 F-ANSS]. In addition, Table 10 showed that tolerance values for all variables were greater than 0.10 and variance increase factors were less than 10. This result shows that there is no multicollinearity problem in regression analysis. The results of all regression models are shown in Figure 2.

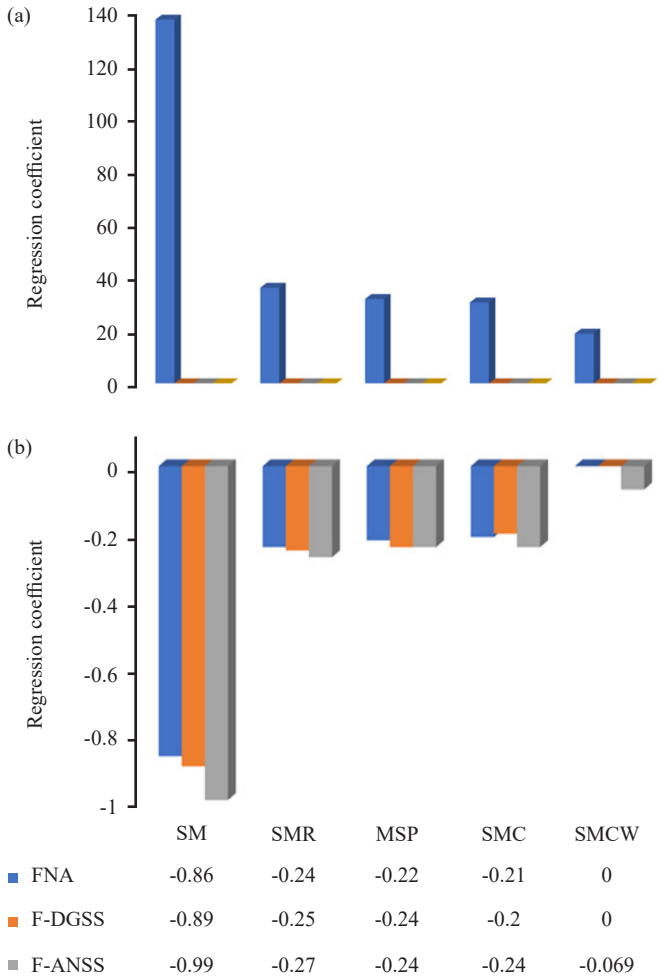

Figure 2. Beta coefficient (a) and regression models (b) for SM and its sub-dimensions

Regression analyses given in Figure 2 indicate that social anxiety systematically, robustly, and multidimensionally reduces motivation to learn science. Anxiety, particularly in novel social situations, is the most critical predictor. After this stage, the results related to RQ2 are presented in the following sections.

4.3 *RQ2: Is there a significant difference in the social anxiety levels for demographic characteristics (gender, class, number of siblings, living space, mother education level, father education level) of secondary school students?*

Here the results of the *t*-test for the independent samples conducted to examine the differentiation according to the gender of the scores from the social anxiety scale and its subscales are shown in Table 11.

Table 11. Independent sample *t*-test results of social anxiety levels by gender

Dimension	Gender	*N*	$\bar{x}$	Std.	*t*	df	*p*
FNA	Girl	252	21.14	6.54	2.69	456	0.007
	Male	206	19.47	6.66			
F-DGSS	Girl	252	13.12	4.73	0.83	56	0.404
	Male	206	12.74	4.86			
F-ANSS	Girl	252	18.02	5.03	2.25	56	0.025
	Male	206	16.90	5.59			
SASA	Girl	252	52.29	13.19	2.48	56	0.013
	Male	206	49.12	14.01			

$\bar{x}$: Arithmetic mean, Std.: Standard deviation, $p < 0.05$

Table 12. One-way Analysis of Variance (ANOVA) results of social anxiety levels for the class

Dimensions	Source of variance	Sum of squares	df	Average of squares	*F*	*p*	Significant differences
FNA	Between groups	825.11	3	275.04	6.54	0.000	1 > 3 1 > 4
	Within groups	19,345.93	454	42.61			
	Total	20,171.04	457	-			
F-DGSS	Between groups	284.51	3	94.84	4.21	0.006	1 > 3 1 > 4
	Within groups	10,207.34	454	22.48			
	Total	10,491.84	457	-			
F-ANSS	Between groups	553.84	3	184.61	6.78	0.000	1 > 2 1 > 3 1 > 4
	Within groups	12,354.48	454	27.21			
	Total	12,908.32	457	-			
SASA	Between groups	4,611.41	3	1537.14	8.67	0.000	1 > 2 1 > 3 1 > 4
	Within groups	80,443.65	454	177.19			
	Total	85,055.06	457	-			

*$p < 0.05$

According to Table 11, it has been determined that FNA ($t_{(456)} = 2.69$, $p < 0.05$), F-DGSS ($t_{(456)} = 2.22$, $p < 0.05$) subscales and SASA scale ($t_{(456)} = 2.48$, $p < 0.05$) scores differ significantly according to gender, whereas F-ANSS ($t_{(456)} = 0.83$, $p < 0.05$) subscales scores does not differ significantly according to gender. Table 11 showed that the social anxiety of girl students in SASA and all subscales had higher than that of boys. One-way analysis of variance results performed to examine the differentiation of the students' scores from the SASA and all subscales by class were shown in Table 12.

According to Table 12, the scores of FNA [$F_{(3,454)} = 6.54$, $p < 0.05$], F-DGSS [$F_{(3,454)} = 4.21$, $p < 0.05$], and F-ANSS subscales [$F_{(3,454)} = 6.78$, $p < 0.05$] and SASA [$F_{(3,454)} = 8.67$, $p < 0.05$] were found to differ significantly according to grade level. Accordingly, social anxiety levels of 5th-graders are higher than 7th- and 8th-grades in all subscales and SASA. One-way analysis of variance results carried out to examine the differentiation of students' scores from SASA and its subscales according to the number of siblings are shown in Table 13.

Table 13. One-way ANOVA results of social anxiety levels for the number of siblings

Dimensions	Source of variance	Sum of squares	df	Average of squares	*F*	*p*	Significant differences
FNA	Between groups	634.39	4	158.60	3.67	0.006	4 < 5
	Within groups	19,536.65	453	43.13			
	Total	20,171.04	457	-			
F-DGSS	Between groups	163.55	4	40.89	1.79	0.129	-
	Within groups	10,328.30	453	22.80			
	Total	10,491.84	457	-			
F-ANSS	Between groups	202.81	4	50.70	1.80	0.126	-
	Within groups	12,705.51	453	28.05			
	Total	12,908.32	457	-			
SASA	Between groups	2,421.79	4	605.45	3.31	0.011	4 < 5
	Within groups	82,633.26	453	182.41			
	Total	85,055.06	457	-			

*$p < 0.05$

Table 13 presented the scores of FNA [$F_{(4,453)} = 3.67$, $p < 0.05$] and SASA [$F_{(4,453)} = 3.31$, $p < 0.05$] were found to differ significantly for the number of siblings. No change was observed in other subscales. Accordingly, FNA and SASA levels of the students who have three siblings were found to be lower than those with four or more siblings. One-way analysis of variance results to examine the differentiation of the students' scores from SASA and its subscales according to the residential area where the majority of life spent was carried out and the results are shown in Table 14.

According to Table 14, SASA scores ($F_{(2,450)} = 16.97$, $p < 0.05$) and FNA ($F_{(2,450)} = 14.13$, $p < 0.05$), F-DGSS ($F_{(2,450)} = 12.90$, $p < 0.05$) F-ANSS ($F_{(2,450)} = 6.84$, $p < 0.05$) subscales of the students differ significantly depending on the residential area where most of the life is lived. In addition, Table 14 showed that the social anxiety levels of the students living in the village were lower in SASA and all its subscales. Table 15 shows the differentiation of the students' scores from the Social Anxiety Scale and its subscales for the education level of the mother. For this, a one-way analysis of variance was performed on the data obtained.

