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# CHAPTER 1

## LANGUAGE FACTOR AND OTHER COMPONENTS IN IMPROVE ORGANIZATIONAL COMMUNICATION

*Emre CALISKAN<sup>1</sup>*

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Culture can spread to employees in a variety of ways, and the most influential of these are stories, habits, physical symbols, and language (Robbins & Judge, 2013). 1. Stories: Includes narrative events related to the organization's founders, employees, past events, reactions, organizational coping. These stories connect the present to the past, explain and legitimize current practices. Rituals: A set of stereotypical activities that express and reinforce the core values of the organization. Language: Many organizations and their subordinates use language that helps their members integrate, accept, and sustain the culture. This language covers terms related to work-related equipment, employees, suppliers, customers, and products.

If we look at communication from the point of view of the school and the school as an organization, it can be said that it is the most important element of the management process, which means that what needs to be done is done through communication. people. In this context, it is possible to define the organization as a communication system. Organizational communication, on the other hand, can be defined as the production, transmission and interpretation of symbols by the members of the organization in order to coordinate and coordinate the actions of all employees of the organization in a way that meets the goals of the organization. Communication is at the center of organizational interaction and it is not possible to exempt communication from any area of organizational activities. In other words, communication should always be considered central to organizational actions and plays a fundamental role in shaping the relationship between formal and informal groups of the organization. In addition to being the basic condition for the healthy functioning of management processes, communication can also be considered as an effective tool in achieving organizational goals. The success of organizations largely depends on the effectiveness of communication.

Since organizational communication has a power that directs the relationship between the internal and external environment of the organization, it also affects organizational results. Effectively and efficiently arranging the elements of the communication process necessary for organizational success will not only enable employees to understand the roles and functions expected of them, but also encourage them to mobilize their knowledge, skills and abilities to achieve organizational goals. Organizational employees learn what is expected of them, how to do their job and what others think about their jobs through all communication tools. The organizational communication system should be insulated from the barriers of access to the information obtained by the employees from both the internal and external environment and should be provided with a structure that will encourage the production of new knowledge. Such a structure will create the values shared by the organization and strengthen the awareness of the



employees to protect these values. When considered within this framework, it is possible to say that communication is the basic process of the organization. It is possible to list the benefits of organizational communication and ways to improve communication as follows:

- Provides management with the opportunity to obtain the information they need to make decisions,
- It facilitates the understanding of the decisions taken by the managers by the employees in accordance with the purpose and their transformation into action,
- Strengthens the sense of commitment of employees to the institution and improves customer relations,
- Organizational performance by positively influencing employee behavior preferences.
- provides an enhancing effect,
- It enables employees to develop and reinforce their sense of sharing,
- Provides an understanding that reduces conflict, friction and pressure arising from the business environment,
- Contributing to the joint execution of the organization's activities.
- It ensures the continuity of a stable environment,
- Change by creating an environment of trust that helps reduce resistance to change.
- speeds up the process,
- Error reducing effect ensures cost reduction,
- Increases organizational profitability and efficiency.

Organizational communication is important in the context of giving a dynamic structure to the process of employees taking action to achieve the determined goals of the organization. Communication has a wide range of power, influence and role from personnel selection of the organization to career planning, determination and functioning of the internal and foreign policy of the organization. It is especially emphasized in the literature that organizational communication has functions such as information sharing, feedback of transmitted messages, coordination of different functions, persuasion, sharing of emotions and innovation. Attention is also drawn to the role of communication in ensuring “cooperation”. When an evaluation

is made within this framework, it is clear that effective communication is needed for the coordinated execution and provision of activities such as planning, organization, direction and control, which are the basic functions of management. . knowledge, trust in the manager, desired way of working, maintaining consistent discipline and participation in management. Understandable The fulfillment of management functions carried out in organizations depends on a well-functioning communication system.

Thanks to the information flowing through vertical, horizontal and cross communication channels, organizational planning, execution of activities and coordination between units are provided. Communication has an important place in motivating the employees of the organization to organize their knowledge, skills and abilities in order to achieve organizational goals. Providing the expected benefit from organizational communication is related to the attitude of the manager as well as the open, efficient and interactive communication channels. In this context, managers are primarily responsible for keeping internal communication channels open and working. The interaction of all elements in the organization in line with organizational goals depends on the effectiveness of communication. In this context, communication has a very important place in the coordination of work, solving organizational problems, sharing information in a healthy and widespread manner, and resolving conflicts (Demirel, Seçkin, & Özçınar, 2011).

All five items are represented by a model by Hatch and Cunliffe (2006). Here all areas are interconnected and no specific process is defined. Considering Whetten (1989), this points to a somewhat incomplete model, as the links between domains are unclear and undefined. By adding a few more chapters it may be possible to discuss and define the structures to be included in an organizational culture structuring model. This issue has been the subject of research for many years. Today, research continues on how the relationships between these structures can be better expressed in a single and non-contradictory model (Dauber, Fink, & Yolles, 2012).

Based on empirical research, case studies and the latest theoretical models of organizational behavior, "Corporate Culture and Organizational Communication" provides a framework for assessing the work environment in almost every business and strategies for reengineering work systems to increase organizational efficiency. "Corporate Culture and Organizational Communication" focuses on four concepts that describe the impact of organizational culture on effective performance: the involvement of organizational members; the ability to respond to new conditions while maintaining its essential character; consistency or strength, a clearly defined culture; a clear mission that provides direction and meaning. These four ideas are presented separately and then integrated into the Culture and

Event Model. The methods used to study cultural activity are described, including an overview of perspectives on the culture-climate debate among organizational behavior experts. For corporate and human resource managers, managers and consultants, "Corporate Culture and Organizational Communication" offers a new understanding of the elements that make up a productive work environment (Denison, 1990).

Although many cultural researchers devote large numbers of articles to the nature and definitions of culture, relatively few articles have contributed to culture and performance studies. A study investigating possible relationships between corporate culture and organizational performance among Singapore companies aimed at two things and was two-fold: First, it aimed to explore the validity of the culture construct. Can the culture structure be functionalized in different, reproducible dimensions? Second, it attempts to evaluate how culture affects organizational performance. Organizational culture profile was used as the primary research tool. Culture has been found to affect various organizational processes and performance. It was emphasized that more research should be done in this area (Lee and Yu, 2004).

Organizational communication, cooperation, coordination and control function in organizations. It cannot be said that this element fully functions in practice. If there was an effective communication at the desired level in organizations, it is possible to encounter organizational conflicts and organizational failures. It might not be. Today, because of the failure of many organizations or conflicts are mentioned. On the basis of this there is miscommunication. Because effective communication there are many factors, both internal and external, that hinder the organization. Among the factors that negatively affect organizational communication, general as the content of the message, the structure of the receiver and the language used in communication, etc. elements can be named. From the buyer's structure the problem arising from the problem is also the difference between the source and the receiver. One of the most important obstacles encountered in communication is arises from language and terminology difficulties or inadequacies. One The words in the language sometimes have more than one meaning and they It seems that they have nothing to do with each other. with different meanings the words are not known at all by the buyer or it depends on his own experience As a result, attributing a different meaning to it causes a communication problem. On the other hand, as societies develop, specializations also increase. Their areas of expertise require a technical language. This technical language is only understandable by experts in the field. These languages cannot be understood by individuals outside of their area of expertise.

As a result, although there are many factors affecting organizational communication, it is necessary to define the concept of organization and language and the variables that affect it in order to develop these communication methods. Because the variables affecting the organization and its dimensions are directly reflected in the forms of communication. The concept of organizational culture has attracted more and more attention in recent years by both academics and practitioners. If the concept of organizational culture is to be used especially in the field of organizational psychology, opinions on how to define and analyze the culture and the language used become very important. Other relevant concepts should be reviewed, historical development should be considered, and case studies showing how to analyze culture and think about cultural change should be well analyzed from these perspectives (Schein, 1990).

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## CHAPTER 2

### AN ANALYSIS OF THE COMMENTS OF PRE-SERVICE SOCIAL STUDIES TEACHERS ON GENDER DISCRIMINATION

*Çiğdem KAN<sup>1</sup>*

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## INTRODUCTION

In traditional societies, female roles are mostly limited to household roles, while male roles are mostly associated with breadmaking and outside the household and disassociated with household chores. Similar expectations are prominent in gender roles in the new society dominated by technological advances. It could be suggested that there the social roles have not changed significantly. The genetic attributes of individuals are called gender, while the roles assigned to the genders by the culture are described as gender roles. In the Turkish Language Institution dictionary, gender was described as an innate attribute that assigns separate reproductive roles to the individual and differentiates the male and female and gender discrimination was defined as different attitudes and behavior towards the individual in educational and professional life due to the possession of a male or female name (Turkish Language Institution Dictionary, [sozluk.gov.tr](http://sozluk.gov.tr)).

The social studies course scrutinizes the human, society and the environment in relation to the individuals and society. In short, social studies aims to train citizens equipped to contribute to the democratic process. Social studies curricula aim to train students with democratic citizenship values and skills (Kabapınar, 2014, 3).

Social reality is the opposite. Due to gender inequality, women are discriminated in health, education, employment and income against men. National or international policies lead to gender inequality favoring men. It is very important to strengthen the position of women and adopt an egalitarian approach in gender practices (Bal, 2014, 15-28).

Through education, individuals are not expected to adopt traditional gender roles, but participative, more egalitarian roles required in the age of technology. However, studies demonstrated that gender inequality is reinforced both by culture and education. In a study conducted by Erbil (2019), it was reported that female students' attitudes towards gender role were more egalitarian when compared to those of the male students and their values in life were higher than male students. In a study conducted by Erdol, Özen and Toraman (2019), it was determined that the ideation of pre-service teachers that women were dependent on men and men were superior was at a moderate level, and as the class level increased, their views became more negative, demonstrating that their views on gender were influenced by variables such as their department at school, the region of residence, and the education level of their parents. This was also true for the textbooks. Based on the findings reported by Yorgancı (2008), the analysis of the pictures and texts in 1-5<sup>th</sup> grade primary education textbooks revealed several sexist expressions.



A similar attitude could be observed in various countries in gender discrimination. Gao, Lin and Ma (2015) investigated whether large corporations contributed to gender discrimination in China. It was observed that males were generally preferred over females in management positions, except for a few female managers. It was noted that a female manager was more likely to face layoff or low compensation when compared to a male manager. Study findings demonstrated that discrimination played an important role in the promotion of women employees.

According to Easterly and Richard (2011), unlawful gender discrimination has been experienced for 40 years in legislative and federal policies in the USA. The findings reported by Daniel (2015) showed that poverty, gender stereotypes, socio-cultural beliefs and lack of awareness affected the low female participation in literacy programs in Adamawa state.

The present study aimed to determine gender discrimination that pre-service social studies teachers experience and underlying reasons for gender discrimination. The research is considered significant since it aimed to reveal the experiences of pre-service social studies teachers in gender discrimination and the reasons behind these problems. The following research problems were determined in the study:

1. What is gender discrimination according to pre-service teachers?
2. What are the gender discrimination problems experienced by pre-service teachers (both males and females)?
3. What are the reasons for the gender discrimination problems experienced by pre-service teachers?

## **Method**

### **The Research Design**

The present study was conducted with the case study methodology, a qualitative research design. For this purpose, the comments of the pre-service teachers on gender discrimination were determined in detail.

The following steps are adopted in a case study: The development of the research problems and sub-problems, the determination of the analysis unit, the determination of the case, the assignment of study participants, data collection and association of the data with the sub-problems, data analysis and interpretation, and reporting (Yıldırım, Şimşek, 2005, 281).

### **Participants**

The study was conducted in Firat University, Faculty of Education. The criterion sampling method, a purposive sampling technique, was adopted in the study. The study group included 26 volunteering pre-service

social studies teachers. In the study, the acceptance criteria included attendance in the social studies teacher training program, exposure to gender discrimination, and adequate self-expression skills. The study group demographics are presented in Table 1.

*Table 1 The study group demographics*

		f
Gender	Female	21
	Male	5
Seniority	Freshman	12
	Sophomore	14
Total		26

As seen in Table 1, 21 participants were female and 5 participants were male.

### **Data Collection Instruments**

The present study aimed to determine the gender discrimination problems experienced by pre-service social studies teachers and the factors behind these problems. Thus, the case study method, a qualitative research design, was employed to determine the experiences of pre-service teachers in the study. The data were collected using a semi-structured interview form. During the development of the interview questions, expert opinion was obtained from two specialists. The questions were finalized based on the expert opinions. To determine whether the questions were comprehensible, the form was applied to 4 pre-service teachers. It was observed that there were no comprehension problems. In the study, the factors that led to gender discrimination were identified. Only volunteer participants were included in the study group.

The interview form included the following questions:

1. What is gender discrimination in your opinion?
2. What were the gender discrimination problems you experienced (as a male or female)?
3. What are the reasons for the gender discrimination problems in your experience?

### **Data Analysis**

Descriptive analysis technique was employed in the analysis of the collected data. First, the interview data were read by the author and other specialists to determine the significant topics. The themes were developed

by grouping the associated topics.

In this approach, the collected data are summarized and interpreted based on the predetermined themes. The data could be organized based on the themes revealed by the research problems, or they could be presented based on the questions or dimensions employed in the interviews or observations (Yıldırım, Şimşek, 2005, 224).

In the study, the aim of the research was explained during the meetings organized with the pre-service teachers, and then they completed the interview forms. The data are presented to the reader based on the titles and themes. Study reliability was determined with the following formula:  $\text{Agreement} / (\text{Agreement} + \text{Disagreement}) \times 100$ . Thus, the reliability coefficient was calculated as 92% in the study. All study data are stored by the author for future examination if necessary.

## FINDINGS

### 1. The Definition of Gender Discrimination Based on the Views of Pre-Service Social Studies Teachers

The descriptions of gender discrimination stated by the pre-service teachers are presented in Table 2.

*Table 2 The descriptions of gender discrimination*

Description	f
Marginalization of women, glorification of men	22
Restriction of behavior in the outdoors	1
Discrimination in clothing, accessories, outing	1
Lack of educational and employment rights	1

The pre-service teachers were asked to define gender discrimination to determine their descriptions and perceptions about gender discrimination and their responses are categorized and presented in Table 2. The pre-service teachers defined gender discrimination as glorification of the male gender and alienation of the women. Certain examples of pre-service teacher statements are presented below. Female pre-service teachers are indicated with an 'F' and males were indicated with an 'E'.

F5: "Gender discrimination is a concept that glorifies men, marginalizes women and treats them as servants."

F7: "It entails unequal treatment of men and women in favor of one gender. For example, it is a discrimination to prevent girls from attending school and to work."

M12: “Male gender is prioritized in the society, while women are treated with constant disdain, as a deficiency. Due to these factors, women are always second class in society.”

Based on the above-mentioned quotes, the pre-service teachers reported that due to gender discrimination, men are glorified, women are marginalized, men are considered superior to women, individuals are treated unequally due to their gender, and women could not act freely. Thus, it was determined that the pre-service teachers had knowledge on the concept of discrimination.

## 2. The Problems Experienced Due to Gender Discrimination

The problems experienced by pre-service teachers due to gender discrimination are presented in Table 3.

*Table 3 The problems experienced due to gender discrimination*

Theme	Problem	f
Problems associated with mentality		
	Prohibitions associated with gender (inability to laugh freely, staying at home, restrictions on clothing)	13
	Superiority of males	4
	Presumed stereotypes of females towards males	2
	Disrespect for women's rights	1
	Inability to speak comfortably with women	1
Social problems		
	Career preference	4
	Public transportation and crowded spaces	3
	Family settings	2
	School	1
	Environment	1

The pre-service teachers were asked to describe the problems they experienced due to gender discrimination and their responses are categorized and presented in Table 3. Themes and sub-themes were determined based on the responses of the pre-service teachers. Two main themes of mentality and social problems were determined based on the study findings and these themes and sub-themes are summarized below. In the theme of problems associated with mentality, sub-themes such as prohibitions imposed on women, the perception of men as the superior gender, female stereotypes towards men, disrespect for women's rights, and inability to speak comfortably with a woman were determined.