Table 14. One-way ANOVA results of social anxiety levels for the living space

Dimensions	Source of variance	Sum of squares	df	Average of squares	*F*	*p*	Significant differences
FNA	Between groups	1,168.25	2	584.12	14.13	0.000	1 < 2
	Within groups	18,597.20	450	41.33			
	Total	19,765.45	452	-			
F-DGSS	Between groups	549.74	2	274.87	12.90	0.000	1 < 2 1 < 3
	Within groups	9,584.27	450	21.30			
	Total	10,134.01	452	-			
F-ANSS	Between groups	372.92	2	186.46	6.84	0.000	1 < 2
	Within groups	12,263.66	450	27.25			
	Total	12,636.57	452	-			
SASA	Between groups	5,786.16	2	2,893.08	16.97	0.000	1 < 2 1 < 3
	Within groups	76,693.40	450	170.43			
	Total	82,479.56	452	-			

*"Metropolitan" and "abroad" groups are not included in the analysis because of insufficient samples. *$p < 0.05$

Table 15. One-way ANOVA results of social anxiety levels for the education level of the mother

Dimensions	Source of variance	Sum of squares	df	Average of squares	*F*	*p*	Significant differences
FNA	Between groups	923.06	3	307.69	7.13	0.000	1 > 3 1 > 4
	Within groups	18,930.54	439	43.12			
	Total	19,853.61	442	-			
F-DGSS	Between groups	245.45	3	81.82	3.58	0.000	1 > 3 1 > 4
	Within groups	10,007.04	439	22.80			
	Total	10,252.49	442	-			
F-ANSS	Between groups	430.20	3	143.40	5.14	0.000	1 > 3 1 > 4
	Within groups	12,227.19	439	27.85			
	Total	12,657.40	442	-			
SASA	Between groups	4,345.77	3	1,448.59	8.03	0.000	1 > 3 1 > 4
	Within groups	79,118.85	439	180.23			
	Total	83,464.62	442	-			

* "Associate Degree", "Undergraduate" and "Postgraduate" groups were not included in the analysis because of the insufficient sample. *$p < 0.05$

According to Table 15, SASA ($F_{(3,439)} = 8.03$, $p < 0.05$) scores and FNA ($F_{(3,439)} = 7.13$, $p < 0.05$), F-DGSS ($F_{(3,439)} = 3.58$, $p < 0.05$) and F-ANSS ($F_{(3,439)} = 5.14$, $p < 0.05$) subscale were found to differ significantly for the education level

of the mother. Accordingly, the Social Anxiety levels of students whose mothers are illiterate were found higher than the students whose mothers were secondary and high school graduates on a general scale, and all subscales. One-way analysis of the variance of the student's scores from the Social Anxiety Scale and its subscales for the educational status of the father is shown in Table 16. Table 16 exhibited that SASA and its sub-scores did not differ significantly for the educational status of the father.

Table 16. One-way ANOVA results of social anxiety levels for the education level of the father

Dimensions	Source of variance	Sum of squares	df	Average of squares	*F*	*p*	Significant differences
FNA	Between groups	371.91	5	74.38	1.697	0.134	-
	Within groups	19,597.28	447	43.84			
	Total	19,969.20	452	-			
F-DGSS	Between groups	71.04	5	14.21	0.614	0.689	-
	Within groups	10,336.08	447	23.12			
	Total	10,407.12	452	-			
F-ANSS	Between groups	348.75	5	69.75	2.198	0.060	-
	Within groups	12,480.10	447	27.92			
	Total	12,828.85	452	-			
SASA	Between groups	1,999.88	5	399.98	2.176	0.056	-
	Within groups	82,178.10	447	183.84			
	Total	84,177.98	452	-			

* "Master" groups were not included in the analysis because of the insufficient sample. $p < 0.05$

After this stage, the results related to RQ3 are presented in the following sections.

4.4 *RQ3: Is there a significant difference in science motivation levels for demographic characteristics (gender, class, number of siblings, living space, mother education level, father education level) of secondary school students?*

The results of the *t*-test for independent samples conducted to examine the differentiation according to the gender of the scores of the students from the science motivation scale and its subscales are shown in Table 17.

According to Table 17, SMR [$t_{(456)} = -1.33$, $p > 0.05$], SMP [$t_{(456)} = -1.95$, $p > 0.05$], SMC [$t_{(456)} = -1.04$, $p > 0.05$], SMCW [$t_{(456)} = -1.54$, $p > 0.05$], AMPA [$t_{(456)} = -0.42$, $p > 0.05$] levels and SM scale [$t_{(456)} = -1.94$, $p > 0.05$] did not show a significant difference for gender. One-way analysis of variance results performed to examine the differentiation of the students' scores from the science motivation scale and its subscales for the class are shown in Table 18.

Table 17. Independent sample *t*-test results of science motivation levels by gender

Dimension	Gender	*N*	$\bar{x}$	Std.	*t*	df	*p*
SMR	Girl	252	22.69	4.86	-1.33	456	0.184
	Male	206	23.26	4.28			
SMP	Girl	252	19.52	4.65	-1.95	456	0.051
	Male	206	20.40	3.95			
SMC	Girl	252	18.97	4.24	-1.04	456	0.295
	Male	206	19.38	4.08			
SMCW	Girl	252	15.47	3.17	-1.54	456	0.123
	Male	206	15.95	3.39			
SMPA	Girl	252	12.36	2.89	-0.42	456	0.668
	Male	206	12.48	2.79			
SM	Girl	252	89.01	14.25	-1.94	456	0.052
	Male	206	91.47	12.40			

$\bar{x}$: Arithmetic mean, Std.: Standard deviation, $*p < 0.05$

Table 18. One-way ANOVA results of science motivation levels for the class

Dimensions	Source of variance	Sum of squares	df	Average of squares	*F*	*p*	Significant differences
SMR	Between groups	528.94	3	176.31	8.70	0.000	1 < 2 1 < 3 1 < 4
	Within groups	9,192.69	454	20.25			
	Total	9,721.64	457	-			
SMP	Between groups	424.50	3	141.50	7.73	0.000	1 < 2 1 < 3 1 < 4
	Within groups	8,308.34	454	18.30			
	Total	8,732.85	457	-			
SMC	Between groups	259.47	3	86.49	5.10	0.002	1 < 2 1 < 3 1 < 4
	Within groups	7,687.83	454	16.93			
	Total	7,947.30	457	-			
SMCW	Between groups	68.23	3	22.74	2.13	0.095	-
	Within groups	4,834.49	454	10.65			
	Total	4,902.72	457				
SMPA	Between groups	178.90	3	59.63	7.71	0.000	1 < 2 1 < 3 1 < 4
	Within groups	3,510.10	454	7.73			
	Total	3,689.01	457	-			
SM	Between groups	4,614.87	3	1,538.29	8.88	0.000	1 < 2 1 < 3 1 < 4
	Within groups	78,563.23	454	173.05			
	Total	83,178.10	457	-			

$*p < 0.05$

Table 18 presented that SMR [$F_{(3,454)} = 8.70$, $p < 0.05$], SMP [$F_{(3,454)} = 7.73$, $p < 0.05$], SMC [$F_{(3,454)} = 5.10$, $p < 0.05$], SMPA [$F_{(3,454)} = 7.71$, $p < 0.05$] and SM [$F_{(3,454)} = 8.88$, $p < 0.05$] differ significantly for the grade level. However, SMCW [$F_{(3,454)} = 2.13$, $p < 0.05$] did not differ significantly. According to this, SMR, SMP, SMC, SMPA, and SM levels of 5th-graders students are lower than that of 6th-, 7th-, and 8th-graders. One-way analysis of variance results performed to examine the differentiation of the student's scores from the science motivation scale and its subscales for the number of siblings are shown in Table 19.

Table 19. One-way ANOVA results of science motivation levels for the number of siblings

Dimensions	Source of variance	Sum of squares	df	Average of squares	*F*	*p*	Significant differences
SMR	Between groups	328.53	4	82.13	3.96	0.004	4 > 5
	Within groups	9,393.10	453	20.74			
	Total	9,721.64	457	-			
SMP	Between groups	196.38	4	49.09	2.60	0.035	4 > 5
	Within groups	8,536.47	453	18.84			
	Total	8,732.85	457	-			
SMC	Between groups	246.65	4	61.66	3.62	0.006	4 > 5
	Within groups	7,700.65	453	17.00			
	Total	7,947.30	457	-			
SMCW	Between groups	81.56	4	20.39	1.91	0.107	-
	Within groups	4,821.17	453	10.64			
	Total	4,902.72	457	-			
SMPA	Between groups	110.89	4	27.72	3.51	0.008	5 < 3 5 < 4
	Within groups	3,578.12	453	7.90			
	Total	3,689.01	457	-			
SM	Between groups	3,546.45	4	886.61	5.04	0.001	5 < 3 5 < 4
	Within groups	79,631.65	453	175.79			
	Total	83,178.10	457	-			

*$p < 0.05$

Table 19 expressed that, students' SMR [$F_{(4,453)} = 3.96$, $p < 0.05$], SMP [$F_{(4,453)} = 2.60$, $p < 0.05$], SMC [$F_{(4,453)} = 3.62$, $p < 0.05$], SMPA [$F_{(4,453)} = 3.51$, $p < 0.05$] and SM level [$F_{(4,453)} = 5.04$, $p < 0.05$] differ significantly for the number of siblings. On the other hand, students' SMCW level [$F_{(4,453)} = 1.91$, $p < 0.05$] did not differ significantly according to the number of siblings. Accordingly, the levels of SMR, SMP, and SMC of students with three siblings had higher than those with four or more siblings. On the other hand, the levels of SMPA and SM students with four or more siblings had lower than those of students with two or three siblings. Table 20 the one-way analysis of variance results of the student's scores from the SM and its subscales according to the living space.

Table 20 exhibited that the level of SMR [$F_{(2,450)} = 15.611$, $p < 0.05$], SMP [$F_{(2,450)} = 10.46$, $p < 0.05$], SMC [$F_{(2,450)} = 11.01$, $p < 0.05$], SMPA [$F_{(2,450)} = 13.98$, $p < 0.05$] and MS [$F_{(2,450)} = 21.78$, $p < 0.05$] of students differ significantly

whereas the SMCW ($F_{(2,450)} = 2.79$, $p < 0.05$) did not differ significantly for the living space. Accordingly, the levels of SMR, SMP, SMC, SMPA, and SM of students who spent most of their lives in the village were higher than those of students who spent most of their lives in the district and city. Table 21 presented the one-way analysis of variance results of the student's scores from the SM scale and its subscales for the education status of the mother.

Table 20. One-way ANOVA results of science motivation levels for the living space

Dimensions	Source of variance	Sum of squares	df	Average of squares	*F*	*p*	Significant differences
SMR	Between groups	619.32	2	309.66	15.61	0.000	1 > 2 1 > 3
	Within groups	8,926.12	450	19.84			
	Total	9,545.43	452	-			
SMP	Between groups	381.09	2	190.55	10.46	0.000	1 > 2 1 > 3
	Within groups	8,196.05	450	18.21			
	Total	8,577.14	452	-			
SMC	Between groups	365.67	2	182.84	11.01	0.000	1 > 2 1 > 3
	Within groups	7,472.88	450	16.61			
	Total	7,838.56	452	-			
SMCW	Between groups	58.86	2	29.43	2.79	0.062	-
	Within groups	4,743.88	450	10.54			
	Total	4,802.73	452	-			
SMPA	Between groups	211.74	2	105.87	13.98	0.000	1 > 2 1 > 3
	Within groups	3,407.03	450	7.57			
	Total	3,618.77	452	-			
SM	Between groups	7,178.44	2	3,589.22	21.78	0.000	1 > 2 1 > 3
	Within groups	74,137.43	450	164.75			
	Total	81,315.87	452	-			

*"Metropolitan" and "abroad" groups were not included in the analysis because of the insufficient sample size. *$p < 0.05$

Table 21 shows that the levels of SMR [$F_{(3,439)} = 5.73$, $p < 0.05$], SMP [$F_{(3,439)} = 4.53$, $p < 0.05$], SMC [$F_{(3,439)} = 5.69$, $p < 0.05$], SMCW [$F_{(3,439)} = 3.49$, $p < 0.05$], SMPA [$F_{(3,439)} = 3.63$, $p < 0.05$] and SM of student [$F_{(3,439)} = 8.12$, $p < 0.05$] differ significantly for the education level of the mother. Accordingly, the motivation levels of the students whose mothers were only literate were lower than those of the students whose mothers were primary, secondary, and high school graduates in the overall scale and all subscales. One-way analysis of variance results of the student's scores from the MS and its subscale for the educational status of the father is shown in Table 22.

Table 21. One-way ANOVA results of science motivation levels for the education status of the mother

Dimensions	Source of variance	Sum of squares	df	Average of squares	*F*	*p*	Significant differences
SMR	Between groups	358.61	3	119.54	5.73	0.001	1 < 2 1 < 3 1 < 4
	Within groups	9,144.31	439	20.83			
	Total	9,502.92	442	-			
SMP	Between groups	255.54	3	85.18	4.53	0.004	1 < 3 1 < 4
	Within groups	8,238.09	439	18.77			
	Total	8,493.63	442	-			
SMC	Between groups	288.30	3	96.10	5.69	0.001	1 < 2 1 < 3 1 < 4
	Within groups	7,409.60	439	16.88			
	Total	7,697.90	442	-			
SMCW	Between groups	108.50	3	36.17	3.49	0.016	1 < 3
	Within groups	4,544.57	439	10.35			
	Total	4,653.07	442	-			
SMPA	Between groups	87.45	3	29.15	3.63	0.013	1 < 4
	Within groups	3,521.23	439	8.02			
	Total	3,608.67	442	-			
SM	Between groups	4,317.32	3	1,439.11	8.12	0.000	1 < 2 1 < 3 1 < 4
	Within groups	77,728.67	439	177.06			
	Total	82,045.99	442	-			

*"Associate", "Undergraduate" and "Master" groups were not included in the analysis because of the insufficient sample size. *$p < 0.05$

Table 22. One-way ANOVA results of science motivation levels for the educational status of the father

Dimensions	Source of variance	Sum of squares	df	Average of squares	*F*	*p*	Significant differences
SMR	Between groups	71.92	5	14.38	0.67	0.647	-
	Within groups	9,598.89	447	21.47			
	Total	9,670.81	452	-			
SMP	Between groups	153.19	5	30.64	1.60	0.157	-
	Within groups	8,522.26	447	19.07			
	Total	8,675.45	452	-			
SMC	Between groups	97.74	5	19.55	1.11	0.350	-
	Within groups	7,815.44	447	17.48			
	Total	7,913.18	452	-			
SMCW	Between groups	35.18	5	7.04	0.65	0.659	-
	Within groups	4,816.68	447	10.78			
	Total	4,851.86	452	-			
SMPA	Between groups	101.11	5	20.22	2.17	0.058	-
	Within groups	3,572.15	447	7.99			
	Total	3,673.26	452	-			
SM	Between groups	1,658.58	5	331.72	1.82	0.106	-
	Within groups	81,075.06	447	181.38			
	Total	82,733.64	452	-			

*"Master" groups were not included in the analysis because of the insufficient sample. *$p < 0.05$

It was determined from Table 22 that the levels of SMR [$F_{(5,447)} = 0.67$, $p > 0.05$], SMP [$F_{(5,447)} = 1.60$, $p > 0.05$], SMC [$F_{(5,447)} = 1.11$, $p > 0.05$], SMCW [$F_{(5,447)} = 0.65$, $p > 0.05$], SMPA [$F_{(5,447)} = 2.17$, $p > 0.05$], and SM of students [$F_{(5,447)} = 1.82$, $p > 0.05$] did not differ significantly for the education level of the father.

5. Discussion and conclusion

In this section, descriptive findings related to students' social anxiety and motivation to learn science, correlational findings between social anxiety and motivation to learn science, findings related to the predictive status of social anxiety's motivation towards science learning and its sub-dimensions, and finally the demographic characteristics of social anxiety and motivation to learn science. The findings on the subject were discussed and concluded under separate headings. Accordingly, 55% of the secondary school students included in the research are male, 26.2% are in the 7th-grade, 25.5% are in the 6th-grade, 25.1% are in the 8th-grade, and 23.1% are in the 5th-grade. 33.4% of them have four or more siblings, 61.6% of them spent most of their lives in the district, 35.8% of their mothers are primary school graduates and 35.4% of their fathers are secondary school graduates. In the research findings, first among the descriptive values, the findings related to the social anxiety scale for adolescents were included. The highest score that students can get from the measurement tool is 90, and the lowest score is 18. The average of the students' social anxiety scale for adolescents was 50.86. Accordingly, it was seen that the social anxiety levels of the students were at a moderate level. In the literature, it is possible to see parallel results in studies conducted to examine the social anxiety levels of secondary school students. For example, as a result of the research conducted by Arslan and Koç (2018) with 665 adolescent secondary school students attending the 6th-, 7th-, and 8th-grades in different secondary schools in Ankara, Turkey, they found that the social anxiety levels of secondary school students were moderate in general. Similarly, Deniz (2018) investigated the social anxiety levels of 151 students between the ages of 11-15 and determined that the social anxiety levels of the students were moderate. In this section, the findings related to the motivation scale for learning science from descriptive values are included in the research findings. Here, it was found that the highest score that the students could get from the measurement tool was 115, the lowest score was 23, and the average of the student's motivation scale for learning science was 90.11. Accordingly, it has been observed that students' motivation levels for learning science are at a high level in general. In the literature, it is possible to see parallel results in studies conducted to examine the motivation levels of secondary school students toward learning science. Uzun and Keleş (2010) examined secondary school students' motivation levels for learning science. Accordingly, it has been determined that students' motivation toward learning science is at a high level. However, Tremblay-Wragg et al. (2019) observed in their research that students' science motivation was generally high.