The theme of social problems experienced due to gender discrimination included the sub-themes such as career choice, family troubles,

scholar problems, verbal or physical harassment, difficulties experienced in public transportation and in crowded spaces. Female pre-service teachers stated that gender was not an obstacle to men in career choice, but it was for women. Certain pre-service teacher quotes are presented below:

F23: “Not being able to go out as a woman after a certain hour in the evening.”

F24: “Some old-fashioned people believe that girls should not study.”

F5: “As women, our biggest problem is the mentality that women cannot. The simplest example is that a woman could not go out at night. If she is out at that hour, then she wants to be bothered.”

M13: “Women are considered lower than men. Their rights are not respected.”

M11: “While women face positive discrimination in all areas of life, I think that when men make a mistake, it is perceived more than the mistakes women make. The biggest problem is that all women treat all men the same as if they are all bad.”

The pre-service teachers mentioned the prohibitions imposed on women, the idea that men were superior to women, the disrespect for women’s rights, and the male pre-service teachers stated that women’s attitudes were prejudicial towards men, and they could not speak comfortably to woman in the sub-theme of the problems associated with mentality. Certain pre-service teacher quotes are presented below:

F3: “I want to be a police officer, but according to the society, only men could be police officers. This is very wrong and stereotypical. I do not accept this naturally.”

F25: “The professions recommended for a woman have always been nursing and teaching.”

F1: “Problems in the family that traditional factors lead only to the victimization of women. Taboos about female behavior in the school environment and several similar phenomena.”

M14: “As man, I experienced problems such as being misunderstood by female friends and not being able to speak comfortably with a woman.”

F19: “We experience problems when walking on the street at night, getting on the bus... about our clothes.”

The gender discrimination problems experienced due to the social mentality included prohibition on going out after a certain hour, the mentality about what women cannot, and perception of women as the inferior gender. Among social problems, the participants mentioned the prejudices

about the professions suitable for women the traditional familial factors leading to the victimization of women, and the problems experienced in crowded spaces, public transportation, or when walking on the street at night.

### **3. The Reasons for the Problems Experienced Due to Gender Discrimination Based on the Views of Pre-Service Teachers**

The views of the pre-service teachers on the reasons behind the problems experienced due to gender discrimination are presented in Table 4.

*Table 4 The reasons for experienced problems*

The reasons for the problems	f
Unchanging traditions and mentality	17
Ignorance, lack of education	13
"I cannot" ideation	1

The pre-service teachers were asked to indicate the reasons of the problems they experienced due to gender discrimination and their responses are categorized and presented in Table 4. They stated that they experienced these problems due to unchanging traditions and mentality, ignorance, lack of education, the 'I cannot' ideation, inability to interact with others, and prejudices. Certain pre-service teacher quotes are presented below:

M3: "The main reasons for the problems are unchanging traditions and mentality."

F9: "I think these problems are caused by ancient customs, and traditions."

M14: "The most important reason is lack of education and social ethics."

F16: "The reason for these problems is that they fall behind in education and social life."

F19 "I think these problems are experienced due to social structure, family discipline and national education."

F22: "These problems stem from the fact that boys always receive more attention."

The reasons behind the difficulties experienced due to gender discrimination were unchanging traditions and mentality, the wrong mindset of the society, customs and traditions and lack of education based on the above-mentioned quotes.

## CONCLUSION AND DISCUSSION

The present study, conducted with 26 pre-service social studies teachers, aimed to determine their experiences about gender discrimination, their definition of gender discrimination, the problems they experienced due to gender discrimination, and the reasons of gender discrimination. They described gender discrimination as the discrimination of a gender. The common definition proposed by the pre-service teachers was consistent with the gender definition reported by Bal (2014).

The problems that pre-service teachers experienced due to gender discrimination were categorized under two themes: problems associated with mentality and social problems. The sub-themes under the theme of social problems included career choice, problems in the family, the school, public transportation and in crowded spaces. Female pre-service teachers stated that gender was not an obstacle for men in career choice, but it was for women. Male pre-service teachers stated that they experienced difficulties such as inability to speak comfortably with a woman. The study findings were consistent with the findings reported by Ak (2018) and Can (2013).

Ak (2018) aimed to determine the gender problems that women experienced and their perception about these problems. The study findings demonstrated that employed women demanded solutions for several problems they experienced more when compared to men. A study conducted by Can (2013) aimed to determine the obstacles and challenges caused by violence against women. The study findings showed that the traditional gender mentality was still effective and legitimized these practices.

The reasons for the difficulties that the pre-service teachers experienced were categorized under the themes of traditional mentality, ignorance and lack of education, and the 'I cannot' ideation. The present study findings supported the reports by İnandı, Özkan (2009), Pınar, Taşkın, and Eroğlu (2008), Seçgin and Kurnaz (2015), Kahraman, Tunçdemir, Özcan (2015), Özkan and Gündoğdu (2011), Kalaycı (2015), Öngen and Aytaç (2013), Seçgin and Tural (2011), and Uygun and Önsan (2020).

In a study conducted by İnandı and Özkan et al. (2009), female teachers stated that familial factors and gender stereotypes hindered their careers more when compared to men. Pınar, Taşkın and Eroğlu (2008) reported that most young individuals residing at Başkent University student dormitory were under the influence of traditional mentality about gender roles. In a study conducted by Seçgin and Kurnaz (2015), it was observed that gender activities embodied student perceptions about gender and raised awareness about the issue. Kahraman, Tunçdemir and Özcan (2015) reported that male students attending the nursing department considered nursing as a female profession and believed that male nurses would serve better only

in situations that require power.

Özkan and Gündoğdu (2011) conducted a study to determine the gender roles in Turkish culture and social expectations from these roles based on proverbs and idioms. The study findings demonstrated that male gender was glorified and prominent in social life, while the female gender was secondary and limited by the household activities based on the distribution of gender roles and associated messages. A study conducted by Kalaycı (2015) analyzed the cartoon titled Pepee for gender equality. Holistic analysis of the study findings demonstrated that the cartoon included messages that promoted gender inequality.

Öngen and Aytaç (2013) conducted a study to reveal the correlation between the attitudes of college students towards gender roles and their life values. The findings revealed that men exhibited more traditional attitudes and women had more egalitarian attitudes and gender roles when compared to men. It was observed that students with employed mothers adopted a more egalitarian attitude towards gender. Seçgin and Tural (2011) aimed to determine the attitudes of pre-service teachers attending the classroom teacher training program towards gender roles. It was determined that there was a significant difference between the attitudes of pre-service teachers towards gender roles based on the gender variable. It was observed that pre-service teachers emphasized and adopted roles associated with certain cultural and traditional values. It was observed that they mostly exhibited attitudes in favor of their own gender. In a study conducted by Uygun and Önsan (2020), it was determined that the views of female teachers on gender were more egalitarian. It was observed that teachers with modern parents were more egalitarian when compared to teachers with traditional parents. Furthermore, it was found that teachers who were raised in egalitarian families exhibited positive gender perceptions when compared to those raised in patriarchal families.

The following could be recommended based on the study findings:

- Further efforts are required to raise awareness about gender discrimination in the society.
- The elements in textbooks and educational activities that promote gender discrimination should be reviewed.
- Policies, plans and projects should be developed to promote the egalitarian perspectives towards gender.



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## CHAPTER 3

### DESCRIPTIVE CONTENT ANALYSIS OF LEARNING THEORIES USED IN ARTICLES PUBLISHED IN THE FIELD OF SCIENCE EDUCATION

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## INTRODUCTION

Considering that human beings make sense of the world by learning it becomes clear how vital learning is for human beings. Some distinguishing features that human beings from other living things are that they can think, make inferences from what they think, learn, and structure what they have learned. Learning is an action that takes place throughout a person's entire life. For this reason, the question of how the act of learning, which is of great importance for human beings, has always been on the agenda of scientists from past to present, many types of research have been made on this subject, and some theories and approaches have been developed about how people learn and what factors are effective in the learning process (Yazar & Karatas, 2018).

Since many of the behaviors of human beings are learned behaviors, it is necessary to investigate what learning means in terms of definition and the reasons for the formation of these behaviors to clarify how these behaviors occur. It will be beneficial for humanity to find answers to questions such as how learning occurs in individuals, which information can be learned in which way, and at what time. For example, parents who want to help their children learn and teachers who want to contribute to the effective learning of their students in the classroom need information about learning (Senemoğlu, 2020).

According to Bower and Hilgard (1981), learning is the process of generating or altering behaviors in response to the environment. This definition excludes innate behaviors, orientations, and transient situations with some external influences. Then, for a behavior to be considered learned, a change in the behavior must be evident and result from gaining experience; it cannot happen suddenly or temporarily as a result of some external factors, nor can it happen solely as a result of growth. In the course of this process, psychologists and educators who support various hypotheses to explain how learning takes place have established certain theories on learning. Learning theories describe the nature of learning, how it happens, and in what way, and under what conditions the best learning will or will not occur. Since each learning theory best explains a particular learning product, any learning theory is not effective and sufficient to explain all types of learning (Senemoğlu, 2020).

The creation of curriculum for educational systems depends critically on the existence of teaching theories that address learning from many perspectives. All teaching activities in schools are designed or organized using learning theories since ensuring that learning is realized in each individual is the primary goal of school establishment and education. Looking back on recent history, new methods to science education have emerged as a re-

sult of technical advancements, particularly in the scientific field. In order to contribute to effective and efficient learning, it is crucial for educators to be aware of innovative ideas and to implement them in science lessons (Özmen, 2019).

Adaptability, critical thinking, entrepreneurship, problem solving, creativity, flexible thinking, cooperation, leadership, creating a plan, and developing communication are just a few of the traits that people need to possess in order to solve problems that have grown more complex due to the advancement of technology in recent years (Çelikoğlu et al., 2022; Çelikoğlu et al., 2023Bahar et al., 2018). Based on this, it was essential to utilize a flexible teaching approach, particularly in the field of science, to help people develop these talents. People who are able to learn by comprehending, apply the knowledge they have acquired in real-world situations, and extract new knowledge from this knowledge will help their nations keep up with the quickly advancing sciences and technologies. Because of this, developing qualified people depends greatly on the use of the most efficient scientific learning and teaching techniques.

Numerous investigations on learning theories in the realm of science have been conducted, according to the literature. When the data from the tests administered after the learning theories were introduced to the students were analyzed for Kara's (2009) study on how pre-service teachers' knowledge of learning theories affects their attitudes toward learning, it became clear that people who understood the learning process were better at perceiving the nature of learning and more open to learning. Additionally, it was discovered that they had higher expectations for their performance and displayed less learning anxiety. In our nation, learning and teaching activities are still actively pursued, particularly in the classroom setting. It is simple to say that learning theories have a significant impact when the learning and teaching components, such as instructor, student, curriculum, etc. are taken into account. For instance, it has a substantial impact on the curriculum's aim, content creation, teaching and learning processes, measurement, and evaluation aspects. We can see that the courses created in 2000 and after follow the fundamental tenets and philosophies of these theories and methodologies. Given that raising student accomplishment is the primary objective, it is obvious how much this only influences the curriculum dimension. The aforementioned learning theories have a considerable impact on the teaching principles, strategies, procedures, and approaches that the teacher employs in accordance with the goals envisioned in the classroom. It is acknowledged in the literature that studies that have dealt directly or indirectly with learning theories in science education from the past to the present in our country have employed those basic concepts and philosophies to some extent.

When academic success and p significance values were analyzed, the group in which cooperative learning theory was applied was more successful, according to a study looking at the effects of constructivism, cooperative learning theory, and the discovery learning strategy in science education (Avgın & Uygun, 2021).

After examining 42 studies on the idea of multiple intelligences in science education in Turkey, it was discovered that the survey method, a quantitative research technique, was primarily employed. Those high school students were primarily chosen as the sample. Most of the experimental studies in this study that tried out activities based on the theory of multiple intelligences revealed that these activities were most effective at boosting students' success, motivation, knowledge retention, perceptions, and attitudes (Efe and Bakçı 2022).

When the studies are analyzed, it becomes clear that science education researchers place a strong emphasis on learning theories. It is believed that additional studies will clarify them in order to serve as a reference for both teachers and students about successful and efficient learning. The fact that the quality of teaching activities will improve with an understanding of learning theories and practices in general education environments and the construction of appropriate arrangements is a significant factor that shouldn't be overlooked.

### **Purpose and Significance of the Study**

As a result of interactions with their environment throughout their lives, people pick up skills, information, attitudes, and values; these experiences serve as the foundation for learning. Science education and everyday life both benefit from the application of learning theories that have been put forth regarding how learning happens (Özmen, 2014). In the literature, there is numerous research on the application of these theories to teaching, but none of them offer a content analysis that describes all learning theories collectively. To fill this gap, a descriptive content analysis of the theories' effects on science education in this study was carried out by reviewing the literature. It is intended to provide new research with a critical perspective on the degree to which learning theories are applied directly or indirectly in science education by examining the descriptive content analyses of the studies. By studying the research where learning theories in science education are directly or indirectly presented in terms of various variables, it seeks to reveal a general framework. Because of these factors, the issue statement for the study is "What are the general trends in the published article studies on the subject of learning theories in science education in the last ten years in Turkey?"

This study includes a descriptive content analysis of studies published on learning theories in the area of science education in our nation over the previous 10 years. The studies carried out between 2012 and 2022, the journal in which the study was published, the year of publication, the type of learning theory or theories included, the research method, the subject area of the research, the sampling method, the sample group, the number of samples, the type of data collection tool, and the data analysis method were examined, according to the descriptive content analysis. In the studies carried out regarding the learning theories in science education, either directly or indirectly, the following questions were sought answers to:

In line with the purpose of the study, answers were sought for the following sub-problems:

- 1) *What is the distribution of the studies according to the type of journal published?*
- 2) *What is the distribution of the studies according to the year of publication?*
- 3) *How is the distribution of the studies according to the subject area?*
- 4) *What is the distribution of the studies according to learning theory(s)?*
- 5) *What is the distribution of the studies according to the research method?*
- 6) *What is the distribution of the studies according to the sampling method?*
- 7) *What is the distribution of the studies according to the sample group?*
- 8) *What is the distribution of the studies according to the number of samples?*
- 9) *What is the distribution of the studies' according to the types of data collection tools?*
- 10) *What is the distribution of the studies according to the data analysis method?*

### **Limitations of the Research**

Between the years 2012–2022, comments about various time periods and academic fields in the subject of science education are not included

in the studied articles. In terms of generalizability and comparability, the study's sample's analysis of studies carried out in Turkey is a limitation. Different analysis score directions can be employed in the coding of these publications, even if the analysis draft contained in the study and produced by the researchers is an alternative to current publications and coding. It is only possible to access the full text of the journals included in the current research in the electronic environment; not all of the journals' archives are accessible in the digital environment. This restriction was put in place to ensure that reasonable publications could be accessed for the research's purposes and to exclude studies from other fields from the research.

## **METHOD**

The sub-titles of the research model, the universe and sample of the research, the coding of the articles suitable for the research's purpose, the literature review, the data collection process, the data collection tool, the collection and analysis of the data for the current study, and the validity and reliability are all included in this section.

### **Research Model**

The aim of the research is to examine the studies carried out in the last ten years in the national literature on the subject of learning theories in science education, directly or indirectly, and to determine the characteristics of academic studies. Examining studies that have been done in the past ten years in the national literature on the topic of learning theories in scientific education, either directly or indirectly, is the goal of the research. It also aims to identify the characteristics of academic studies. In the current study, the descriptive content analysis method was used to examine the articles published between 2012 and 2022 in terms of several factors in order to indicate the overall trend. The presentation of studies carried out in a specific field in an extensive framework is known as descriptive content analysis (Yıldırım & Şimşek, 2018; Çalık & Sözbilir, 2014). Besides, according to Creswell (2016), descriptive content analysis research aims to organize and comment in a form that will facilitate the reader's understanding by bringing together similar data in certain codes and themes.

### **Population and Sample**

The publications that were published in Turkey between 2012 and 2022 and indexed in the Web of Science database form the study's population. It consists of 15 articles that were selected using an accessible selection method and that contain studies on learning theories that are directly or indirectly explored in the context of science education. By simply having access to the complete texts of the journals included in the study electronically, the conveniently accessible sample approach was utilized



to obtain the publications for the research and to omit studies in other domains from the research. To reach the publications for the research and to exclude studies in different fields from the research, the easily accessible sampling method was used by accessing the full text of the journals included in the study only from the electronic environment.