5.1 *Findings related to the RQ1*

As a result of the analysis in the research, it was determined that there is a negative and high degree of relationship between the social anxiety levels of secondary school students and their motivation levels for learning science. In addition, negative and significant relationships were found between the subscale associated with these two concepts. In this sense, it can be said that as students' social anxiety tendencies increase, their science motivation decreases. When examined across subscales, SMR (r = -0.75) and SMP (r = -0.72) values indicated that as social anxiety increased, students' value for science courses, intrinsic motivation for the course, and performance orientation significantly decreased. This result is consistent with studies reporting that students experiencing social anxiety tend to avoid performance-based activities in science classes (Storch et al., 2005). On the other hand, the relationship between SMC and social anxiety (r = -0.53) suggests that students with high anxiety have lower beliefs about their ability to succeed in science courses. This finding is consistent with findings indicating that anxiety is a cognitive factor that suppresses the development of self-efficacy (Kashdan & McKnight, 2010). The low correlation between SMCW and social anxiety (r = -0.24) suggests that social anxiety primarily reduces motivation in tasks requiring social interaction, but may have a more limited impact on individual study processes. On the other hand, the correlation between F-ANSS and SM (r = -0.75) suggests that the physiological symptoms accompanying anxiety cognitively impair students' learning processes in science classes. The literature supporting this finding suggests that anxiety hinders learning by increasing cognitive load (Kashdan & McKnight, 2010). The strong negative correlation between F-DGSS and SM (r = -0.70)

suggests that students' sensitivity to peer pressure and social evaluation processes significantly reduces motivation in science learning environments. Studies showing that students with high social anxiety tend to avoid peer interaction are consistent with these findings (Kashdan & McKnight, 2010). Another finding in the study is the strong negative correlation between FNA and SM (r = -0.79). This result suggests that the possibility of students being seen making mistakes, being criticized, or being deemed incompetent by others directly undermines their motivation to learn science. This finding is consistent with that of Mesri et al. (2017), who reported that students with high social anxiety avoid performance-demanding tasks. Overall the correlation structure in Table 4 demonstrates that social anxiety negatively impacts all social, cognitive, and motivational components of science learning. Furthermore, it demonstrates that social anxiety is not merely an emotional challenge in the context of science learning, but a fundamental learning obstacle that directly impacts students' scientific literacy, engagement, self-efficacy, and commitment to learning. The findings indicate that failure to consider social-emotional factors in science education environments can significantly hinder the achievement of cognitive goals. As a result, according to the findings obtained from correlation analyses the following recommendations can be made:

• Given the strong negative impact of fear of negative evaluation on motivation, teachers can offer students feedback that is more constructive, supportive, and emphasizes individual progress.

• For students who experience anxiety in new or large-scale social situations, small group work, peer-supported learning, or phased engagement strategies may be used.

• Self-efficacy development programs that can mitigate the impact of social anxiety on motivation can focus on making students recognize their achievements through structured feedback.

• Informing families about students' motivation and social anxiety tendencies can strengthen family-school collaboration and contribute to increased supportive attitudes in the home environment.

Also, regression analyses of the study revealed that social anxiety was a strong and significant negative predictor of all sub-dimensions of motivation for science learning. When all models were evaluated together, anxiety in new social situations (F-ANSS) was found to be the variable that most significantly reduced students' motivation to learn science. It is noteworthy that in the motivation model, the standardized beta coefficients for the F-ANSS, F-DGSS, and FNA variables were -0.99, -0.89, and -0.86, respectively. These values indicate that social anxiety strongly suppresses students' general tendency toward science learning. The F-ANSS, in particular, has the highest coefficient, indicating that students experience intense anxiety in situations requiring them to communicate with new people, initiate new activities, or attract attention in class, which directly undermines their motivation to learn. Furthermore, the F-ANSS, F-DGSS, and FNA variables are similarly negative predictors in the SMR and MSP models, indicating that social anxiety affects both the cognitive and behavioral components of the science learning process. In the SMC and SMCW models, the highest negative effect of F-ANSS suggests that social anxiety makes communication-based science practices particularly challenging and that anxiety experienced in new social environments is a determining factor in group activities. Finally, the MSP model, consistent with other models, revealed that all sub-dimensions of social anxiety reduce students' active participation in science learning. This suggests that social anxiety acts not only as a direct cognitive factor in science learning motivation but also as a behavioral inhibitor. In conclusion, analyses showed that social anxiety reduces motivation to learn science in multiple ways. Therefore, the following measures can be taken to increase student motivation in science education:

• Creating safe social environments,

• Ensuring step-by-step participation in small groups,

• Implementing teaching strategies that reduce assessment anxiety,

• Increasing student motivation are necessary.

On the other hand, today, students' concerns about the future are increasing. Therefore, Çapkın (2001) stated that a certain level of anxiety is needed to improve parameters such as motivation and performance. In the research, it was also expressed that a low level of anxiety reduces motivation, while a moderate level of anxiety contributes positively to success. However, it has been reported that the most important thing is the high level of anxiety, and in this case, it negatively affects the cognitive functions of the individual such as perception, understanding, interpretation, remembering, and behavior of the individual. As a result, she reported that the most important thing in determining certain parameters is the level of anxiety. Also, Christina et al. (2020) stated that socially anxious youth are at an increased risk for academic failure, school withdrawal, and negative peer relationships. According to this, as the social

anxiety level of the students increases, their academic failures, and withdrawals from school increase and they develop negative peer relations. On the other hand, Erath et al. (2007) reported that socially anxious students are more prone to failure because of their unwillingness to seek help from their classmates or teachers. In the research findings, it was determined that students' social anxiety levels were a significant predictor of their motivation to learn science. Accordingly, in this research, it was found that the subscale of students' social anxiety levels negatively and significantly predicted their motivation to learn science. However, it was found that all subscales of social anxiety levels negatively predicted motivation for research, motivation for performance, motivation for communication, and motivation for participation. This situation shows that the tendency of social anxiety level negatively contributes to the development of students' motivation towards learning science. Choudhury (2020) states that students' academic motivation stems from classroom performance, peer pressure, social anxiety, and parental expectations. Accordingly, encouraging the parent's and the teacher's awareness of the student's effort are the reasons that increase academic motivation. On the other hand, Choudhury (2020) states that since social anxiety affects students' internal mental abilities, they will have problems participating in peer-based participation and academic group tasks, and reports that teachers should observe this situation. This explains why social anxiety predicts all subscales of motivation to learn science. On the other hand, Ader and Erktin (2010) agree that self-regulation taught by teachers in educational institutions helps to reduce social anxiety and increase academic performance. However, Meenakshi and Singh (2018) stated that an optimal level of social anxiety is needed for higher academic achievement in the school-level curriculum. In addition, Akhtar (2012) stated that by eliminating social anxiety, motivation toward communication will be provided, and thus high academic motivation will be achieved.

5.2 *Findings related to the RQ2*

In the research findings, it was determined that the girl students' fear of negative evaluation, fear and unrest in new social situations, and social anxiety levels were higher than those of the boys. In the literature, Ak and Kılınç (2017) stated that women showed more predictive power of social anxiety than men. Çivitci (2020) reported in his study with university students that fear of negative evaluation and levels of social avoidance were statistically significantly higher among female students. In addition, there are studies in the literature showing that the social anxiety levels of adults differ significantly in favor of girls according to the gender variable (Morris, 2001). On the other hand, Méndez et al. (2017) found that overall social anxiety levels did not significantly differ by gender among adolescents. Additionally, McLean et al. (2011) scanned the studies on social anxiety and applied a meta-analysis to these studies and concluded that the level of social anxiety did not differ according to gender. Therefore, although the effects of the gender variable on social anxiety have been investigated in the literature, no consensus has been reached on how this variable affects social anxiety and which variable it favors (Van Dam et al., 2009). The reason for these different results in the studies can be shown that the people participating in the studies have different demographic characteristics from each other. According to the research findings, the levels of fear of negative evaluation and fear and unrest in general social situations of 5th-graders were higher than in 7th- and 8th-grades. Also, it was found that the levels of fear and restlessness in new social situations and social anxiety for adolescents of the 5th-graders were higher than in the 6th-, 7th-, and 8th-grades. Related results were found in the literature. For example, Telli and Ünal (2016) examined the social anxiety of university students according to their socio-demographic characteristics. As a result of the research, it was found that the social anxiety levels of university students differ according to their grade levels and this difference was in favor of lower classes. In addition, Arslan and Koç (2018) examined the relationship between body image and social anxiety levels of secondary school students with different variables and with each other. As a result of the research, the social anxiety levels of the 6th-grade students were found to be higher than the 8th-grade students, and it was found that the body image levels did not make a significant difference according to the grade level. In the findings of the research, the levels of fear of negative evaluation and social anxiety for adolescents of the students with three siblings were found to be lower than those with four or more siblings. Accordingly, as the number of siblings increases, students' social anxiety levels increase. Considering the region where the research was conducted, it can be said that the result found is within the prediction. There are studies in the literature that support this result. Demiriz and Ulutaş (2003) published a report to determine whether variables such as gender, number of siblings, mother's and father's education level, mother's employment status, and parents' occupation cause differences in children's anxiety scores. As a result of the research, they determined that as the number of siblings of children increased, their state-trait anxiety levels increased. On the

other hand, according to the results of the research conducted by Çoban and Kısa (2020) on high school students and Kenny et al. (2020) on primary school students, it was determined that as the number of siblings increased, the anxiety levels of both primary school students and high school students increased. Alisinanoğlu and Ulutaş (2000) reported the following statement on this subject.

> "*Having more than one child in the family can affect their anxiety level. The jealousy between siblings, envy, and inability to share the attention of parents can be the basis for anxiety. Concerns arising from jealousy such as not being able to meet the needs of children in families with insufficient economic level or not being able to win the love of parents among siblings can cause anxiety*."