### **Coding Process of Studies**

All the studies included in the current study were examined in detail, and the results were evaluated. Summary data for each publication was noted. To analyze the studies included in the research more easily and systematically, each published publication was coded as M1, M2, M3..., M15 and presented.

### **Literature Review**

The Web of Science database was searched in order to reach studies that directly or indirectly discussed learning theories in science education in Turkey between the years 2012-2022. As a keyword while scanning from the database; The concepts of science education, learning theories, and descriptive content analysis were used. Thus, a total of 33 studies published in journals were reached. Of the studies reached, the ones that meet the criteria of the current research were selected and finally 15 studies were examined.

### **Data Collection**

All publications on learning theory in science education that was published in the Web of Science database between 2012 and 2022 were included in the research during the data-gathering phase. Within the scope of this study, 15 articles were examined. According to inclusion and exclusion criteria for various factors, these articles were reviewed. In this context, 15 articles were examined within the scope of the research. These articles were reviewed according to inclusion and exclusion criteria for various variables.

-Inclusion Criteria for Studies: Some criteria were determined while selecting the studies that constitute the sample of this study. These criteria are as follows:

- 1) Studies published in journals in the Web of Science database,
- 2) Studies that include the related keywords,
- 3) Studies published between 2012-2022,
- 4) Studies carried out using sample(s) in Turkey,
- 5) Studies about learning theories

6) Studies which have access to the full text

7) Studies published in indexed journals such as SSCI, SCI, ESCI, ESCI EXPANDED

-Exclusion Criteria for Studies

1) Articles that did not pass the peer-review process,

2) Proceedings, theses,

3) Articles whose full text could not be reached.

4) Articles that were not published between 2012-2022 years were excluded from the scope of the present study.

### **Data Collection Process and Data Collection Tool**

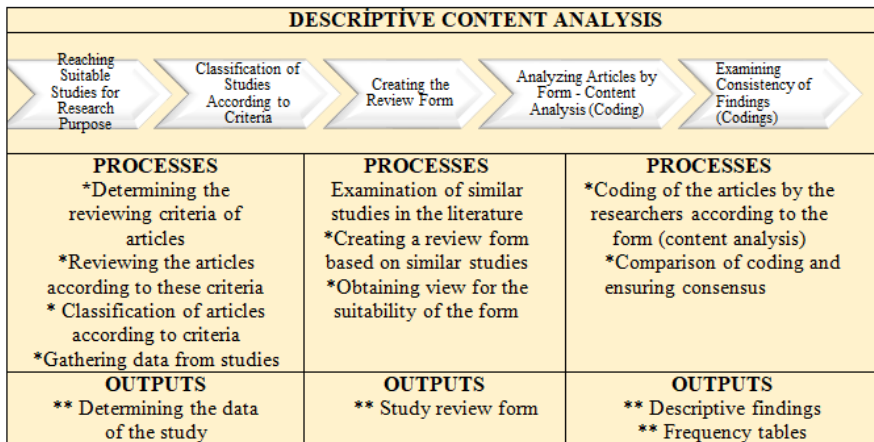
We aimed to examine the published studies in Turkey between the years 2012-2022, which directly or indirectly discussed learning theories in science education. In this context, the Web of Science database was used to examine the journals in which the studies were published, the year of publication, the type of learning theory or theories included, the research method, the subject area of the research, the sampling method, the sample group, the sample size, the type of data collection tool and the data analysis method. Searches were carried out with the keywords determined in the Web of Science database. Out of 33 articles initially obtained from the database, 15 articles were included in our current study as a result of using certain criteria in line with the purpose of the research. Subsequently, a study-specific form was developed based on the forms in the descriptive content analysis studies in the literature for the evaluation of the articles by creating codes and themes (Yayla-Eskici & Özsevgeç, 2019; Çiltaş, Güler & Sözbilir, 2012; Aztekin & Taşpınar Şener, 2015; Sözbilir & Kutu, 2008; Boztunç Öztürk, Eroğlu, & Kelecioğlu, 2015). The tool that we used to collect the data consists of 2 main parts. In the first part, the identifier of the current study (name of the study, authors, year, the name of the journal in which the study was published, subject area, type of learning theory) in the second part, the method section of the research (method of the study, sampling method, sample size, sample group, data collection tools, data analysis) (Table 1).

**Table 1.** *Data Collection Form for Descriptive Content Analysis*

SECTION 1					
STUDY					
Title:	Authors:	Publication Year:	Published Journal:	Subject Area:	Type of Learning Theory:
SECTION 2					
METHOD					
Research Method: Qualitative () Quantitative () Mixed ()	Data Collection Tool Tests () Scale () Observation () Questionnaire () Interview ()	Data Analysis Method**			
		Quantitative Data Analysis ()		Qualitative Data Analysis ()	
		1.Descriptive Frequency () Percentage() Average() Standard deviation () Other ()	2. Predictive Parametric Test () Non-Parametric Tests() Other ()	3. Qualitative Content analysis () Descriptive analysis () Other ()	
Sampling Method: Probability sampling () Nonprobability sampling ()		Sampling Group: Teacher () Student ()		Sample Size: 0-50 ()    51-100 () 101-150 ()    151-200 () 201 and over ()	

### Data Analysis

In this study, articles on learning theory in science education between the years 2012-2022 were examined and classified according to their similarities and differences in a common framework divided into 10 different themes in line with the data obtained. A general trend was created by describing each figure and table (Yeşiltaş et. al. 2023).



**Figure 1.** *Research Process (Gültekin & Burak, 2019).*

## Research Validity and Reliability

The data were individually examined by the researchers at different times and places in order to ensure the reliability and validity of the study. The required criteria for selecting the studies included in the research were established by reviewing a team made up of experts in the field (1) and experts in science education (3). According to the same team's consensus, studies that were and weren't included in the study were classified, assessed individually, and drawn conclusions.

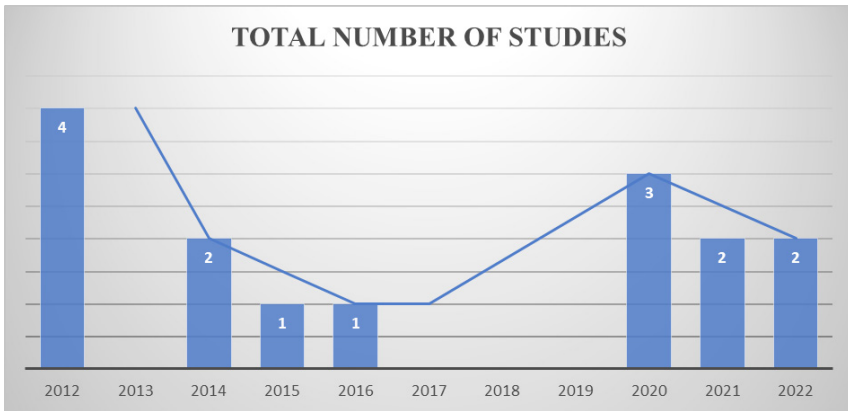
## FINDINGS

In this part, the studies and themes addressed by the research are given. For each sub-problem, the study's findings are provided independently, and the data representation is shown in tables and figures with the relevant topic headings. Table 2 displays the distribution of the journals where the studies were published.

**Table 2.** *Distribution of the articles according to the journals in where they were published.*

	<b>Journals Where the Studies Published</b>
<b>M1</b>	Cultural Studies of Science Education
<b>M2</b>	Research in Science & Technological Education
<b>M3</b>	Energy Education Science and Technology Part B: Social and Educational Studies
<b>M4*</b>	Chemistry Education Research and Practice
<b>M5</b>	Procedia-Social and Behavioral Sciences
<b>M6</b>	Journal Of Qualitative Research in Education
<b>M7*</b>	Chemistry Education Research and Practice
<b>M8</b>	Çukurova University Faculty of Education Journal
<b>M9</b>	International Journal of Instruction
<b>M10</b>	Thinking Skills and Creativity
<b>M11</b>	Physical Review Physics Education Research
<b>M12</b>	Journal Of Chemical Education
<b>M13</b>	Problems Of Education in the 21st Century
<b>M14</b>	Educational Assessment, Evaluation and Accountability
<b>M15</b>	Educational Research and Evaluation

When the above table is examined, since two of the 15 studies on learning theories in science teaching are published in the same journal, a total of 14 journals are seen. It is indicated by the (\*) sign that some articles have been published in the same journal. The findings of the published studies for a more detailed explanation of their distribution by year are given in Figure 2.



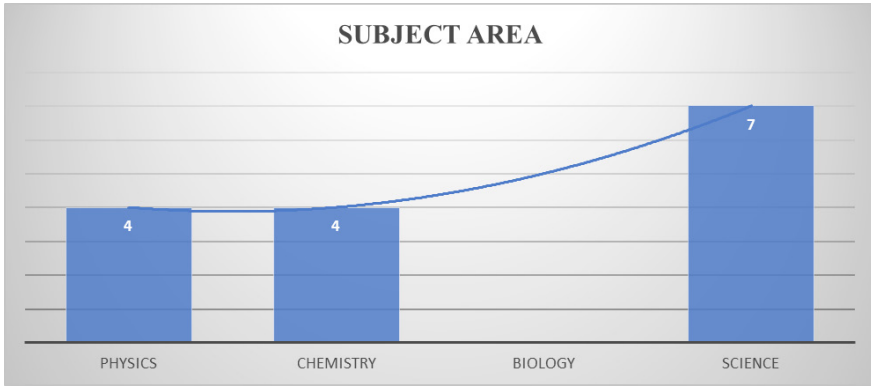
**Figure 2.** *Distribution of Studies According to Year of Publication*

The distribution of publications published on learning theories in science education over the years is presented in the figure above. Most studies ( $f=4$ ) were conducted in 2012, followed by 2020 ( $f=3$ ), while no studies were published in 2013, 2017, 2018, or 2019 ( $f=0$ ), according to the results. Figure 3 presents the findings with a more comprehensive overview of the distribution of the published studies in line with the study methodology.



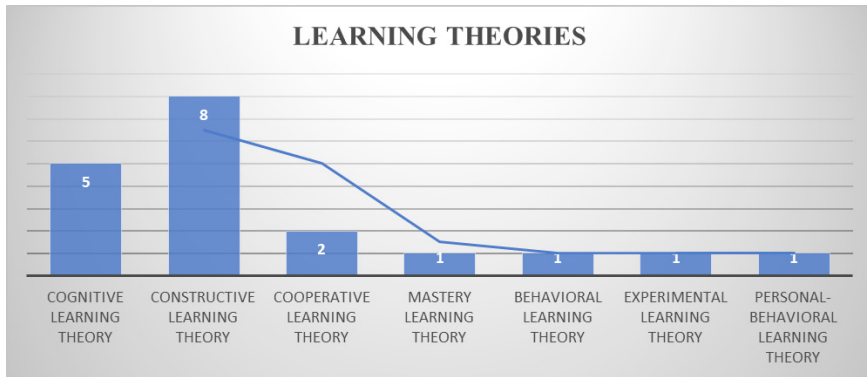
**Figure 3.** *Distribution of Studies According to Research Method*

Figure 3 presents descriptive information about the study methodology used in the publications published on learning theories in science education. Examining the study's data reveals that quantitative studies are published most frequently ( $f=6$ ), followed by mixed research ( $f=5$ ), and that qualitative research studies are favored the least ( $f=4$ ). Figure 4 provides data for a more comprehensive overview of how published research is distributed in relation to the theme of the subject area.



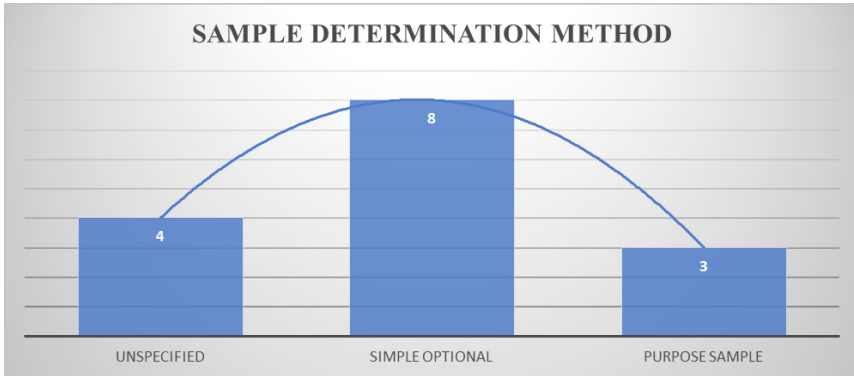
**Figure 4.** *Distribution of Studies According to Subject Area*

When Figure 4 is examined, we see that 7 studies on learning theories in science teaching were carried out in the field of science, 4 studies in the field of chemistry, and 4 studies in the field of physics. In addition, we have determined that no study has been carried out in the field of biology on learning theories in science teaching. The findings regarding a more detailed explanation of the distribution of published studies according to the theme of learning theories are given in Figure 5.



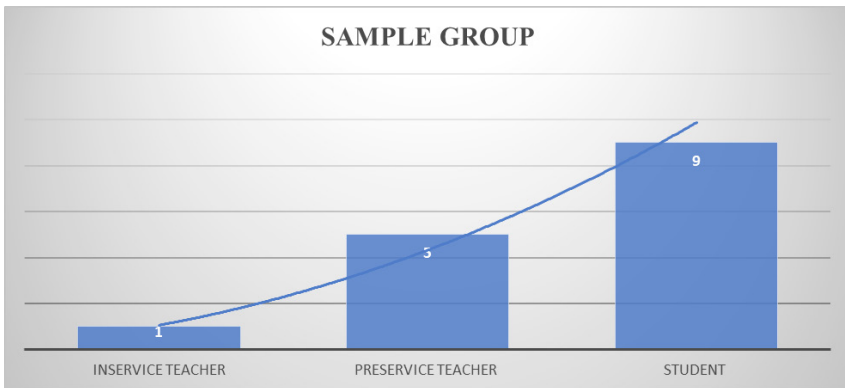
**Figure 5.** *Distribution of Studies According to Learning Theories*

We can say that most of the studies are based on the constructivist learning theory ( $f=8$ ). In addition, the number of studies based on cognitive learning theory ( $f=5$ ) is in second place. Mastery learning, behavioral learning, experiential learning, and cognitive-behavioral learning theories are the least preferred learning theories.



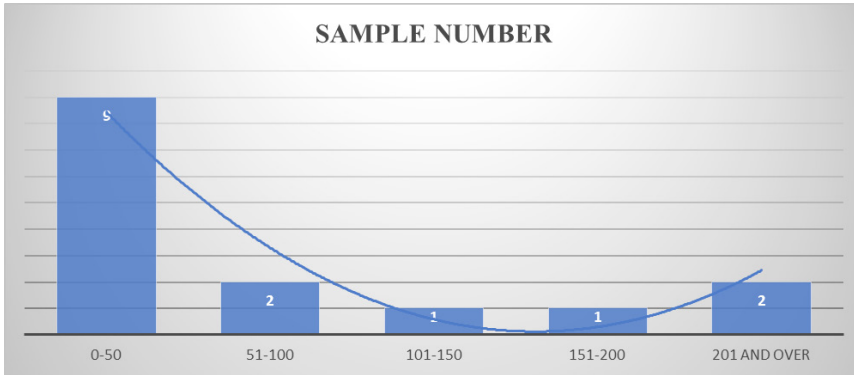
**Figure 6.** *Distribution of Studies According to Sample Determination Method*

When Figure 6 is examined, descriptive findings regarding the sampling method of the articles published on learning theories in science teaching are included. When the findings of the study were examined, it was concluded that simplest random sampling ( $f=8$ ) was used. We see that the purposive sampling method ( $f=3$ ) is in second place. In some studies, however, no information was given about the sampling method. Findings for a more detailed explanation of the distribution of the published studies according to the sample group are given in Figure 7.



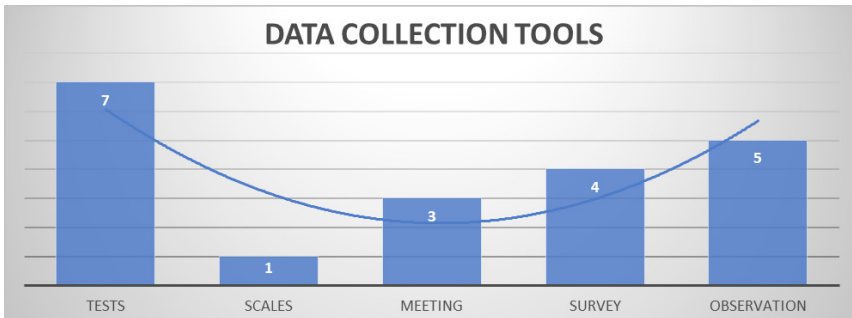
**Figure 7.** *Distribution of Studies According to Sample Group*

When Figure 7 is examined, there are descriptive findings related to the sample group of the articles published on learning theories in science teaching. When the findings are examined, it is seen that the sample studies with the most students (9) were conducted. In the figure, it has been found that the number of sample studies with teachers is 1, and the number of sample studies with teacher candidates is 6. The findings regarding a more detailed explanation of the distribution of the published studies according to the number of samples are given in Figure 8.



**Figure 8.** *Distribution of Studies According to Sample Number*

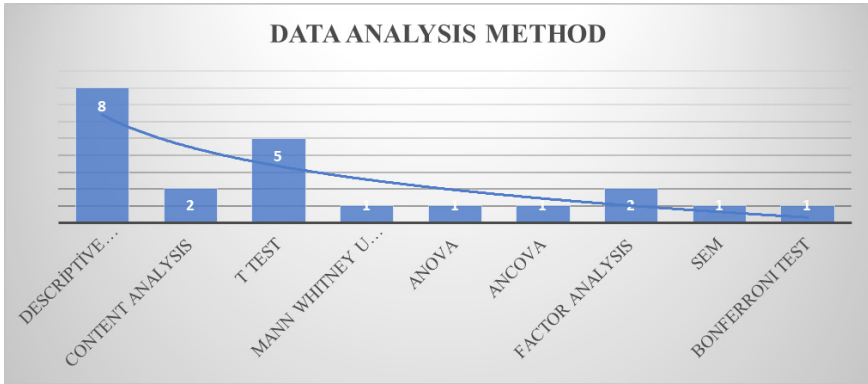
Considering the findings (Figure 8), we see that the study was carried out with the number of samples ( $f=9$ ) in the range of 0-50 numbers at most. Findings related to a more detailed explanation of the distribution of published studies according to the data collection tool are given in Figure 9.



**Figure 9.** *Distribution of Studies According to Data Collections Tools*

When the findings were examined, we determined that tests were mostly used as data collection tools ( $f=7$ ). In the present study, we concluded observation is the second most used data collection tool after tests. It was determined that  $f=5$  of the 20 data collection tools used in the publications were observations. In the study, it was found that the scale ( $f=1$ ) was the least preferred data collection tool. The findings regarding a more comprehensive explanation of the distribution of the published studies according to the data collection tool are given in Figure 10.





**Figure 10.** *Distribution of Studies According to Data Analysis Method*

Based on the results, it was found that the descriptive analysis method was most frequently used ( $f=8$ ). In addition, we determined that, after the descriptive analysis approach, the t-test analysis was the second most chosen data analysis technique in the study. The study's findings show that factor analysis and content analysis are two of the data analysis techniques employed in publications. The study discovered that the least favored data analysis techniques were the Mann-Whitney U Test, ANOVA, ANCOVA, SEM (Structural Equation Modeling), Bonferroni Test.

## CONCLUSION AND DISCUSSION

The most important aim of education is to reveal positive changes in the behavior of individuals through their own lives. For this purpose, planned teaching activities are prepared and implemented in educational environments (Fidan, 2012). To raise qualified individuals needed, meaningful learning is expected to occur in individuals. For this reason, it has become extremely important to know the theoretical foundations of both learning and teaching to carry out and implement successful teaching activities effectively. In other words, all instructors who will organize these activities are required to absorb learning theories and teaching practices related to these theories perfectly and to include teaching practices related to them (Yeşilyaprak, 2012).

Since a learning theory is a framework for expressing how people learn based on the findings of numerous comprehensive research, there are some presumptions that indicate a philosophical understanding of knowing and what knowledge is at the core of each learning theory. Due to this, actions like setting learning objectives, planning the content, carrying out instructional activities, and evaluating student learning clearly demonstrate the philosophical thinking behind the learning theory (Özerbaş, 2007). Learning is a change of behavior that results from a person's contact with

his/her environment. Studies are still being conducted today since there are so many ideas that have been proposed and established on how this change occurred.

In this study, descriptive content analysis was used to investigate articles that were published in journals in the SSCI, SCI, ESCI, and ESCI EXPANDED indexes between the years of 2012 and 2022 and that related directly or indirectly to learning theories in science education in Turkey. In this context, our goal was to inform new researchers about the research carried out in the area of learning theories during the last ten years and to highlight trends. To perform this, research from the past ten years that included learning theories in Turkey was gathered, analyzed, and assessed within a broad framework, and certain conclusions were drawn. By comparing the findings to those of related research that had been published in the same field, the findings were assessed and presented.

As a result of the examinations, when the distribution of the studies on the direct or indirect subject of learning theories in science education according to the year of publication is examined, it is determined that there has been an increase and decrease in the number of articles published in the last decade, and the number of articles was the highest in 2012 and this was followed by 2020. In the studies, it is seen that there is a differentiation in the period of 2013 and after compared to 2012. In the current study, it has been determined that the publications on learning theories on science education in recent years are higher than in other years, whereas in 2013, 2017, 2018 and 2019, no studies were carried out and the changes made to the content of the curriculum within the scope of the studies carried out in Turkey in these years are thought to be a reason for this. Science curriculum is based on different approaches due to the requirements of the age and the need for change, and there is not much difference between the implementation of the program and the exchange years of these two programs. For this reason, it is foreseen that the theories and approaches used in the education process according to the programs affect the studies to be carried out considering that it takes time to reflect the results in the most effective way in terms of efficiency (Filiz & Kaya, 2013; Candaş, Kırıyak, Kılınc, Güven, & Özmen, 2019; Deveci, 2018)

From the point of view of the research methods of the studies, it is seen that the most quantitative research methods have been used and the semi-experimental patterns, one of the quantitative research methods, are the most preferred. This can be expressed by making easier and faster access and analysis of the data reached from the measurement tools used in the studies where quantitative research methods are preferred. In parallel, the second most used method in publications is the mixed research method. In the last place, qualitative research methods are included. Quantitative

research method is considered to be used most due to the easy access to the data to be obtained in the researches, saving time and quantitative research habits of the researchers (Yakut Çayır & Sarıtaş, 2017; Turgut & Denizalp, 2021). The reason for the underuse of qualitative research methods is that the data collection process is long, and it takes time to interpret the collected data by interpreting it. Another reason for this situation is the learning environment in the studies due to the fact that due to the differences in the education of the researchers at the universities, the analysis of the qualitative data analysis cannot be effectively resolved or the lack of a suitable computer program knowledge. It is thought that the data collection tool cannot be used to achieve meaningful results, it does not provide a more comprehensive perspective to practitioners and researchers (Gültekin & Burak, 2019; Gurel et al. 2017). In contrast, it is envisaged that the researcher will obtain better data to understand the situation in a versatile and holistic manner and to conduct studies in which qualitative research methods are kept in the foreground to resolve the problem to be addressed without time.

When the publications that directly or indirectly are the subject of learning theories in science education are examined, it is concluded that the most publications in terms of subject area are in the field of science. In addition, it has been determined that studies on physics and chemistry have been published at an equal rate, but no studies have been made in the field of biology (Hündür et al., 2022). Considering the effects of developing and changing technology in the studies carried out according to the subject areas, it is predicted that there is an education system that moves away from traditional methods and is based on constructivist methods (Oğuzman, Metin & Kaya, 2021; Özarslan & Özcan, 2022). It is thought that one of the reasons why the studies examined in the context of the subject are mostly concentrated in the field of science is that different learning theories have an effect on students' attitudes, success, teaching concepts and eliminating misconceptions (Özmen, 2014; Oğuzman, Metin & Kaya, 2021).

When evaluated in terms of learning theories, it was determined that the most constructivist learning theory was studied, followed by studies on cognitive learning theory. In these studies, it was determined that the least number of studies related to mastery learning theory, behavioral learning theory and experiential learning theory were done. In the years when the studies based on the scope of the current research were published, it was predicted that the changes in the curricula in Turkey also changed in the imposition of different educational approaches and learning theories on the courses. For this reason, considering the years in which the current study was based on the curriculum, which was changed in 2005, the constructivist learning theory was used more, but since the curriculum was changed

again in 2013 and 2018, this ingrained learning theory is still used, however, due to the change in the learning programs in other years, the situation and course contents are affected. It is thought that it adopts different approaches according to the number of years, and this affects the number of studies conducted over the years (Candaş, Kıryak, Kılınç, Güven, & Özmen, 2019; Filiz & Kaya, 2013; Deveci, 2018).

When the sampling methods of the studies were examined, it was concluded that the “simple random” sampling method was mostly used in the article studies. Yavuz & Yavuz (2017) and Taşkın (2020) also stated that the most preferred sample selection methods in their studies are simple randomness. It is thought that this result is due to the ease of accessing the sample by the researchers or to the fact that these sample selection methods are more economical.

When we look at the distribution of the studies conducted for the sample groups, it was seen that the studies with student groups were preferred more, while the studies with the teachers were less preferred. In the publications made in the literature, it was stated that more work should be done with the sample groups formed by the teachers. The reason for this is that it is thought that it is vital to know how effective the learning theories based on the lesson are in the lessons and how the teacher can transfer these theories to the lessons effectively (Uysal, Köse & Pehlivan, 2021; Akyol, 2011; Tosun, 2014).

When evaluated in terms of the number of samples, we determined that the studies were carried out with a sample number of 0-50 at the most, followed by the studies with a sample number of 51-100 and over 201, and the studies with the minimum sample number of 101-150 and 151-200. We think that the sample size of the studies is mostly in the range of 0-50, and studies based on quantitative methods are conducted with larger sample numbers than studies based on qualitative methods, due to the nature of the study methods (Turgut & Denizalp, 2021; Oğuzman, Metin, & Kaya, 2021; Özmen, 2014).

When the distribution of the published studies in terms of data collection tools was examined, we see that the use of tests was preferred more in the publications, followed by the observation data collection tool, and it was determined that the scales were used the least. Some of the reasons for the preference of the tests are that the tests reach more participants in a shorter time frame, creating convenience in data collection and the researcher's less effort when working with a developed test (Uysal, Köse & Pehlivan, 2021; Taşkın, 2020).

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### **SUGGESTIONS**

According to the studies, quantitative research methodologies are mostly concerned with the direct or indirect issue of learning theories in scientific education. Research utilizing qualitative research approaches can offer more in-depth information than quantitative studies.

In order to reach more comprehensive results, the number of studies can be increased by changing the year range.

In this study, publications related to science education were examined. Researchers can also work on other subjects and fields, and thus, they can reach different trends within the scope of the relevant publication.

The articles used in the research were accessed from the Web of Science database. Researchers can conduct more in-depth research by examining studies published in different databases and journals.

The results obtained can be diversified by examining the contents of the articles with different criteria than the criteria used in the research.

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## CHAPTER 4

### THE ROLE OF SOCIOECONOMIC STATUS, CULTURE AND ETHNICITY IN ACADEMIC SOCIALIZATION

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Theorists and researchers are progressively drawing more attention to parents' role in the academic socialization of children and adolescents in order to facilitate and enable their educational development and academic success. The present study aims to offer comparative and complex perspectives for identifying and addressing the roles of socioeconomic status (SES), culture and ethnicity in versatile academic socialization processes from preschool to university education. The author of the study addresses the impact of socioeconomic status, culture and ethnicity on academic socialization by trying to present an overall view and further aspects of research.

Parents may use academic socialization as a way of facilitating and enabling the educational development and academic success of children and youths. Academic socialization processes involve parents' educational beliefs, expectations and behaviors in order to manage and influence the educational development and academic success of children and adolescents (Pomerantz, Ng, Cheung, & Qu, 2014; Puccioni, 2015). Academic socialization may also play a crucial role in the development of children's academic beliefs, attitudes and abilities from early childhood to adolescence (Hoover-Dempsey, Walker, Sandler, Whetsel, Green, Wilkins, & Closson, 2005; Sonnenschein, Galindo, Metzger, Thompson, Huang, & Lewis, 2012). Nevertheless, a large number of studies indicate that the patterns and impacts of academic socialization can differ and vary according to the socioeconomic status, cultural and ethnic backgrounds of families (García Coll & Marks, 2009; Pomerantz et al., 2014; Yamamoto & Holloway, 2010). Culture and socioeconomic status may serve or interact to influence parents' beliefs, involvement and engagement as well as academic socialization practices that can help and contribute to the educational development and academic success of children and adolescents (Serpell, Baker, & Sonnenschein, 2005). It is crucial to acquire a deeper understanding of the relationships, interactions and intersections among socioeconomic status, culture and ethnicity, and to comprehend how much they moderate or mediate academic socialization processes throughout the educational development and success of children and adolescents.

Studies involving various socioeconomic status and ethnic groups demonstrate the impact of SES, culture and ethnicity on academic socialization, development and achievement. The current research aims to introduce comparative and complex perspectives on the role of socioeconomic status, culture and ethnicity in versatile academic socialization processes. The author discusses how parents' academic socialization can impact academic beliefs, engagement, and school outcomes of children and adolescents.

## **Impact of Culturally and Socioeconomically Diverse Families on Children's Academic Development and Achievement through Academic Socialization**

Research asserts that low SES families with ethnic minority status struggle or fail to provide adequate or effective support for the educational development and academic success of their children (Brooks-Gunn & Markman, 2005). SES has been considered as one of the strongest factors affecting and designating parenting styles and academic socialization in the family (Bornstein & Bradley, 2012). In order to promote, nurture and enhance education and academic achievement of children, the socio-economic status of the family plays an important role in spending money and time, investing in their children and providing them with educational opportunities and supporting their academic development (Engle & Black, 2008; Yeung, Linver & Brooks-Gunn, 2002). Studies focusing solely on socio-economic status to explore academic socialization in ethnic minority families might criticize and blame children and families from low-socio-economic status for plenty of difficulties and risks they meet stemming from living in a low-socio-economic status. It is asserted that such an approach and attitude might conceal the strengths and risks experienced by low SES or ethnic minority families (Yamamoto & Sonnenschein, 2016).

Research indicates not only the disadvantages and risks of living under poor conditions but also the conditions, strengths and resilience shared by poor, ethnic minority and immigrant families, such as utilizing creative strategies to manage and improve children's education and academic achievement (Cooper & Smalls, 2010; García Coll & Marks, 2009). Poor and ethnic minority families often provide rare and unique singular academic socialization experiences through cultural beliefs and resources to promote, nurture and enhance their children's educational development and achievement. It is deemed crucial for poor and ethnic minority parents to socialize their children and adolescents academically in terms of culture and to conduct their education and academic lives as they meet challenges owing to their low SES and minority status (García Coll, Lamberty, Jenkins, McAdoo, Crnic, Wasik, & Garcia, 1996). Socio-economic status, culture and ethnicity play a crucial role in the academic socialization of children and adolescents as well their educational, academic lives and trajectories. Owing to the fact that socio-economic status and ethnicity are often intertwined, it can often be hard to reveal the impacts of each element while examining academic socialization. The present study strives to present diverse and complex ways in which socio-economic status, culture, and ethnicity are associated with examples, patterns, types, and functions of academic socialization during families from diverse origins.