In the research findings, it was found that the levels of fear and restlessness in new social situations, fear and restlessness in general social situations, and social anxiety of the students living in the village were lower than those of the students living in the town and city. In the literature, Yağız et al. (2016) investigated the relationship between the prevalence of social anxiety disorder in university students and the level of anger in individuals with this disorder. As a result of the research, it was determined that students living in cities have more social anxiety than those living in villages. In addition, Kılıç (2015) examined the relationship between university students' social anxiety, self-esteem, and loneliness levels. As a result, it was found that there was a significant difference between "where a significant part of their life was spent". This is attributed to the difference between university students whose living space is metropolitan and those whose living space is village and city. According to the findings of the research and the reports given in the literature, it can be said that the social anxiety of the students living in the regions with high population increases due to the sense of competition. According to the research findings, the levels of fear of negative evaluation, fear and unrest in general social situations, fear and unrest in new social situations, and general social anxiety of the students whose mothers are illiterate were found to be higher than those of the students whose mothers graduated from secondary school or high school. In the literature, Bayar (2019) examined the social anxiety levels of adolescent students (10-19 years old) and obtained significant results in favor of students whose mothers were illiterate. According to this, the level of social anxiety is higher in students whose mothers' education level is illiterate than those whose mothers' education level is primary, secondary, or high school graduates. In addition, Gümüş (2002) determined that there is a significant difference between the educational status of the mother and the social anxiety levels of the children and that the anxiety levels of the children whose mothers are college graduates are low. Alisinanoğlu and Ulutaş (2000) expressed this situation as follows:

> "*Education aims to make individuals acquire desired behaviors in society. Therefore, every level of education brings the individual closer to this goal. It is thought that the person at the highest level will be better in harmony with her environment. For this reason, educational status may also be effective in determining the attitudes of parents toward their children. According to the research, the attitudes of parents who are primary school graduates and parents who are graduates of high schools toward their children may differ*."

In the research findings, no difference was found between the social anxiety levels of the students according to their fathers' education level. In the literature, studies by Ak (2020) show that a father's education level does not predict social anxiety level. In addition, the report results of Çaçan (2020) support the findings in this research and are given in the literature. Bowlby (2018) explains this situation with attachment theory. Bowlby (2018) defines attachment as "*a behavioral system for seeking and maintaining closeness in another individual*" and states that attachment is primarily directed toward the mother. Ainsworth et al. (2017) describe attachment as "*the most important feature that distinguishes attachment from other emotional attachments in the individual is that the effort to be close to and maintain closeness to the mother results in a feeling of security and relaxation*". The fact that there is a difference according to the education level of the mother, but not according to the education level of the father, can be evaluated within the framework of Bowlby's (2018) attachment theory.

5.3 *Findings related to the RQ3*

In the research findings, it was determined that the motivation levels of secondary school students toward learning

science did not differ according to the gender variable. The literature reveals different findings in determining students' motivation to learn science in terms of gender variables. Saraçoğlu (2020), in their research with 251 high school students, determined that the motivations for learning science did not change with the gender variable. In addition, Azizoğlu and Çetin (2009) tried to determine the relationship between the learning styles of primary school 6th- and 7th-grade students, their attitudes toward science, and their motivation. As a result of the research, they determined that gender did not significantly affect the motivation level of 6th- and 7th-grade students. In addition, Yenice et al. (2012) examined primary school 6th-, 7th-, and 8th-grade students' motivation to learn science according to various variables such as gender and grade level. As a result of the research, they could not determine a significant difference according to gender in students' motivation towards learning science. Other studies in the literature support these results (Türkmen, 2002). However, contrary to these studies, some research have shown that gender makes a significant difference in attitudes toward science motivation and this significant difference is in favor of female students (Britner & Pajares, 2001). In addition, Britner and Pajares (2001) found that female students' motivation levels are generally higher than those of male students. Additionally, Hagos and Andargie (2022) reported that female students made more effort to explain their work than male students. Robinson and McIlroy (2021) also found that female students were more motivated to learn science than male students. As seen in all these studies, there is no consensus in the literature about the change in the level of motivation for learning science according to the gender variable. In the research findings, it was determined that the 5th-graders' motivation for research, motivation for performance, motivation for communication, motivation for participation, and motivation for science learning were lower than those of 6th-, 7th-, and 8th-grades. Accordingly, in the research, it was found that as the grade level increased, the motivation for learning science increased. This result was supported by reports from Tseng et al. (2009). They concluded that as the grade level of the students increases, their motivation also increases. According to this result, as the grade levels of the students increase, their success and motivation levels increase. In addition, Vedder-Weiss and Fortus (2012) reported that an increase in grade level had a positive effect on students' motivation to learn science. However, there are studies in the literature reporting that as the grade level increases, the motivation to learn science decreases (Ahn et al., 2021). On the other hand, Uzun and Keleş (2010) and Azizoğlu and Çetin (2009) concluded that the motivations of secondary school students do not differ according to their grade levels. As can be seen from all these studies, there is no consensus in the literature regarding the change in students' motivation levels for learning science according to the class variable. In the literature, the reason why the motivation to learn science decreases as the grade level increases is explained in the following sentence. According to this, the literature states that students have a positive motivation towards school at a young age, but as the grade levels increase at later ages, the student's motivation to learn science decreases due to the intensity and complexity of the subjects. On the other hand, the "result of the increase in the motivation towards learning science according to the grade level" obtained in this research can be explained by the change made in the Science and Technology Curriculum in 2018 in Turkey, where the research was conducted. Accordingly, reducing the number of achievements and narrowing the scope of the subjects in the 2018 curriculum of 8th-classes may have led to an increase in student motivation. In the research findings, it was determined that the students with 3 siblings had higher motivation for research, motivation for performance, and motivation for communication than those who had 4 or more siblings. Also, it was found that the motivation for participation and motivation for science learning levels of students with 4 or more siblings were lower than those with 2 siblings and 3 siblings. According to this result, as the number of siblings increases, the motivation levels for science learning decrease. In the literature, Gelbal (2008) reported that students' success increased as the number of siblings decreased. Yilmaz et al. (2012) stated that as the number of siblings increases, students' self-efficacy scores decrease. Sadi et al. (2014) stated that there is no difference between the number of siblings of the students and their success. Duman (2014) reported that as the number of siblings of the students decreased, there was an increase in the average motivation scores, but there was no statistical difference. According to the literature, as the number of siblings increases, students' motivation levels decrease. However, this decrease in the number of siblings is not statistically significant. In this research, it was found that as the number of siblings increased in parallel with the literature, the motivation levels of students toward learning science decreased. Also, it was determined that the decrease in motivation level was statistically significant. This result, which cannot be determined in the literature, may be due to the different demographic characteristics of the students or the regional differences of the sample groups studied. In the research findings, it was found that the students who spent most of their lives in the village had higher levels of motivation for research, motivation for performance, motivation for communication, motivation for

participation, and motivation for science learning than students who spent most of their lives in the town and city. According to our knowledge, no research has been found in the literature investigating the change of motivation for learning science with the variable of living place. In the findings of the research, it was found that the levels of motivation for research, motivation for communication, and motivation for learning science of students whose mothers were only literate were lower than those whose mothers were primary, secondary, and high school graduates. In addition, students whose mothers are only literate have lower levels of motivation for performance than students whose mothers are secondary or high school graduates. On the other hand, students whose mothers were only literate were found to have lower motivation for collaborative work than students whose mothers were secondary school graduates. Finally, it was found that the motivation levels for the participation of students whose mothers were only literate were lower than those whose mothers were high school graduates. Accordingly, in the research, as the education level of the mother decreases, the motivation of the students towards learning science decreases in all subscales and the overall scale. In the literature, Bolat (2007) stated that as the education level of the mother increases, the motivation levels of the students increase. On the other hand, Oral and McGivney (2013) reported from the Trends in International Mathematics and Science Study (TIMSS) 2011 results that the success of female students in particular increases as the education level of mothers increases. In addition, Uzun and Keleş (2010) investigated the effects of primary school 6th-, 7th-, and 8th-grade students' gender, class, and parental education status on their motivation to learn science and found that as the mother's education level increased, students' motivation to learn science increased. Likewise, Şengönül (2019) also reported that as the mother's education level increases, students' motivation levels for learning science increase. However, Çeliker et al. (2015) stated that the children of mothers with higher education levels and non-working mothers have higher motivation to learn science. They attributed the reason to the fact that they were more interested in their children's education. Finally, studies of the literature confirm the result found here. On the other hand, Atay (2014), Duman (2014) and Yavuz (2006) concluded that students' motivation levels for science lessons did not differ according to their mother's education levels. According to the literature above, there is no consensus on how maternal education affects students' motivation to learn science. Literature studies reporting that students' motivation levels for science lessons do not differ according to their mother's education level, expressed these results in the following sentence: "*as the mother's education level increases, the probability of working in a job increases and they do not have enough time to deal with student's education*". On the other hand, Gonzalez-DeHass (2005) stated that students' motivation levels for science lessons differ according to their mothers' education levels. Gonzalez-DeHass (2005) examined the effect of family involvement on students' motivation levels and reported positive relationships between family involvement and motivation from primary school to high school. According to Gonzalez-DeHass (2005), families with a high level of education have higher expectations for their children's education than families with a low level of education. Therefore, well-educated families show more interest in their children's education than families with low education levels. In addition, Kyriacou and Zhu (2008) determined that students' motivation to learn is positively affected by their families. In the interviews, the students stated that their families supported them in learning. Teoh et al. (2010) reported that families and teachers support students' motivation for learning. In the research findings, it was determined that the motivation of the students towards learning science did not differ according to the educational status of their fathers. There are studies in the literature that support this result (Uzun & Keleş, 2010). This study was designed within a relational screening model, requiring the research's predetermined objectives to be limited to correlation and regression-based analysis. Furthermore, examining the extent to which the impact of social anxiety on motivation varies across individuals, under what circumstances, would further deepen the study.