Studies on racial/ethnic groups have shown that children from Black and Latino families generally exhibit lower academic performance and school achievement, and higher dropout rates compared to children from White families (Cheadle, 2008; Kena, Musu-Gillette, Robinson, Wang, Rathbun, Zhang, & Dunlop Velez, 2015). Children from Black and Latino families may experience more academic difficulties compared to children from White families, most probably owing to their low socio-economic status and poor living conditions (Jiang, Ekono, & Skinner, 2015). Research focuses on different socio-economic status contexts, such as families living in poverty, mothers with or without high school education, and parents with different levels of education, to explain and illuminate the multiple ways that support the education of children in Black and Latino families, and their educational and academic processes, with respect to and beyond socio-economic status. Researchers have revealed the different types of academic socialization that Black and Latino parents provide to their children in contexts of varying socio-economic status and at different developmental stages, and their links to educational beliefs, academic engagement, and school consequences of children and adolescents

A study conducted on a Chinese immigrant group revealed that students from Chinese immigrant families generally displayed higher school performance and academic achievement compared to other racial/ethnic groups, and exposed a link between low poverty rate and their overall high academic success (Jiang et al., 2015). Yamamoto, Li, and Liu (2016) explored the relationships between children's academic socialization and school performance in low SES and middle SES Chinese immigrant families. They examined academic socialization in the education of kindergarten children in Chinese immigrant families, such as the functionality and efficiency of the family, as well as parents' sense of responsibility, engagement and involvement. The researchers investigated the academic socialization of Chinese immigrants from low and middle socio-economic status in an effort to designate whether poverty carries disadvantages and risks and whether it leads to reduced academic engagement in Chinese immigrant families. They established how academic socialization mediates the association between socioeconomic status and educational success of children by examining academic socialization and the school performance of kindergarten children from Chinese immigrant families in low socio-economic status and middle socio-economic status.

The research discovered that lower SES parents lived in less stressful family environments and demonstrated stronger beliefs about parental responsibility for education. Chinese cultural values and beliefs as well as family cohesion have generally been able to buffer the negative impacts connected with low socioeconomic status on the ability and capacity of

Chinese immigrant parents to create and maintain a positive family environment. Chinese immigrant parents in low socioeconomic status notified more positive family functionality and efficiency, less conflict, and more cohesion compared to parents in middle socioeconomic status. The concept of educational guidance has been deemed to be particularly important for lower SES Chinese immigrant parents, who have to cope with and overcome difficulties on a daily basis, and who constantly and often remind that they do not wish the same poor and difficult life for their children. Therefore, Chinese immigrant parents from low socioeconomic status have placed a strong emphasis on close relationships that create and maintain a positive family environment despite financial difficulties and poverty-related stresses and tensions they face (Li, Holloway, Bempechat, & Loh, 2008; Raikes & Thompson, 2005). Middle socio-economic status in parents were more likely to engage in reading and reading enrichment activities. Engagement in reading coupled with socio-economic status was found to be significantly associated with academic performance of children. While these findings show low SES parents' strengths, they point to the need to ensure more aid and support for families in low socioeconomic status (Yamamoto et al., 2016).

The researchers explored the relationships, interactions and intersections between socio-economic status and culture by comparing two international environments, namely Japan and South Korea. (Holloway, Campbell, Nagase, Kim, Suzuki, Wang, Iwatate, & Baak, 2016). Owing to the fact that children in East Asian countries have consistently scored high on international academic tests, the research has asserted that cultural beliefs and practices that exist and are rooted in East Asia such as Confucianism are used as a basis for building strong family support to promote, nurture and enhance children's education and academic achievement. These families have tried hard and worked intensely to promote, nurture and enhance their children's educational and academic success by means of their cultural beliefs and practices (Li, 2012). Nevertheless, recent research has emphasized the need to look at the SES variable beyond cultural beliefs or practices in these countries, and the persistent or growing academic inequalities, disparities and gaps between students from lower SES families and their peers from higher SES families (Byun & Kim, 2010; Yamamoto & Brinton, 2010). Holloway and colleagues (2016) explored the roles of socio-economic status on academic socialization and school-related capacity of children in Japanese and South Korean families. Their findings demonstrate that cultural differences are often dependent on a country's economic conditions and education system.

The research has claimed that socio-economic status, culture, and ethnicity can uniquely contribute to academic socialization and education-

al processes. Research has also demonstrated various strengths related to culture and ethnicity, as well as efforts exerted by low SES parents for academic socialization of their children. However, the research revealed that academic inequalities, disparities, and gaps between students from lower SES families and their peers from higher SES families are linked to disadvantages arising from poverty, restricted economic resources, and limited educational experiences of parents. Researchers have illustrated with examples that education-related positive beliefs exist and are shared in families in different ethnic groups. Black and Latino parents in low socioeconomic status valued and attached importance to education of their children and were more involved and engaged in learning of their children (Rivas-Drake & Marchand, 2016; Suizzo, Pahlke, Hilliard, & Harvey, 2016; Sonnenschein et al., 2012). In spite of poverty, Black, Latino families (Sonnenschein et al., 2012) and Chinese immigrants (Yamamoto, Li & Liu, 2016) were involved and engaged in various school-associated activities with their preschool children. Culturally rare and unique socialization processes, without regard to socio-economic status, could foster children's educational processes and academic achievement. In a meta-analysis they conducted, Hill and Tyson (2009) demonstrated that academic socialization, accomplished through parent-child conversations and discussions on educational and academic issues, contributes significantly to students' academic success. In her meta-synthesis, Wilder (2014) highlighted that the educational expectations of parents from their children and adolescents laid the foundation of academic socialization and that these parental expectations were closely related to students' academic success. McNeal Jr, (2014) alleged that parents talked about and discussed school-related issues with their children to facilitate their academic socialization and conveyed the significance and value of education to them, thus enhancing and improving students' attitudes and expectations. By holding conversations and discussions on school events, parents tried to convey the message, "school is important to me and I want school to be important to you too." Academic socialization, which occurred in the form of parent-child conversations and discussions about school issues and school events, could lead to enhanced and improved academic success of students by influencing their attitudes and behaviors. Academic socialization efforts exerted by parents, such as holding conversations and discussions with children and adolescents on educational issues, school events and educational plans, enhanced learning at home and at school, and also contributed to academic success (Fernández-Alonso, Suárez-Alvarez, & Muñoz, 2016; Sebastian, Moon, & Cunningham, 2017; Trautwein & Lüdtke, 2009). Parents have placed particular emphasis on the meaning and value of education that leads their children and adolescents to understand the value of their time at school in order to help their academic socialization (Hill & Taylor, 2004). Academic

socialization has motivated and stimulated the educational and academic engagement of children and adolescents at school and intensified their efforts to attain higher academic achievement. Parental involvement via academic socialization could enable students to implement effective strategies to cope with and overcome the challenges and difficulties experienced at school (Pomerantz, Ng, & Wang, 2006).

Psychological stress and strains on parents, including long working hours, low and restricted income, and struggles with economic hardships, lower SES parents using common approaches, attitudes, and behaviors to enhance and promote higher academic achievement motivation and school performance in adolescents could reduce or prevent their skills and efforts to get involved and engaged with their children. More importantly, however, when lower SES parents applied home-based parental involvement strategies, their adolescents were more deeply engaged in school lessons and academic content compared to their peers from higher SES families. This was most probably stemming from the fact that parents from lower socioeconomic status tended to live in more disadvantaged and high-risk environments. When parents from lower socioeconomic status provided a structured and enriched environment at home, they could protect their children against negative environmental distractions, and also impress them and provide a level of self-discipline and orientation towards learning (Gutman, Sameroff, & Eccles, 2002). Academic socialization was more strongly linked to lower SES students' emotional engagement with lessons and academic content compared to their higher SES peers. Adolescents who grew up in disadvantaged communities were less likely to be exposed to information about university or to positive educational role models. It was especially important for parents to have more knowledge of university or to act as positive role models in education to convey the value of education to adolescents as well as holding conversations and discussions with children on plans for achieving future goals. Such parent-child conversations and discussions could help adolescents to appreciate and understand significance of the time spent at school and facilitate development of more positive attitudes and behaviors towards education; hence, resulting in higher and improved academic success in the future. So as to socialize them academically, parents conveyed their expectations related to schoolwork and the importance of education to their children and adolescents; moreover, they encouraged educational and career goals, and tried to make plans and preparations that would support future goals. Such academic socialization efforts have been able to enhance the academic success of students. Parents conveyed the significance and value of education, and also held conversations and discussions with their children on plans for the future, in order to encourage and motivate their children to get behavior-

ally and emotionally engaged with academic work. Behavioral and emotional engagement with lessons and academic content at school was able to lead to increased academic achievement. Providing appropriate structure as well as intellectual stimulation and support for adolescents in the home was positively correlated with students' academic success through behavioral engagement (Wang & Sheikh-Khalil, 2014). Academic socialization had a positive impact on the educational achievement of adolescents and offered opportunities to develop their personal identities and to believe and trust in their competencies to succeed. Academic socialization provided appropriate strategies for not only the high school structure but also the developmental needs of adolescents. Providing emotional and psychological support to adolescents at home as well as intellectual and cognitive stimulation and motivation to learn could behaviorally and emotionally engage them in lessons and academic content at school (Wang & Eccles, 2012).

By holding conversations and discussions with their children and adolescents on future educational plans, parents could set an example for a coping mechanism that takes control of the situation by using techniques and strategies that can create positive changes in their mental health and academic success (Grolnick & Slowiaczek, 1994). Academic socialization could increase adolescents' academic self-efficacy and competence and reduce any sense of learned helplessness by providing strategies implemented to actively cope with and overcome hardships and challenges (Baird, Scott, Dearing, & Hamill, 2009). Sebastian et al. (2017) discovered that academic socialization via conversations and discussions between parents and their children about school schedules, school activities, school learning and junior high school educational planning for the 8<sup>th</sup> graders, contributes to higher levels of academic success in the 10<sup>th</sup> grade. Higher 10<sup>th</sup> grade achievement positively predicted parent-child conversations and discussions when students were in the 12<sup>th</sup> grade, respectively. Cultural beliefs and practices in families were especially strong for some ethnic groups and could minimize the disadvantages and risks stemming from low socio-economic status (Crosnoe & Fulgni, 2012; García Coll & Marks, 2009). Cultural values and beliefs, such as familism as well as beliefs about shared obligations and support, observed in Latino families regardless of socio-economic status, could encourage and enable adolescents to be emotionally involved and engaged with learning at school (Rivas-Drake & Marchand, 2016). In a study they conducted on Chinese immigrant families, Yamamoto, Li, and Liu (2016) discovered that cultural beliefs and practices were more strongly preserved and less exposed to the influence of mainstream cultural principles and norms in low SES families compared to middle SES families. Parents from low socio-economic status displayed a stronger sense of devotion towards education and academic



success of their children and more harmonious family environments compared to middle socio-economic status parents.

Academic socialization degree or type of socio-economic status was linked to academic involvements, engagements and school outcomes of children and adolescents. Sonnenschein and colleagues (2012) investigated the relationships between parents' beliefs about development of their children and children's notified math activities at home. They conducted research interviews with parents about the frequency of their participation in math activities of their children, the importance of doing math activities at home, how children learn math, the role of parents in math learning of their children, and own math skills of parents. The sample included African Americans, Chinese, Latino, and Caucasian parents, but the majority were Chinese or Caucasian. The research revealed that parents' beliefs about math development and the role these beliefs play in promoting, nurturing, and enhancing math development were significantly associated with math activities of children. In this connection, children's participation in math activities at home has varied considerably and remained relatively limited. Chinese and Caucasian parents displayed much the same beliefs related to how children develop mathematics. Although math activities of children at home were associated with their math skills, a considerable part of the children had limited involvement in mathematics at home. Although their parents attached great importance to and strongly valued these activities, kindergarten children from low-income or low SES Black and Latino families had very limited engagement in mathematics and literacy activities. Parents' beliefs about math development of their children and the role of these beliefs in promoting, nurturing, and enhancing math development were significantly associated with math activities.

In a study they conducted on low-income Chinese immigrant parents, Yamamoto, Li, and Liu (2016) discovered that despite strong motivation, responsibility and obligation to promote and support education of their children, their engagement was not necessarily reflected in literacy or enrichment activities. Surprisingly, lower SES parents notified a stronger sense of responsibility in disciplining and engaging their children compared to middle SES parents. Reflecting the sacrifice and dedication of the parents, the Chinese education thought could guide immigrant parents, especially those of low socioeconomic status, to promote, nurture and enhance cognitive and academic development of their children even when coping with disadvantages, risk-related factors and financial hardships. A previously-conducted study revealed that Chinese immigrant parents of middle socioeconomic status demonstrated stronger views and beliefs in educating young children compared to Caucasian parents (Chao, 1994). Yamamoto, Li, and Liu (2016) emphasized that low SES parents in Chinese immigrant

communities maintained and preserved a strong sense of responsibility compared to middle SES parents. As they preserved and maintained traditional cultural values, beliefs and practices, low SES parents residing in ethnic neighborhoods such as Chinatown were able to highlight traditional cultural values compared to parents in middle socio-economic status, who had a greater tendency to be exposed to mainstream cultural beliefs (Zhou, 2008). Having limited economic resources and financial hardships, Chinese immigrant parents in low socioeconomic status highly relied on their role to promote, nurture and enhance cognitive and academic development of their children, as middle SES parents could not trust educational institutions for such responsibility. (Yamamoto, 2015). Still, as expected, parents from middle socioeconomic status were more able to read and ensure more extracurricular lessons to their children than lower SES parents. Middle SES parents felt more comfortable and capable of reading to their children than low SES parents thanks to their proximity to and greater familiarity with literacy activities, as well as comprehending and appreciating their importance (Yamamoto, Holloway & Suzuki, 2006). Socioeconomic status could play a significant role in domains such as literacy, which called for more academic skills and human capital than fundamental cognitive activities such as teaching children letters and numbers. The type of academic support for children, such as offering opportunities to provide special extracurricular lessons that demanded more financial resources, was more common among middle SES families than lower SES families generally living in poverty (Li et al., 2008; Yamamoto, 2015).

Although low socioeconomic status is generally linked to disadvantaged and negative family environments and diminished parental engagement in education, Chinese cultural values, beliefs and practices can buffer the disadvantages, adversities, and risks associated with low socioeconomic status during the process of parents' providing guidance and support for education of their children. Nevertheless, the influence of socioeconomic status was stronger and more evident in areas that required parenting behaviors and actions beyond cultural values and beliefs (Lareau, 2003). In order to engage their children in literacy and other enrichment activities, parents need economic capital and human capital in terms of knowledge and skills, regardless of the fact that their children are young. Parents' involving and engaging their children with reading could explain the differences in academic performance and school success of children, even after socioeconomic status as well as children's preferred language was controlled independently. In this connection, the differences in socioeconomic status and gaps in reading involvement and engagement have clearly been noted. Four-year-olds from middle SES families performed considerably higher in mathematics and literacy compared to lower SES

children. Daily reading activities enhanced children's literacy skills and also stimulated and boosted their involvement and engagement in literacy and learning activities, thus bringing an additional advantage to middle SES children. Enrichment activities and extracurricular lessons have been linked to children's academic performance (Hill & Tyson, 2009; Lareau, 2003). Extracurricular lessons and activities such as music, art and dance were less directly associated with math and literacy skills, especially for four-year-olds. It has been emphasized that the potential effects of such concerted socialization efforts by parents might become more evident in later years of development (Lareau, 2003).

Socioeconomic status could explain the large change in academic performance of children even after the parents' educational involvement and engagement variables were entered into the model. Research has generally indicated significant and positive relationships between socio-economic status and academic socialization strategies of parents across different ethnic groups. In this respect, it was observed that there was a connection between the general parental support as well as educational and academic expectations and the academic success of their children. The educational expectation that parents have for their children has played an important role in their children's academic progress. Parental educational expectations have played a significant role in the successful progress of their children in education. The educational and academic expectations that parents hold for their children have motivated children and enabled them to boost their efforts to get higher grades, achieve higher scores on standardized tests, and successfully complete their education (Yamamoto, & Holloway, 2010). Socio-economic status was closely linked to higher educational expectations among Latino parents (Rivas-Drake & Marchand, 2016), more parental engagement in literacy and extracurricular lessons among Chinese immigrant families (Yamamoto Li & Liu, 2016), more active involvement and willingness to work hard, particularly by African American parents (Suizzo et al., 2016), and higher parenting efficacy in socializing, educating and raising children and greater maternal involvement in South Korean children's education (Holloway et al., 2016). As academic socialization resulted in positive academic beliefs, academic engagement, academic consequences in children and adolescents and socio-economic status played a direct and indirect role in the academic lives and academic trajectories of children and adolescents through academic socialization.

Going beyond socio-economic status, studies discovered ethnic and cultural differences in academic socialization processes (Sonnenschein et al., 2012; Suizzo et al., 2016). When socio-economic status was controlled, children from Black families were more frequently engaged in school-based activities than their peers from Latino families; and Black parents

were more actively involved and engaged in education of their children than their Latino counterparts. Suizzo and colleagues (2016) referred to stronger associations for African Americans than Mexican Americans in their study and reported that ethnicity moderated the association between parental demands for hard work and academic self-efficacy of university students. However, the relationship between the parental support for autonomy and students' university readiness and adjustment was stronger for Mexican Americans compared to their African American counterparts. Holloway and colleagues (2016) also measured and defined academic socialization as parenting self-efficacy, as well as parental involvement in socializing, educating and raising children. They underlined country and ethnic differences in their findings. Academic socialization mediated the relationship between family income and school-associated skills of children in South Korea, but not Japan.

### **Overview of the Role of Socioeconomic Status, Culture and Ethnicity in Academic Socialization**

Research has shown that parents built, offered and provided academic socialization experiences to their children from preschool to university. Relevant articles revealed that Yamamoto, Li and Liu (2016) and Sonnenschein et al. (2012) investigated preschool children and Holloway et al. (2016) examined first and second grade students; whereas, Rivas-Drake and Marchand (2016) focused on adolescent students, and Suizzo et al. (2016) on university students. When children are young, parents have strived to provide a family environment that educates, socializes, and rears children, and cognitive and academic types of activities that can assist and contribute to cognitive development as an introduction to academic socialization. Yamamoto, Li and Liu (2016) compared Chinese immigrant family environments in low and middle socio-economic status and parental engagement in not only basic cognitive and literacy activities of children but also in their enrichment, and extracurricular program activities. Although many studies have notified cultural beliefs and practices that could facilitate academic socialization processes of Chinese children (Lee & Zhou, 2015; Li, 2012), Yamamoto and colleagues (2016) have informed that little attention has been attached to socio-economic status-related differences, inequalities and gaps in Chinese immigrant families. The majority of families in low socio-economic status lived under poor conditions. In this connection, there are inequalities and gaps in academic performance and academic achievement observed between children from families in low socio-economic status and their peers from families in middle socio-economic status. These SES-related differences inequalities and gaps in academic performance and academic achievement were partially elucidated by different degrees of literacy experiences. Nonetheless, Yamamoto et

al.'s (2016) study implied that cultural advantages such as caring, supportive and frequent family relationships, and parental commitment to fostering, nurturing and supporting their children's educational, cognitive and intellectual development and academic achievement buffered disadvantages and negative impacts linked to low socio-economic status and poverty.

In a study conducted on low SES Black and Latino parents within the scope of government economic and social assistance and support programs, Sonnenschein et al. (2012) examined these parents' beliefs about math as well as reading education and socialization for their children and associated academic consequences. Their findings supported the assertion that cultural advantages might reduce the disadvantages, risks, and negative effects stemming from poverty and low socio-economic status. It was highlighted that domain-specific academic socialization processes should also be examined. Although most Black and Latino parents in this study strongly valued their children's involvement and engagement in reading and math activities, they underlined the importance of engagement in reading more than math. Besides, ethnic differences in educational beliefs for Blacks than Latinos varied contingent upon the subject domains. When parents acted as role models of academic engagement, children became more involved and engaged in reading and math activities, which significantly improved and enhanced their vocabulary and early math skills. Parents' engagement and enjoyment in their own reading and math activities positively and significantly affected development of academic engagement in their children.

Along with academic socialization, ethnic minority families could use messages pertaining to cultural and ethnic heritage as core socialization strategies to improve educational life and educational trajectories, particularly in adolescence. In their research, Rivas-Drake and Marchand (2016) explored deeply the impacts and roles of cultural processes, such as messages pertaining to cultural heritage transmitted by parents or family members, and familism, which prioritizes respect and obligations for families, on the academic beliefs and academic engagements of adolescents. The study accepted mothers' completion of high school education as a measure and indicator of socio-economic status, and revealed that socio-economic status had an indirect role in adolescents' beliefs about the usefulness of education through their perceptions of parents' educational expectations. Nevertheless, cultural socialization and adolescents' value of familism that were unrelated to socio-economic status played a significant role in their academic involvement and engagement. The same study has asserted that although the socio-economic status of the parents plays a significant role in parental educational expectations, the contributions of cultural beliefs and socialization in the family to children and adolescents appear to be robust

and solid as regards the impacts of socio-economic status (Yamamoto, Li & Liu, 2016).

In a study conducted on African-American and Mexican-American university students, Suizzo et al. (2016) investigated the direct impacts of parents' academic socialization both on students' academic beliefs and behaviors and on their readiness, adaptation, and adjustment to university. In the study, which focuses on students who attended university, nearly two-thirds of the participants' mothers had completed their university education. The proportion of African American and Mexican American mothers who completed university education appeared to be much lower. Nonetheless, university entry did not guarantee educational and academic success, or resulted in lower educational and academic achievement as African American and Mexican American students were prone to higher dropout rates. The research explored that three types of academic socialization on the basis of secondary students' perceptions of parental involvement from various ethnic groups: parents' demanding for hard work, being actively involved and engaged in education of their children and ensuring emotional autonomy support. When socio-economic status was controlled, parents' providing emotional support to their children and adolescents to promote, nurture, and enhance autonomous personality development was seen as the most frequently notified type of academic socialization by African-American and Mexican-American students; while university readiness, adaptation and adjustment emerged as the most important factor. When parental education was controlled, the association between parental support for autonomy and students' university readiness, adaptation, and adjustment was regulated by ethnicity. The relationship between parental support for autonomy and university preparation, readiness, adaptation and adjustment was stronger for Mexican American students compared to their African American peers. Regardless of parents' education levels, Mexican American students derived more benefits from autonomy-supportive parenting practices compared to African American students. The more Mexican American parents supported their children's autonomy, the higher levels of academic preparation, readiness, adaptation and adjustment the students reported.

Living away from family and adjusting to university environment has been tough and stressful especially for students who are ethnic minorities with intimate family ties and have become accustomed to family members who believe, assist and support them. Although Mexican American and African American cultural values, beliefs, and models attach great emphasis to family, African American parents, who are relatively more aware and conscious of the future discrimination their children will experience as adults (Else-Quest & Morse, 2015), stressed the importance of being an actor or agency as well as self-confidence more than Mexican Ameri-

can parents (Ng, Tamis-LeMonda, Godfrey, Hunter, & Yoshikawa, 2012). Hence, African Americans' university preparation, readiness, adjustment and adaptation were less strongly associated, compared to when they started university, thanks to their parental autonomy support, which was previously integrated with their parent's messages of autonomy support. Mexican Americans could be protected at university and when they themselves needed to make decisions and take actions to enhance autonomy as their parents' cultural models emphasized less autonomy. African American parents practiced racial socialization more than their Latino peers to prepare their children to cope with and overcome racism and to nurture and enhance their cultural pride and pretension (Hughes, 2003). Compared to African American children, Mexican American children were less engaged in conversations and discussions about their rare and unique cultural heritage and background as well as chances of discrimination (French, Coleman, & DiLorenzo, 2013).

Researchers explored the impact of parents' active interest, autonomy support, and demands for hard work, as three dimensions of academic socialization, and their impact on college readiness, adaptation and adjustment. When parental education was controlled, African American students reported higher active involvement by their parents. Again, when parental education was controlled, both parents' demanding hard work from their children and providing support for autonomy affected students' preparation, readiness, adaptation, and adjustment for university, and students' academic self-efficacy mediated these influences. Both parents' demands for working hard and their support for autonomy affected children's academic self-efficacy. The impacts of both parents' demands for working hard and their support for autonomy on children's academic self-efficacy were stronger for African American students compared to Mexican American students. Students' academic self-efficacy and competence mediated the relationships between parents' academic socialization and students' university readiness, adaptation and adjustment. Students' higher academic self-efficacy predicted better academic preparation, readiness, adaptation and adaptability. Parents who demanded hard work from their children throughout middle school and high school demonstrated higher self-efficacy in university. When parental education was controlled separately, these relationships were found to be stronger for African American students. Even when parental education was controlled, it was seen that the impact of parents' academic socialization on the academic beliefs and behaviors of university students varied in magnitude according to ethnic groups. These findings provided additional support to the importance of parents as sources of children's and adolescents' self-efficacy and competence through the social persuasion mechanism described by Bandura (1997). When parents

conveyed high expectations for the academic success of their children and adolescents by observing and monitoring their school work and school performance, they told their children that they had the capacity and powers to achieve these high expectations. Regardless of ethnicity or race, by parental encouragement for their children and adolescents to work hard, it has been seen as important for academic socialization to stimulate and persuade children firstly, that hard work and success can be achieved, and secondly, that hard work is useful and paves the way for success. That being the case, when parents demand and expect their children to work hard, rather than limiting their role and agency, they can correspondingly convince them of trusting and having faith in their power, and also promote, encourage, nurture and support their self-efficacy and competence.

In a study focusing on the role of socio-economic status and culture in the efficacy and competence of parents to improve and enhance academic socialization, Holloway et al. (2016) presented data gathered in Japan and South Korea and brought a general perspective. Researchers have found that different effects of family income and parental education as two separate indicators of socio-economic status on mothers' self-efficacy and competence to socialize, educate, and raise children, on their involvement in education of their children and on the school-related ability of 1<sup>st</sup> and 2<sup>nd</sup> grade students. While it seems that shadow support training, such as private tutoring and private educational institutions, exists and is more widespread in South Korea, it has been discovered that family income is important in determining the sense of efficacy and competence of mothers who can help and contribute to the development of children's school ability to socialize, educate and raise them. Alternatively, family income did not seem to play an important for socializing, educating, and raising children in Japan; instead, maternal education was found to mediate and regulate the relationship between mothers' sense of efficacy and competence to socialize, educate, and raise children, and students' school-related competence. These findings implied that more research is needed to investigate the relationships and interactions between socio-economic status, culture, and academic socialization in the broader educational and economic contexts of societies.

## Conclusions

Despite a number of detailed constructive discussions about definitions and measures of socio-economic status in the field of educational sociology (Bornstein & Bradley, 2012), further research focusing on these matters is required as there are very few studies examining the impact and role of socio-economic status on academic socialization and developmental processes of children with regard to culture and ethnicity. On many occasions, socio-economic status is used as background information or a



control variable. Socio-economic status can influence academic socialization and educational processes, particularly through its relationships and interactions with culture and ethnicity, and can play mediating and moderating roles in socialization and education processes.

This research aims to introduce various ways used and implemented by ethnically and culturally diverse parents in order to encourage, nurture, facilitate and enable their children's educational and academic development and success, and how these ways and processes relate to SES, culture, and ethnicity. In order to examine the impact and role of socio-economic status, culture and ethnicity on academic socialization, longitudinal studies are deemed significant, together with cross-sectional studies that deal with children from different developmental periods in their sample. More longitudinal studies are needed to uncover and explain the dynamic aspect of academic socialization with respect to socio-economic status, culture, and ethnicity, and its sustained impact on the socialization, education, and rearing of children and adolescents. Longitudinal studies are deemed important for understanding and explaining how academic socialization has changed over time within and across various socio-economic status and cultural and ethnic groups. In this connection, longitudinal studies will also help us understand whether there are critical periods during which socio-economic status or culture has a greater impact on academic socialization and whether it plays a more powerful role in academic success of children via its effects on academic socialization.

The research findings discussed and examined in the present study have revealed that family income and parental education play a role in accessing information and resources for effective academic socialization as the two main SES indicators. Socio-economic status, culture and ethnicity could significantly affect academic socialization in the direction and on basis of their associations and interactions with one another. The findings across the study have indicated that more attention should be paid to socio-economic status, countries and communities that facilitate and enable parents' access to knowledge and resources for effective and efficient academic socialization of their children and adolescents. Exploring SES contexts, culture and communities is important to discover the disadvantages and risks experienced by parents as well as their children and adolescents living in poverty, lower socio-economic status, and certain ethnic/racial communities. Politicians, the Government and the Ministry of Education need to undertake necessary economic, social, political and educational measures in order that parents living in poverty, low socio-economic status and certain ethnic/racial communities can achieve effective academic socialization for their children and protect them from the negative and harmful effects of disadvantaged conditions.

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## CHAPTER 5

### **A META-ANALYTIC REVIEW OF THE EFFECT OF ARGUMENTATION-BASED INSTRUCTION ON ATTITUDE AND HIGHER-ORDER THINKING SKILLS<sup>1</sup>**

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1 This study was prepared based on the doctoral thesis titled “The Effect of Argumentation-Based Instruction on Different Variables: A Mixed-Research Synthesis” written by Ayhan KOÇOĞLU (2022) under the supervision of Associate Professor Sedat Kanadlı.

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## Introduction

The rapid changes occurring in all areas of life are also evident in education systems, highlighting certain characteristics that future individual should possess. At the forefront of these characteristics are qualities such as researching, accessing knowledge, and even constructing first-hand knowledge, enabling individuals to adapt to the current age. When it comes to education, the suitability of educational programs is imperative to have individuals acquire the mentioned characteristics. Today, a constructivist understanding continues in education programs and the changes in the roles of individuals who can keep up with the times are underlined in these programs. The roles expected from students are also expressed in various education programs (primary, secondary, and high school mathematics and science courses). Students with these qualifications are expected to be able to produce information, use information functionally in life, solve problems, think critically, be entrepreneurial and determined, and have communication skills. Furthermore, the required instructional environments and processes for raising such individuals have been addressed. The creation of learning environments where students can freely express their opinions has been emphasized as contributing to their ability to disclose their thoughts and enhance their reasoning and communication skills (MoNE, 2018). Also, it is stated that environments, where students can freely express their ideas, support their thoughts with different justifications, and develop counterarguments to refute their friends' claims, should be established and that the learning process should involve discovering, inquiring, designing products, and developing arguments (MoNE, 2018, p.11). When closely examined, the changes in educational programs indicate references to all three types of constructivism, with particular emphasis on methods based on social constructivism, such as discussions and argumentation.

The concept of argumentation, first translated into Turkish as Learning Science by Doing and Writing (LSDW), was used as Argumentation-Based Science Learning (ABSL) in subsequent years (Günel, Kingir & Geban, 2012, p.318). In order to ensure the unity of expressions concerning the concept of argumentation in this study, all studies using the argumentation method, including Learning Science by Doing and Writing, Argumentation-Based Science Learning, and Scientific Discussion were addressed under the concept of Argumentation-Based Instruction (ABI). Considering the advantages of the argumentation method, supports higher-order thinking skills (Newton, Driver, & Osborne, 1999, p.64), increases student achievement (Kabataş-Memiş, 2011), and improves communication and critical thinking skills (Jiménez-Aleixandre & Erduran, 2007). However, one could argue that the most important limitations are taking a lot of time (Karakas, 2022) and insufficient knowledge of students and teachers about



the method (İspir & Yıldız, 2021, p.247).

Many educational programs developed in Turkey are generally grounded on following learning strategies based on research inquiry and knowledge transfer in an environment where students are responsible for their own learning and actively participate in the learning process (MoNE, 2018). In addition, it is mentioned that in these programs, teachers take on a role that encourages and guides the teaching-learning process, while students take on the role of an individual who investigates, questions, explains, and discusses the source of knowledge, transforming this knowledge into a product. For this purpose, the necessity of creating a democratic classroom atmosphere in learning environments where students can freely express and discuss their own opinions has been emphasized. This emphasis may refer to argumentation-based educational practices in classes. This is because ABI is a method in which students take active participation in the learning process, transform knowledge into outcomes through discussion-based interactions, and when doing this, they use higher-order thinking skills like critical thinking. Therefore, the effect of this method on student achievement, attitudes, and higher-order thinking skills has also been a matter of curiosity.

Generally, attitudes are individuals' inclination toward positive or negative evaluation of phenomena (İnceoğlu, 2011, p.11), representing invisible behaviours (Kağıtçıbaşı & Cemalcılar, 2014). For this reason, methods like argumentation play a critical role in turning attitudes into observable behaviours. From this perspective, one can say that ABI and student attitudes are associated with each other in that many studies have examined the effect of the ABI method on student attitudes in the literature (Öç, 2019; Yılmazçelik, 2020). Besides affecting students' attitudes, the ABI method is closely related to their higher-order thinking skills. As thinking is a key concept at the center of mental skills, it enables people to construct knowledge in the mind and develops higher-order skills, such as problem-solving, decision-making, creative thinking, and critical thinking (Cevger, 2018, p.4). Given that students frequently utilize their higher-order thinking skills such as critical thinking, creative thinking, and problem-solving in the ABI method, the method may affect their higher-order thinking skills. This is because the relationship between the method and higher-order thinking skills has been examined in various studies and emphasis has been made on how ABI affected higher-order thinking skills. However, no meta-analysis study examining higher-order thinking skills was found. However, argumentation is very important, as it is a student-centered method where students utilize higher-order thinking skills like critical thinking skills and have frequent interactions with each other (Koçak, 2014, p.4). Therefore, answers were sought to the following ques-

tions in the research.