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Data sharing statement

Data supporting the findings and conclusions are available upon request from the author.

Conflict of interest

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References

Abdollahi, A., & Abu Talib, M. (2016). Self-esteem, body-esteem, emotional intelligence, and social anxiety in a college sample: The moderating role of weight. *Psychology, Health & Medicine, 21*(2), 221-225.

Ader, E., & Erktin, E. (2010). Coping as self-regulation of anxiety: A model for math achievement in high-stakes tests. *Cognition, Brain, Behavior: An Interdisciplinary Journal, 14*(4), 311-332.

Ahn, I., Patrick, H., & Chiu, M. M. (2021). Associations between science motivation and future career aspirations in STEM: A developmental perspective. *Journal of Educational Psychology, 113*(4), 731-745.

Ainsworth, M., Marc, A., & Natalia, B. (2017). *Patterns of attachment*. Lawrence Erlbaum Associates.

Ak, G. (2020). *Investigation of the relationship between teacher candidates' perfectionism and social anxiety levels* [Master's thesis]. Institute of Educational Sciences, Yakın Doğu University.

Ak, S., & Kılınç, S. (2017). Does gender affect the relationship between anxiety sensitivity and social anxiety? *Turkish Journal of Psychiatry, 28*(4), 240-245.

Akan, Ş. (2024). Anxiety during the COVID-19 pandemic: Prevalence, effects and predisposing factors. *Current Approaches in Psychiatry, 16*(1), 111-125.

Akhtar, Z. (2012). Influence of parental occupation and level of education on stress, anxiety and adjustment among school children. *Indian Journal of Positive Psychology, 3*(3), 269.

Alisinanoğlu, F., & Ulutaş, D. (2000). Çocuklarda kaygı ve bunu etkileyen etmenler [Anxiety in children and factors affecting it]. *National Education Journal, 145*, 15-19.

American Psychiatric Association. (2022). *Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Publishing.

Antony, M., & Swinson, R. (2008). *The shyness and social anxiety workbook: Proven, step-by-step techniques for overcoming your fear* (2nd ed.). New Harbinger Publications.

Arslan, H., & Koç, Z. (2018). Body image and social anxiety levels of secondary school students. *Journal of Education Theory and Practical Research, 4*(3), 65-77.

Aslan, M., & Doğan, S. (2020). A theoretical view of extrinsic motivation, intrinsic motivation, and performance interaction. *Süleyman Demirel University Visionary Journal, 11*(26), 291-301.

Atay, A. D. (2014). *Investigation on secondary school students' motivation levels and metacognitive awareness on learning science* [Master's thesis]. Institute of Science and Technology, Adnan Menderes University.

Aydın, A., & Sütçü, S. T. (2007). Validity and reliability of social anxiety scale for adolescents. *Turkish Journal of Child and Adolescent Mental Health, 14*(2), 79-89.

Azizoğlu, N., & Çetin, G. (2009). Sixth- and seventh-grade students' learning styles, attitudes towards science, and motivations. *Kastamonu Education Journal, 17*(1), 171-182.

Balçın, M. D., & Çavuş, R. (2020). Secondary school students' perceptions related to teaching based on motivation in science course. *Dicle University Journal of Ziya Gökalp Education Faculty, 36*, 18-37.

Baptista, C. A., Loureiro, S. R., Osório, F. L., Zuardi, A. W., Magalhães, P. V., Kapczinski, F., & Crippa, J. A. S. (2011). Social phobia in Brazilian university students: Prevalence, under-recognition and academic impairment in women. *Journal of Affective Disorders, 136*(3), 857-861.

Barlia, L. (1999). *High school students' motivation to engage in conceptual change learning in science* [Doctoral dissertation]. Ohio State University.

Barlow, D. H. (2022). Anxiety and its disorders: A comprehensive theory and review. *Annual Review of Clinical Psychology, 18*, 1-26.

Bayar, B. D. (2019). *The relationship between technology addiction and social anxiety in adolescent girls* [Master's thesis]. Institute of Health Sciences, İnönü University.

Bayramkaya, E., Toros, F., & Özge, C. (2005). The relationship between social phobia and depression, self-concept, and smoking habit in adolescents. *Bulletin of Clinical Psychopharmacology, 15*(4), 165-173.

Beck, J. S. (2021). *Cognitive behavior therapy: Basics and beyond* (3rd ed.). Guilford Press.

Beghetto, R. A. (2009). Correlates of intellectual risk taking in elementary school science. *Journal of Research in Science Teaching, 46*(2), 210-223.

Beesdo-Baum, K., Knappe, S., & Pine, D. S. (2012). Anxiety and anxiety disorders in children and adolescents: developmental issues and implications for DSMV. *The Psychiatric Clinics of North America, 35*(3), 485-506.

Beidel, D. C., Turner, S. M., & Morris, T. L. (1999). Psychopathology of childhood social phobia. *Journal of the American Academy of Child & Adolescent Psychiatry, 38*(6), 643-650.

Beidel, D. C., Turner, S. M., & Morris, T. L. (2000). *Social effectiveness therapy for children: A treatment manual*. Allyn & Bacon.

Biggs, B. K., Vernberg, E. M., & Wu, Y. P. (2011). Social anxiety and adolescents' friendships: The role of social withdrawal. *Journal of Early Adolescence, 32*(6), 802-823.

Bolat, N. G. (2007). *Motivation and success levels of 6th and 7th grade students in the science and technology course at primary education with respect to learning styles* [Master's thesis]. Institute of Science and Technology, Eskişehir Osmangazi University.

Bowlby, J. (2018). *A secure base: Clinical applications of attachment theory* (pp. 87-96). Routledge.

Boyd, D., Rae, J., Thompson, J., Burns, B., Bourdon, K., Locke, B., & Regier, D. (1990). Phobia: Prevalence and risk factors. *Social Psychiatry and Psychiatric Epidemiology, 25*, 314-323.

Britner, S. L., & Pajares, F. (2001). Self-efficacy beliefs, motivation, race, and gender in middle school science. *Journal of Women and Minorities in Science and Engineering, 7*, 271-285.

Brook, C. A., & Schmidt, L. A. (2008). Social anxiety disorder: A review of environmental risk factors. *Neuropsychiatric Disease and Treatment, 4*(1A), 123-143.

Calsyn, R. J., Winter, J. P., & Burger, G. K. (2005). The relationship between social anxiety and social support in adolescents: A test of competing causal models. *Adolescence, 40*(157), 103-113.

Çaçan, Ö. (2020). *The mediating role of cognitive emotion regulation strategies in the relationship between fear of negative evaluation and social anxiety* [Master's thesis]. Graduate Education Institute, İstanbul Kent University.

Çapkın, N. (2001). *The effect of employees' anxiety level on business content* [Master's thesis]. Institute of Social Sciences, Trakya University.

Čekrlija, Đ., Roković, N. M., Dinić, B. M., & Schermer, J. A. (2023). Relationship between the inferiority and superiority complex and the big five and dark triad traits. *Personality and Individual Differences, 206*, 112123.

Çeliker, H. D., Tokcan, A., & Korkubilmez, S. (2015). Does motivation toward science learning affect scientific creativity? *Mustafa Kemal University Journal of Social Sciences Institute, 12*(30), 167-192.

Chiu, K., Clark, D. M., & Leigh, E. (2021). Prospective associations between peer functioning and social anxiety in adolescents: A systematic review and meta-analysis. *Journal of Affective Disorders, 281*, 618-629.

Choudhury, S., & Sharma, M. (2020). Developments in academic anxiety and academic achievement in Indian secondary and higher secondary school students: A critique on literature review. *Journal of Critical Reviews, 7*(14), 907-923.

Christina, L. S., Juan, D. T., & Ming-Te, W. (2020). Socially anxious science achievers: The roles of peer social support and social engagement in the relation between adolescents' social anxiety and science achievement. *Journal of Youth and Adolescence, 49*, 1005-1016.

Çivitci, N. (2020). Gender differences in social anxiety, social avoidance, and fear of negative evaluation among university students. *Current Psychology, 39*, 2290-2298.

Çoban, Y., & Kısa, C. (2020). Determining the relationship between adolescent high school students' social anxiety and parental attitudes. *Biruni Health and Education Sciences Journal, 6*(1), 16-33.

Dede, Y., & Yaman, S. (2008). A questionnaire for motivation toward science learning: A validity and reliability study. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, 1*(2), 19-37.

De Los Reyes, A., & Prinstein, M. J. (2004). Applying depression-distortion hypotheses to the assessment of peer victimization in adolescents. *Journal of Clinical Child and Adolescent Psychology, 33*(2), 325-336.

Demiriz, S., & Ulutaş, İ. (2003). A study on children's anxiety levels according to some variables. *Ege Journal of Education, 3*(1), 1-9.

Demirtaş, E. (2009). *Researching the shyness and self-esteem of high school students of dysfunctional attitudes* [Master's thesis]. Social Sciences Institute, Selçuk University.

Deniz, A. (2018). *An assessment of the relationship of irrational beliefs with self-esteem and social anxiety among adolescents aged 11-15* [Master's thesis]. Institute of Social Sciences, Işık University.

Dilbaz, N. (2002). The prevalence of social phobia among Turkish university students. In *Proceedings of the XII World Congress of Psychiatry*. Yokohama, Japan.

Dilmaç, B., & Yücesoy, Ö. (2019). The precursor relations among values, irrational beliefs, and social appearance anxiety in university students. *OPUS-International Journal of Society Researches, 11*(18).

Duman, B. (2014). *Motivation statement of 6th grade students at secondary school at science lesson* [Master's thesis]. Institute of Educational Sciences, Mehmet Akif Ersoy University.
Erath, S. A., Flanagan, K. S., & Bierman, K. L. (2007). Social anxiety and peer relations in early adolescence: Behavioral and cognitive factors. *Journal of Abnormal Child Psychology, 35*, 405-416.
Fenigstein, A., Scheier, M. F., & Buss, A. H. (1975). Public and private self-consciousness: Assessment and theory. *Journal of Consulting and Clinical Psychology, 43*(4), 522-527.
Gelbal, S. (2008). The effect of socio-economic status of eighth grade students on their achievement in Turkish. *Education and Science, 33*(150), 1-13.
Giaouzi, A., & Giovazolias, T. (2015). Remembered parental rejection and social anxiety: The mediating role of partner acceptance-rejection. *Journal of Child and Family Studies, 24*(11), 3170-3179.
Glynn, S. M., & Koballa, T. R. (2006). Motivation to learn in college science. In J. J. Mintzes & W. H. Leonard (Eds.), *Handbook of college science teaching* (pp. 25-32). National Science Teachers Association.
Glynn, S. M., Brickman, P., Armstrong, N., & Taasoobshirazi, G. (2011). Science motivation questionnaire II: Validation with science majors and nonscience majors. *Journal of Research in Science Teaching, 48*(10), 1159-1176.
Gonzalez-DeHass, A. R., Willems, P. P., & Holbein, M. F. D. (2005). Examining the relationship between parental involvement and student motivation. *Educational Psychology Review, 17*(2), 99-123.
Gulley, L. D., Oppenheimer, C. W., & Hankin, B. L. (2014). Associations among negative parenting, attention bias to anger, and social anxiety among youth. *Developmental Psychology, 50*(2), 577-585.
Gültekin, B. K., & Dereboy, F. (2011). The prevalence of social phobia and its impact on quality of life, academic achievement, and identity formation in university students. *Turkish Journal of Psychiatry, 22*(3), 150-158.
Gümüş, E. A. (2002). *The effect of the group program of coping with social anxiety upon social anxiety level of university students* [Doctoral dissertation]. Institute of Educational Sciences, Ankara University.
Hagos, T., & Andargie, D. (2022). Gender differences in students' motivation and conceptual knowledge in chemistry using technology-integrated formative assessment. *Asian Journal of Assessment in Teaching and Learning, 12*(1), 10-22.
Kahyaoğlu, M., & Saraçoğlu, M. (2018). Examination of secondary school students' scientific inquiry skills perceptions in terms of curiosity, motivation, and attitude. *Journal of Computer and Education Research, 6*(12), 360-376.
Kaplan, A., & Maehr, M. L. (2007). The contributions and prospects of goal orientation theory. *Educational Psychology Review, 19*(2), 141-184.
Karakaya, F., Avgın, S. S., & Yılmaz, M. (2018). Middle school students' interest in science-technology-engineering and mathematics (STEM) professions. *Ihlara Journal of Educational Research, 3*(1), 36-53.
Kashdan, T. B., & McKnight, P. E. (2010). The darker side of social anxiety: When aggressive impulsivity prevails over shy inhibition. *Current Directions in Psychological Science, 19*(1), 47-50.
Kashdan, T. B., & Roberts, J. E. (2004). Social anxiety's impact on affect, curiosity, and social self-efficacy during a high self-focus social threat situation. *Cognitive Therapy and Research, 28*(1), 119-141.
Kashdan, T. B., & McKnight, P. E. (2010). The darker side of social anxiety: When aggressive sadness leads to avoidance and dysfunction. *American Psychologist, 65*(6), 440-448.
Kenny, M. C., Abreu, R. L., & Donohue, B. (2020). Physical child abuse: A comprehensive review of risk factors, assessment, and intervention. *Trauma, Violence, & Abuse, 21*(4), 635-648.
Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSMIV disorders in the National Comorbidity Survey Replication. *Archives of General Psychiatry, 62*(6), 593-602.
Kılıç, M. (2015). *The study of the relationships between social appearance anxiety, self-esteem and loneliness level among university students* [Master's thesis]. Institute of Health Sciences, Selçuk University.
Kışoğlu, M. (2018). An examination of science high school students' motivation towards learning biology and their attitude towards biology lesson. *International Journal of Higher Education, 7*(1), 151-164.
Köksal, M. S. (2014). Investigation of higher-order correlates of gifted students' motivation towards science learning. *GESJ: Education Sciences and Psychology, 6*(32), 18-26.
Köksal, M. S., & Taşdelen, Ö. (2008). An analysis of scores of prospective biology teachers on the factors of MSLQ. *Journal of Uludağ University Faculty of Education, 22*(2), 417-431.
Kyriacou, C., & Zhu, D. (2008). Shanghai pupils' motivation towards learning English and the perceived influence of important others. *Educational Studies, 34*(2), 97-104.
La Greca, L. J., & Lopez, N. (1998). Social anxiety among adolescents: Linkages with peer relations and friendships. *Journal of Abnormal Child Psychology, 26*, 83-94.

La Greca, A. M., & Harrison, H. M. (2005). Adolescent peer relations, friendships, and romantic relationships: Do they predict social anxiety and depression? *Journal of Clinical Child and Adolescent Psychology, 34*(1), 49-61.

Mamlok-Naaman, R. (2011). How can we motivate high school students to study science? *Science Education International, 22*, 5-17.

Maricic, J., Bjelic, S., & Jelic, K. (2023). The role of self-compassion and attributions in the mental health of older adolescents amid the COVID-19 pandemic. *International Journal of Environmental Research and Public Health, 20*(21), 6981.

McDonald, K. L., Bowker, J. C., Rubin, K. H., Laursen, B., & Duchene, M. S. (2010). Interactions between rejection sensitivity and supportive relationships in the prediction of adolescents' internalizing difficulties. *Journal of Youth and Adolescence, 39*, 563-574.

McLean, C. P., Asnaani, A., Litz, B. T., & Hofmann, S. G. (2011). Gender differences in anxiety disorders: Prevalence, course of illness, comorbidity and burden of illness. *Journal of Psychiatric Research, 45*(8), 1027-1035.

McLoughlin, E., Arnold, R., & Moore, L. J. (2024). The tendency to appraise stressful situations as more of a threat is associated with poorer health and well-being. *Stress and Health, 40*(3), e3358.

McWilliams, N. (2019). *Psychoanalytic psychology* (2nd ed.). Guilford Press.

Meenakshi, & Singh, G. (2018). Academic anxiety and happiness in relation to academic achievement of adolescents. *International Journal of Education and Management Studies, 8*(2), 292-296.

Méndez, X., Inglés, C. J., Hidalgo, M. D., & García-Fernández, J. M. (2017). Gender and age differences in social anxiety symptoms in a community sample of adolescents. *Journal of Affective Disorders, 208*, 504-510.

Mendler, A. (2000). *Motivating students who don't care: Successful techniques for educators*. National Education Service.

Mercer, S. H., & DeRosier, M. E. (2008). Teacher preference, peer rejection, and student aggression: A prospective study of transactional influence and independent contributions to emotional adjustment and grades. *Journal of School Psychology, 46*(6), 661-685.