- (1) What is the effect of ABI on student attitudes?
- (2) What is the effect of ABI on students' higher-order thinking skills?
- (3) Does the effect of ABI on attitude and higher-order thinking skills significantly differ by education level and course type?
- (4) Is the duration of the ABI intervention a significant predictor of effect sizes calculated for attitude and higher-order thinking skills?

### Method

This study aimed to examine the effect of ABI on student attitudes and higher-order thinking skills and determine the mean effect size, the effect level, its direction, and how the method affects various moderators. Therefore, of quantitative research methods, a meta-analysis method was employed in the study. Cooper (2010, p.12) outlines the steps of the meta-analysis method used to combine the results obtained from the primary studies, as in Figure 1.



**Figure 1** Steps of the Meta-Analysis Process

### Literature Search

Databases such as EBSCO, ERIC, Google Scholar, ProQuest, CoHE Thesis Centre, and Web of Science were used to search for the relevant literature in the study. For this purpose, the following keywords were scanned in databases: “argumentation”, “scientific discussion”, “argumentation-based instruction”, and “heuristic science writing”. Primarily, the studies retrieved were examined by title and abstract, and their suitability for the study was determined. In addition, other studies were also accessed with the snowballing method by examining the reference lists of the accessed studies. The authors of studies whose full texts could not be accessed were contacted via email. The literature search lasted from May

2018 up to December 2020. Further, the eligibility of the retrieved studies was examined considering the inclusion criteria determined within the scope of this study.

### ***Determining the Inclusion Criteria***

The inclusion criteria determined for the studies included in the meta-analysis are given in Table 1.

**Table 1.** *The Inclusion Criteria of Studies Included in the Meta-Analysis*

(1) Published between the years 1990 and 2020
(2) Published as an article or thesis in Turkey
(3) Use an experimental design (quasi-experimental or true experimental)
(4) Examine the effect of ABI practices employed in any lesson on student attitude and/or higher-order thinking skills
(5) The study group consists of students (primary, secondary, high school, and university).
(6) Report sample size ( $N$ ), mean ( $\bar{X}$ ), and standard deviation ( $SD$ ).
(7) Use parametric tests ( $t$ -test or $F$ statistic)

A summary of the literature search process is given in Figure 2, considering the inclusion criteria of the research presented in Table 1.

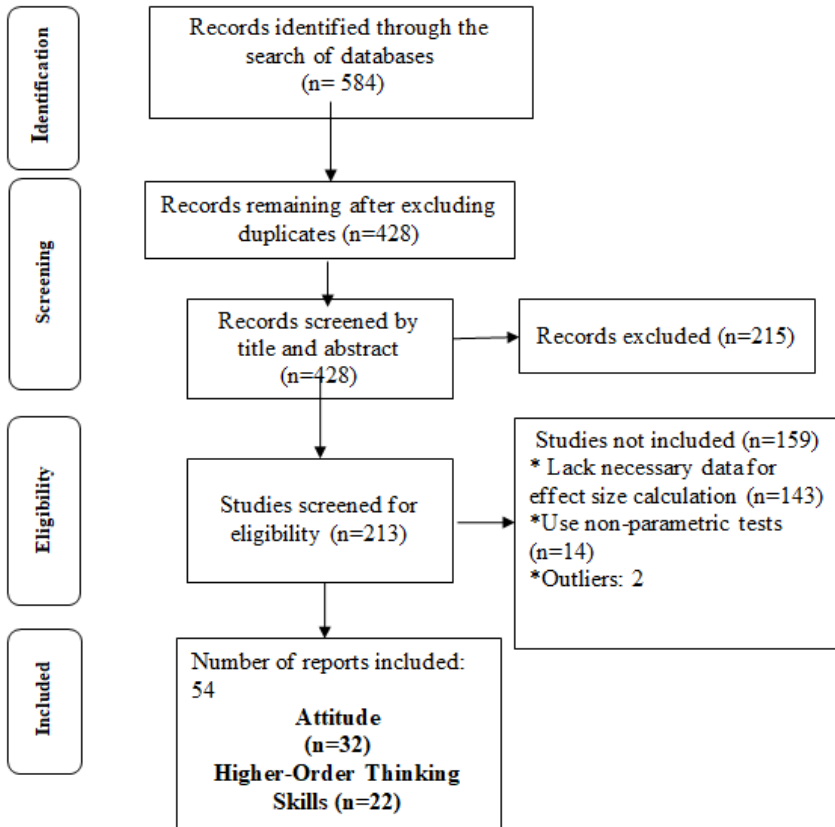
### ***Assessing the Quality of Studies***

The quality of studies included in this meta-analysis was examined through a quality assessment form developed by Pluye, Gagnon, Griffiths, and Johnson-Lafleur (2009). There are three quality assessment criteria in this form. These are *i*) reporting the implementation procedure and randomization in sampling (controlling the confounding variables), *ii*) Concealing the information of the group (blinding technique), and *iii*) Ensuring the validity and reliability of the data obtained and the absence of missing data. The quality assessment is performed by giving a score of 1 when the specified criteria are present and 0 when not present. In calculating the quality score, the following formula is used: (Number of criteria met / total number of criteria) X 100 (Pluye et al., 2009, p.540). In addition, experimental studies partially meeting the determined criteria are scored as 0.5 (Kanadlı, 2019, p.12). Studies with a quality score of 50 and above were included in the meta-analysis.

### ***Coding the Study Characteristics***

The characteristics of selected studies were coded by the researchers using a study characteristics form they prepared. In this form, the studies

were coded in different columns in terms of the researcher(s) name, publication year, research method, sample size, data collection tools, analysis methods, publication type, discipline area, education level, and education duration. To determine the coding validity, 20% of the studies (11 studies) were randomly selected and recoded by two different researchers. The coding reliability of the forms was calculated using the  $(\text{Number of codes agreed} / \text{Total number of codes}) \times 100$  formula (Card, 2012, p.76). According to this calculation, the coders coded 11 studies in the same way. Accordingly, the inter-coder reliability was 100%.



**Figure 2.** Flow Chart of Study Inclusion Process in the Meta-Analysis (Liberati et al., 2009)

### **Data Analysis Strategy**

Hedges’ g effect size index was used to calculate the effect of the ABI method on student attitudes and higher-order thinking skills. When there are studies with sample sizes smaller than 20, Hedges’ g should be used

as an effect size index (Cooper, 2010). Given that there were studies with sample sizes smaller than 20 in this study, Hedges'  $g$  index was preferred for calculating the effect sizes. In interpreting the effect index, Thalheimer and Cook's (2002) classification was used. According to this classification, the effect size values and their interpretation are presented in Table 2.

**Table 2.** *Thalheimer and Cook's Effect Size Classification*

Effect Size Value	Interpretation
-0.15–0.15	Negligible
0.15–0.40	Small
0.40–0.75	Moderate
0.75–1.00	Large

After deciding on the effect size index, it was determined which model to use for the mean effect size. *Fixed-Effect* and *Random-Effects* models can be used for calculating the mean effect size. Borenstein et al. (2009) suggest using a random-effects model when the studies are obtained from the relevant literature. Therefore, this model was preferred for combining the effect sizes in this study. Furthermore, a heterogeneity test was performed to determine the presence and the magnitude of heterogeneity in the study. The heterogeneity test examines whether the observed variance in effect sizes varies across the expected variance due to sampling error (Cooper, 2010, p.185). The  $I^2$  index was used for interpreting this test. The  $I^2$  index shows the percentage value of the proportion of the variance of a study included in the meta-analysis to the total variance. In this index, an  $I^2$  index is intercepted as a small heterogeneity ratio when it is 25%, moderate when 50%, and high when 75% (Card, 2012, p.189).

Categorical moderator analysis was performed to determine the source of the variance and if the mean effect size yielded by the meta-analysis was affected by study characteristics (Cooper, 2010). There were four discrete categorical moderators in this study, including the type of skill (critical thinking skill, problem-solving skill, creative thinking skill), study type (article, thesis), course type (Biology/Genetics, Science, Laboratory, Chemistry, Mathematics, Special Teaching Methods, Social Studies), and education level (primary school, secondary school, high school, university). In addition, another variable considered within the scope of the study was the experimental intervention duration. The intervention duration, which is a continuous moderator, was expressed as "class hour" in this study. Therefore, the effect of this moderator was determined through a meta-regression analysis. Ac-

cording to Kanadlı (2019, p.25), meta-regression determines whether an independent and continuous variable predicts the effect size variability. In this study, the significance level of the test was taken into consideration when interpreting the meta-regression analysis results.

Various methods were employed to evaluate the publication bias in the study. These tests included the Funnel Plot (Borenstein et al., 2009), Duval and Tweedie's Trim and Fill method (Duval and Tweedie, 2000), Egger's Intercept Test (Egger et al., 1997), and Rosenthal's Fail N Safe (Rosenthal, 1979).

## Findings

### Meta-Analysis Results Regarding Attitude

A total of 32 studies examining the effect of ABI on student attitudes were included in the meta-analysis. A forest plot including the effect sizes of studies included in the meta-analysis and other statistics related to these studies are given in Figure 3.

According to the forest plot in Figure 3, the study with the largest effect size ( $ES = 2.383$ ) was a thesis study by Tekeli (2009), whereas the study with the smallest effect size ( $ES = -0.487$ ) was a study by Yılmazçelik (2020). There were a total of 1993 participants in studies on attitude, where 1017 (51%) represented the experimental groups and 976 (49%) represented the control groups. Considering the observed effect sizes, 56.25% ( $n = 18$ ) were statistically significant ( $p < .05$ ) and 43.75% ( $n = 14$ ) were non-significant ( $p > .05$ ). The effect sizes ranged between  $-0.487$  and  $2.383$ , and most of them ( $n = 29$ , 90.6%) were positive. In addition, 34.38% ( $n = 11$ ) of the effect sizes were strong, 18.75% ( $n = 6$ ) moderate, 18.75% ( $n = 6$ ) small, and 28.13% ( $n = 9$ ) weak. According to Figure 3, the mean effect was  $0.740$ , 95% CI [ $0.524, 0.956$ ], which significantly differed from zero ( $z = 6.71, p < .01$ ). According to Thalheimer and Cook's (2002) classification, this mean effect is moderate. The result of the heterogeneity test conducted to determine the presence and magnitude of the heterogeneity among the effect sizes was significant ( $Q(31) = 179.08, p < .01$ ). In addition, the approximate critical value in the chi-square table of critical values with 31 degrees of freedom is  $43.773$  at a 0.05 significance level. Here, the  $Q$  value is higher than this value, indicating that the between-study variance not only stems from the sampling error but also from the characteristics of the studies. The  $I^2$  index was 83%, showing a high amount of between-study heterogeneity (Higgins et al., 2003). According to Figure 3, the true effect sizes fall between the 95% prediction interval of  $-0.423$  and  $1.903$ . Therefore, this data could be interpreted that true effect sizes in some studies included in the meta-analysis could be even negative or zero. If we accept the point of zero as a point of no effect, the ABI has a negative effect in

18% of studies included in the meta-analysis, while it has a positive effect in 82% of studies. Accordingly, the ABI method may not influence student attitudes in all populations.

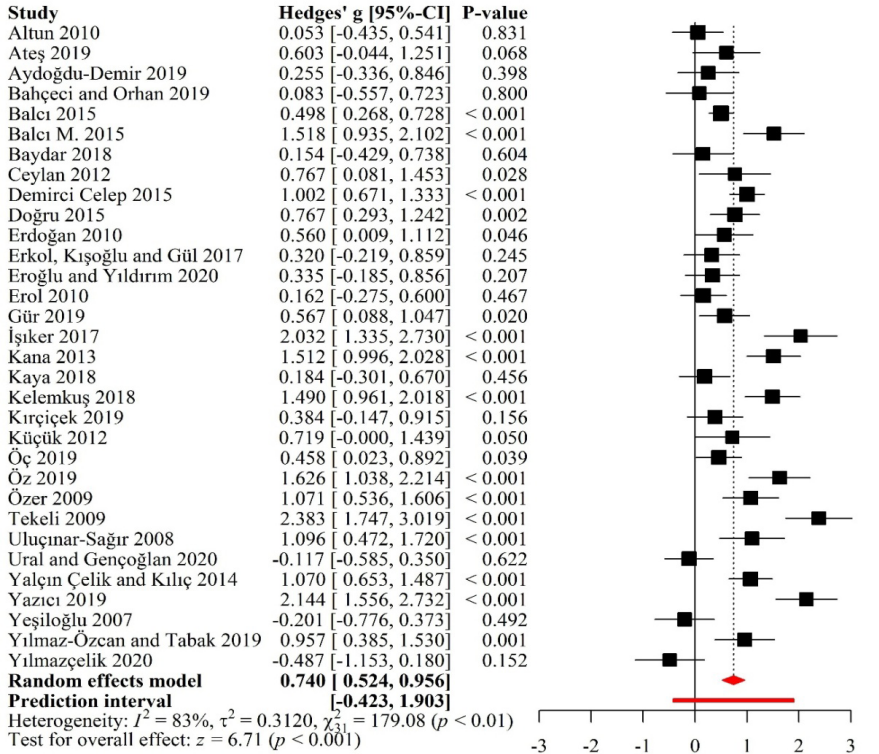


Figure 3 Forest Plot of Attitude

The presence of a high heterogeneity across the studies included in the meta-analysis on the effect of ABI on student attitude requires exploring the causes of this heterogeneity. Therefore, the between-study variance must be explained by analysing the characteristics coded in primary studies. In this study, studies included in the meta-analysis were coded based on four characteristics. Studies were examined in terms of categorical variables of education level (primary school, secondary school, high school, university), course type (Science/Science and Technology, Chemistry, Mathematics, Social Studies, Laboratory, Biology/Genetics, Special Teaching Methods), and publication type (thesis, article), and the continuous variable of intervention duration (course hour). Categorical moderator analyses were conducted for these variables and meta-regression analysis for the continuous variable. The results are given in Table 3.

**Table 3.** *Categorical Moderator Analysis Regarding the Effect of ABI on Student Attitudes*

Moderators	k	Effect Size	95%CI		Heterogeneity		
			Lower Limit	Upper Limit	$Q_i$	df	p
<b>Study Type</b>							
Thesis	26	0.809	0.560	1.057	2.15	1	.142
Article	6	0.450	0.040	0.859			
<b>Education Level</b>							
Primary School	6	1.183	0.739	1.626	5.93	3	.115
Secondary School	16	0.608	0.307	0.910			
High School	5	0.920	0.435	1.405			
University	5	0.456	-0.121	1.034			
<b>Course Type</b>							
Science	20	0.779	0.487	1.071	3.77	3	.287
Chemistry	4	0.764	0.252	1.275			
Laboratory	3	0.397	0.112	0.683			
Social Sciences	2	0.610	-0.078	1.298			

\* $p < .05$ , \*\* $p < .01$

According to Table 3, the study type, education level and course type were non-significant moderators and did not contribute to the heterogeneity ( $p > .05$ ). Considering the effect sizes of the sub categories, the ABI method strongly affected student attitudes towards Science ( $g = 0.779$ , 95% CI [0.487, 1.071]) than other courses. A meta-regression analysis was conducted to determine whether the experimental intervention duration (class hour) in studies included in the meta-analysis significantly predict the effect sizes. Six of these studies were not included in the analysis, as they did not report the duration of the experimental procedure. The analysis results are given in Table 4.