Mesri, B., Niles, A. N., Pittig, A., LeBeau, R. T., Haik, E., & Craske, M. G. (2017). Public speaking avoidance as a treatment moderator for social anxiety disorder. *Journal of Behavior Therapy and Experimental Psychiatry, 55*, 66-72.

Morris, T. L. (2001). Social phobia. In M. W. Vasey & M. R. Dadds (Eds.), *The developmental psychopathology of anxiety* (pp. 435-458). Oxford University Press.

Myers, D. G., & DeWall, C. N. (2021). *Exploring psychology* (12th ed.). Worth Publishers.

Ohayon, M. M., & Schatzberg, A. F. (2010). Social phobia and depression: Prevalence and comorbidity. *Journal of Psychosomatic Research, 68*(3), 235-243.

Oral, I., & McGivney, E. (2013). *Student performance in math and science in Turkey and determinants of success*. Education Reform Initiative.

Öztürk, N. (2008). *An analysis of aggression levels of 9th grade students at secondary school with regard to some variables* [Master's thesis]. Institute of Social Sciences, İnönü University.

Palmer, D. (2005). A motivational view of constructivist-informed teaching. *International Journal of Science Education, 27*(15), 1853-1881.

Pintrich, P. R., & Schunk, D. H. (2014). *Motivation in education: Theory, research, and applications* (3nd ed.). Pearson.

Riskind, J. H. (2024). Unscrambling the dynamics of danger: Scientific foundations and evidence for the looming vulnerability model and looming cognitive style in anxiety. *Cognitive Therapy and Research, 48*(3), 808-832.

Robinson, R. J., & McIlroy, D. (2021). Gender differences in science motivation and achievement: A meta-analytic review. *International Journal of Science Education, 43*(5), 678-702.

Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology, 25*(1), 54-67.

Ryan, R. M., & Deci, E. L. (2020b). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology, 61*, 101860.

Sadi, Ö., Dağyar, M., & Yalçın, H. (2014). The role of gender, grade level and family environment in high school students' biology achievement. *Journal of Research in Education and Teaching, 3*(2), 138-151.

Salant, P., & Dillman, D. A. (1994). *How to conduct your own survey*. John Wiley & Sons.

Sani, A., Rochintaniawati, D., & Winarno, N. (2018). Using brain-based learning to promote students' concept mastery in learning electric circuit. *Journal of Science Learning, 2*(2), 42-49.

Saraçoğlu, G. (2020). Relationship between high school students' motivation levels and learning strategies. *International Journal of Progressive Education, 248*, 67-83.

Scaini, S., Belotti, R., & Ogliari, A. (2014). Genetic and environmental contributions to social anxiety across different ages: A metaanalytic approach to twin data. *Journal of Anxiety Disorders, 28*(7), 650-656.
Scanlon, C. L., Del Toro, J., & Wang, M. T. (2020). Socially anxious science achievers: The roles of peer social support and social engagement in the relation between adolescents' social anxiety and science achievement. *Journal of Youth and Adolescence, 49*(5), 1005-1016.
Schunk, D. H., Meece, J. L., & Pintrich, P. R. (2020). *Motivation in education: Theory, research, and applications* (5th ed.). Pearson.
Schulze, S., & Lemmer, E. (2017). Family experiences, the motivation for science learning and science achievement of different learner groups. *South African Journal of Education, 37*(1), 1-9.
Şengönül, T. (2019). Influence of parental involvement on school achievement of children. *Celal Bayar University Journal of Social Sciences, 17*(4), 268-292.
Sertelin-Mercan, Ç. (2016). Ostracism experience scale for adolescents: Turkish validity and reliability. *HAYEF Journal of Education, 13*(2), 175-186.
Shin, S., Lee, J. K., & Ha, M. (2017). Influence of career motivation on science learning in Korean high-school students. *EURASIA Journal of Mathematics, Science and Technology Education, 13*(5), 1517-1538.
Silgado, J., Timpano, K. R., Buckner, J. D., & Schmidt, N. B. (2010). Social anxiety and bulimic behaviors: The moderating role of perfectionism. *Cognitive Therapy and Research, 34*(5), 487-492.
Storch, E. A., Masia-Warner, C., Crisp, H., & Klein, R. G. (2005). Peer victimization and social anxiety in adolescence: A prospective study. *Aggressive Behavior, 31*(5), 437-452.
Subaşı, G. (2007). Some variables for social anxiety prediction in college students. *Education and Science, 32*(144), 3-14.
Sübaşı, G. (2009). Social anxiety differences and peer relations in adolescents according to sociometric status groups. *Ege Journal of Education, 10*(1), 1-23.
Sübaşı, G. (2010). Social anxiety and peer relations among adolescents: Testing a psychobiological model. *Van Yüzüncü Yıl University Journal of Education, 7*(1), 52-68.
Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Pearson.
Taş, Y. (2016). The contribution of perceived classroom learning environment and motivation to student engagement in science. *European Journal of Psychology of Education, 31*(5), 557-577.
Teachman, B. A., & Allen, J. P. (2007). Development of social anxiety: Social interaction predictors of implicit and explicit fear of negative evaluation. *Journal of Abnormal Child Psychology, 35*, 63-78.
Telli, E., & Ünal, Z. (2016). Social appearance anxiety of university students according to socio-demographic characteristics: A field study. *Mehmet Akif Ersoy University Journal of Social Sciences Institute, 8*(15), 134-146.
Teoh, S. H., Koo, A. C., & Singh, P. (2010). Extracting factors for students' motivation in studying mathematics. *International Journal of Mathematical Education in Science and Technology, 41*(6), 711-724.
Tremblay-Wragg, É., Raby, C., Ménard, L., & Plante, I. (2019). The use of diversified teaching strategies by four university teachers: What contribution to their students' learning motivation? *Teaching in Higher Education, 24*(1), 18-33.
Tseng, C. H., Tuan, H. L., & Chin, C. C. (2009). Investigating the influence of motivational factors on conceptual change in a digital learning context using the dual-situated learning model. *International Journal of Science Education, 32*(14), 1853-1875.
Tuan, H. L., Chin, C. C., & Shieh, S. H. (2005). The development of a questionnaire to measure students' motivation toward science learning. *International Journal of Science Education, 27*(6), 639-654.
Türkmen, L. (2002). Freshman elementary education major students' attitudes toward science and science teaching. *Hacettepe University Journal of Education, 23*, 218-228.
Uzun, N., & Keleş, Ö. (2010). Evaluation of the motivation for science learning according to some demographic characteristics. *Gazi University Gazi Faculty of Education Journal, 30*(2), 561-584.
Van Dam, N. T., Earleywine, M., & Forsyth, J. P. (2009). Gender bias in the sixteen-item Anxiety Sensitivity Index: An application of polytomous differential item functioning. *Journal of Anxiety Disorders, 23*, 256-259.
Van Zalk, N., Van Zalk, M., Kerr, M., & Stattin, H. (2011). Social anxiety as a basis for friendship selection and socialization in adolescents' social networks. *Journal of Personality, 79*(3), 499-525.
Vedder-Weiss, D., & Fortus, D. (2012). Adolescents' declining motivation to learn science: A follow-up study. *Journal of Research in Science Teaching, 49*(9), 1057-1095.
Vernberg, E. M., Abwender, D. A., Ewell, K. K., & Beery, S. H. (1992). Social anxiety and peer relationships in early adolescence: A prospective analysis. *Journal of Clinical Child Psychology, 21*(2), 189-196.
Watters, J. J., & Ginns, I. S. (2000). Developing motivation to teach elementary science: Effects of collaborative and

authentic learning practices in preservice education. *Journal of Science Teacher Education, 11*(4), 277-313.
Weiss, D. V., & Fortus, D. (2017). Teachers' mastery goals: Using a self-report survey to study the relations between teaching practices and students' motivation for science learning. *Research in Science Education, 48*, 181-206.
Yağız, K., Kuğu, N., Semiz, M., & Kavakçı, Ö. (2016). The relationship between anger expression, body image, and eating attitudes in social anxiety disorder. *Turkish Journal of Psychiatry, 27*(1), 15-22.
Yavuz, F. (2006). *School motivation assessment scale: Arrangement and reliability* [Unpublished master's thesis]. Institute of Educational Sciences, Marmara University.
Yenice, N., Saydam, G., & Telli, S. (2012). Determining factors affecting primary school students' motivation towards science learning. *Ahi Evran University Journal of Kırşehir Education Faculty, 13*(2), 231-247.
Yıldırım, H. İ., & Karataş, F. (2018). Investigation of middle school students' motivation toward science learning. *Sivas Cumhuriyet University Institute of Educational Sciences Journal, 7*(3), 241-268.
Yılmaz, E., Yiğit, R., & Kaşarcı, İ. (2012). A study on self-efficacy levels of primary education students in terms of academic success and some variables. *Mehmet Akif Ersoy University Journal of Education Faculty, 12*(23), 371-388.