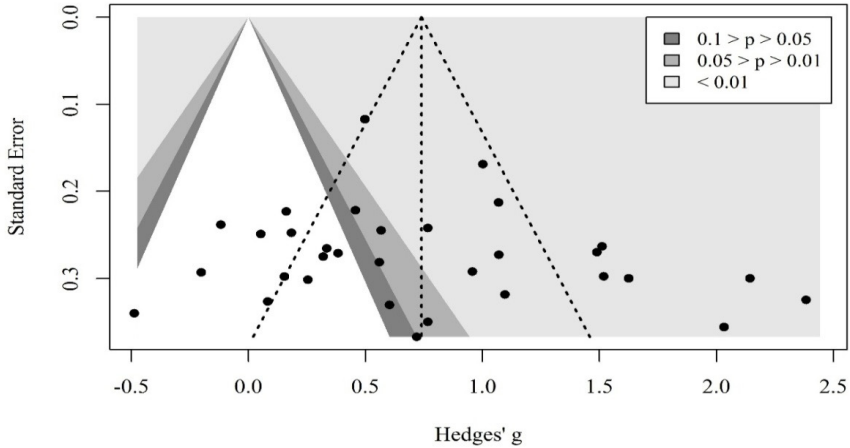
**Table 4.** *Moderator Analysis Regarding the Intervention Duration in the Effect of ABI on Student Attitudes*

Variable	k	Estimate	SE	95% CI	Q	df	p	$R^2$
Duration (Class Hour)	26	0.0047	0.0025	-0.0003-0.0097	3.400	1	.065	10.99%

According to the meta-regression analysis results, the intervention duration of the argumentation method was not a significant predictor of student attitudes ( $k = 26$ ,  $Q(1) = 3.400$ ,  $p > .05$ ). In order to determine the presence of publication bias, a categorical moderator analysis was conducted between published and unpublished studies. However, there was no significant difference between published (article) and unpublished (thesis) studies examining the effect of ABI on student attitudes ( $p > .05$ ). Non-significant difference found between these two effect sizes indicate that there is no publication bias in the meta-analysis. In addition, the funnel plot



presented in Figure 4 shows the distribution of the observed effect sizes around the mean.



**Figure 4** *Funnel Plot Relating to Attitude*

The asymmetry illustrated in the funnel plot given in Figure 4 indicates that there could be publication bias. However, since the interpretation of the funnel plot is very subjective (Borenstein et al., 2009), Egger’s intercept test was used to determine whether this asymmetry was significant. Test results are presented in Table 5.

**Table 5.** *Egger’s Test Relating to the Effect of ABI on Student Attitudes*

Variable	Intercept ( $B_0$ )	SE	Lower Limit	Upper Limit	t	df	p
Attitude	0.3159	1.5711	0.523	0.956	0.98	30	.3979

As seen in Table 5, the funnel plot asymmetry was not significant ( $B_0 = 0.3159, t = 0.98, p > .05$ ). In other words, there is no publication in studies on attitude included in the meta-analysis. In this case, Duval and Tweedie’s trim and fill test was conducted to determine the unbiased mean effect size. The test results are given in Table 6.

**Table 6.** *Duval and Tweedie’s Trim and Fill Test for Attitudes*

Random-Effects Model	Trimmed	Hedges’ g	Lower Limit	Upper Limit	Q-Value
Observed Effect		0.739	0.524	0.956	179.08
Adjusted Effect	0	0.739	0.524	0.956	179.08

According to Table 6, both the observed and adjusted mean effect sizes were calculated as 0.739, 95% CI [0.524, 0.956]. As both the observed and adjusted effects were the same and were under the same category of effect size classification, one can say that there is no publication bias. In addition, Rosenthal's Fail N Safe Test was conducted to determine whether the mean effect size estimate obtained concerning attitude was robust. Considering the result of this test, 2824 additional studies with zero effect sizes were required to be included in the meta-analysis to make the mean effect size estimate non-significant. Rosenthal (1979) states that when the number of studies included in the meta-analysis is more than five times plus 10 (threshold value =  $5k + 10$ ;  $k$  is the number of studies), the mean effect is robust and there is no publication bias. Considering this calculation, the threshold value ( $5 \times 32 + 10$ ) was 170. Accordingly, the mean effect size is robust and there is no publication bias because the number of studies required is larger than the threshold value (170).

### Meta-Analysis Results Regarding the Higher-Order Thinking Skills

A total of 22 experimental studies examining the effect of ABI on students' higher-order thinking skills were included in the meta-analysis. A forest plot containing the effect sizes of studies and other statistics related to these studies is given in Figure 5.

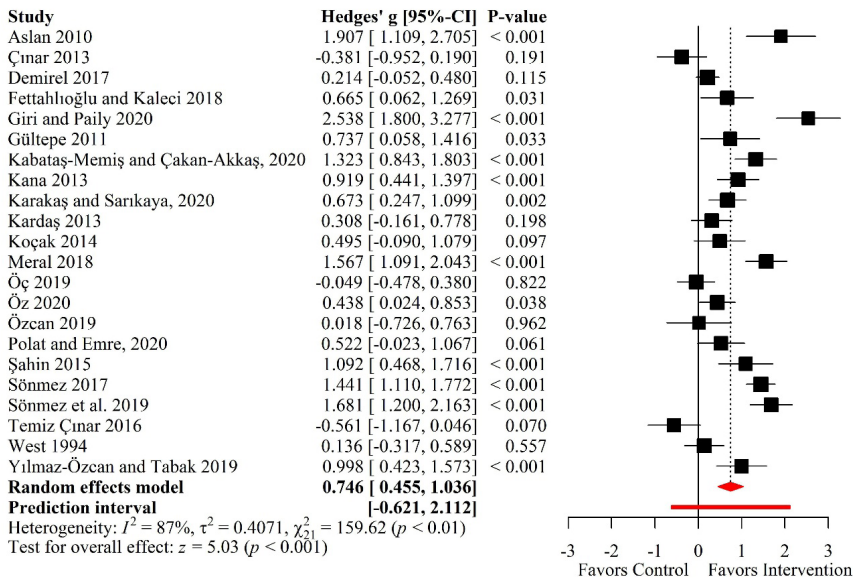


Figure 5 Forest Plot Relating to Higher-Order Thinking Skills

According to Figure 5, the study with the largest effect size ( $ES = 2.538$ ) was an article by Giri and Paily (2020) and the one with the smallest effect size ( $ES = -0.561$ ) was a thesis study by Temiz-Çınar (2016). There were 1391 participants in the studies on higher-order thinking skills included in the meta-analysis. Of these participants, 752 (54%) represented the experimental groups and 639 (46%) represented the control groups. Considering the observed effect sizes, 61.90% ( $n = 13$ ) were statistically significant ( $p < .05$ ), and 38.10% ( $n = 8$ ) were statistically non-significant ( $p > .05$ ). Further, the effect sizes ranged between -0.561 and 2.538 and most of them ( $n = 18$ , 85.7%) were positive. In addition, 28.60% ( $n = 6$ ) of studies yielded strong effect sizes, 28.60% ( $n = 6$ ) moderate, 19% ( $n = 4$ ) small, and 23.80% ( $n = 5$ ) weak.

According to Figure 5, the mean effect size was 0.746, 95% [0.455, 1.036], which significantly differed from zero ( $z = 5.03$ ,  $p < .01$ ). This mean effect size is at a moderate level according to Thalheimer and Cook's (2002) classification. It indicates that students (experimental group) who participated in ABI activities scored higher in tests related to higher-order thinking skills than students (control group) who did not receive such instruction.

The result of the heterogeneity test performed to determine the presence and magnitude of heterogeneity between the effect sizes was non-significant ( $Q(71) = 159.62$ ,  $p < .01$ ). The critical value in the table of chi-square critical values with 21 degrees of freedom at a 0.05 significance level is 32.671. Here, the  $Q$ -value is higher than the critical value, showing that the between-study variance not only stems from the sampling error but also from the characteristics of the studies. In addition, the  $I^2$  index was 86.8%, showing a very high heterogeneity between studies (Higgins et al., 2003). According to Figure 5, true effect sizes fall between the 95% prediction interval values of -0.621 and 2.112. Therefore, this finding could be interpreted that even though the mean effect size is positive, true effect sizes in some studies included in the meta-analysis may be negative or zero. Considering that the point of zero is the point of no effect, 22% of studies included in the meta-analysis have negative effects, whereas 78% have positive effects. Accordingly, ABI may not influence students' higher-order thinking skills in all populations, as the true effect may take a value of 0 in some populations.

The high level of heterogeneity found between the studies included in the meta-analysis requires examining the reasons behind this heterogeneity. Therefore, the between-study variance should be explained through the coded characteristics of primary studies. In this study, studies included in the meta-analysis were coded based on five characteristics. Studies were examined in terms of categorical variables of education level (primary

school, secondary school, high school, university), course type (Science/ Science and Technology, Chemistry, Mathematics, Social Studies, Laboratory, Biology/Genetics, Special Teaching Methods), publication type (thesis, article), and the type of higher-order skills (critical thinking skill, problem-solving skill, creative thinking skills), and the continuous variable of intervention duration. Categorical moderator analyses were conducted for these variables and meta-regression analysis for the continuous variable. The results are given in Table 7.

**Table 7.** *Effect of ABI on Students' Higher-Order Thinking Skills*

Moderators	k	Effect Size	95% CI		Heterogeneity		
			Lower Limit	Upper Limit			
<b>Study Type</b>							
Thesis	15	0.545	0.204	0.885	4.61	1	.031**
Article	7	1.174	0.711	1.636			
<b>Education Level</b>							
Secondary School	9	0.459	0.017	0.900	4.56	2	.102
High School	3	1.717	0.637	2.798			
University	9	0.726	0.324	1.128			
<b>Skill Type</b>							
Critical Thinking	19	0.847	0.532	1.162	12.54	2	.004**
Creative Thinking	2	-0.032	-0.404	0.033			
<b>Course Type</b>							
Science	9	0.362	0.007	0.718	8.86	3	.031**
Chemistry	3	1.009	0.211	1.807			
Social Sciences	2	1.306	0.750	1.862			
Laboratory	4	0.903	0.101	1.704			

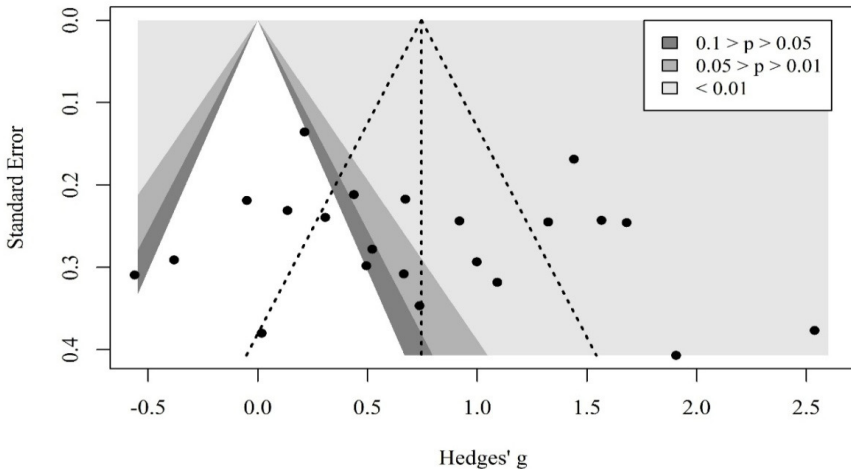
As seen in Table 7, the education level was a non-significant moderator and did not cause heterogeneity ( $p > .05$ ). However, the study type was a significant moderator of types of higher-order skills and courses ( $p < .05$ ). Considering the subgroups yielding a significant effect size, the ABI method yielded a stronger effect in articles related to higher-order skills than thesis studies (Article,  $g = 1.174$ , 95% CI [0.711, 1.636]). The results also showed that the types of higher-order skills significantly contributed to the heterogeneity. Accordingly, the critical thinking skill had a larger effect size than other types of skills (Critical Thinking Skill,  $g = 0.847$ , 95% CI [0.532, 1.162]). However, considering the creative thinking skill, the experimental intervention had a negative effect (Creative Thinking Skill,  $g = -0.032$ , 95% CI [-0.404, 0.033]). According to this finding, the ABI practices have a positive effect on students' critical thinking skills, but have a negative effect on their attitudes in terms of creative thinking skills. Another significant moderator was the course type. Accordingly, the

social sciences course yielded a stronger effect size than other courses ( $g = 1.306$ , 95% CI [0.750, 1.862]). This data can be interpreted that applying the ABI method in social sciences has a greater effect on students' higher-order thinking skills. In addition, a meta-regression analysis was conducted to determine whether the experimental intervention duration (class hour) significantly predicted the effect sizes. Eight studies did not report the duration of the experimental process and therefore were not included in the analysis. The analysis results are presented in Table 8.

**Table 8.** *Intervention Duration in the Effect of ABI on Students' Higher-Order Thinking Skills*

Variable	<i>k</i>	Estimate	SE	95% CI	<i>Q</i>	<i>df</i>	<i>p</i>	<i>R</i> <sup>2</sup>
Duration (Class Hour)	14	0.0019	0.0022	-0.0024-0.0063	4.045	1	.3849	0

According to the meta-regression analysis results in Table 8, the intervention duration of the argumentation method was a non-significant moderator and did not predict students' higher-order thinking skills ( $k = 14$ ,  $Q(1) = 0.755$ ,  $p > .05$ ). Moreover, the funnel plot was examined to determine whether the mean effect of studies related to higher-order thinking skills was due to publication bias. The funnel plot in Figure 6 illustrates the distribution of the observed effect sizes around the mean, where these effect sizes have not formed a complete symmetry.



**Figure 6** *Funnel Plot Relating to Higher-Order Thinking Skills*

Egger's intercept test was examined to determine whether this asymmetry was significant. Table 9 below shows the test results.

**Table 9.** Egger's Test Relating to the Effect of ABI on Students' Higher-Order Thinking Skills

Variable	Intercept (Bo)	SE	Lower Limit	Upper Limit	t	df	p
Higher-Order Thinking Skills	0.291	0.539	0.365	0.972	0.77	20	0.448

As appears in Table 9, the funnel plot asymmetry is not significant ( $p > .05$ ). In other words, there is no publication bias in studies included in the meta-analysis in terms of higher-order thinking skills. In this case, Duval and Tweedie's trim and fill test was performed to determine the unbiased mean effect. Test results are given in Table 10.

**Table 10.** Duval and Tweedie's Trim and Fill for Higher-Order Thinking Skills

Random-Effects Model	Studies Trimmed	Hedges' g	Lower Limit	Upper Limit	Q-Value
Observed Effect		0.746	0.455	1.036	159.62
Adjusted Effect	1	0.670	0.367	0.972	185.05

As seen in Table 10, the observed mean effect was 0.746, 95% [0.455, 1.036], and the adjusted effect was 0.670, 95% CI [0.367, 0.972]. Considering the observed and adjusted effect sizes, there is a small difference between the two effect sizes, indicating that the publication bias has little effect on the results. Moreover, Rosenthal's Fail N Safe test, conducted to determine whether the mean effect relating to higher-order thinking skills was robust, indicated that the number of studies required (1418) was larger than the threshold value (120), showing that the mean effect size was robust and therefore no publication bias was present.

## Conclusion and Discussion

### Meta-Analysis Discussion and Results Regarding the Effect of ABI on Student Attitudes

In the study, when the results of 32 quantitative studies examining the effect of ABI method on student attitudes were combined using a random effects model, the mean effect was 0.740, 95% CI [0.524, 0.956], which significantly differed from zero ( $z = 6.71, p < .01$ ). This mean effect can be considered moderate according to Thalheimer and Cook's (2002) classification. This value indicates that students who participate in ABI activities develop more positive attitudes towards a course, subject, or method. However, the prediction interval revealed in the meta-analysis demonstrates that the true effect can take values ranging from -0.423 to 1.903. This finding can be interpreted that ABI practices may positively affect student attitudes in some studies, while they may negatively affect

their attitudes in other cases. Also, there are conflicting findings in some studies in this meta-analysis showing the negative impact of ABI on attitude (Yeşiloğlu, 2007). Yet, studies included in the meta-analysis and the combined effect of a large body of studies indicated that ABI practices could positively affect student attitude. Existing studies in the literature report that the lessons conducted with ABI lead to significant differences in student attitudes, favouring the experimental groups. Study by Ceylan (2012), Balcı and Yenice (2016) is one example of those studies. In addition, there are also studies reporting non-significant differences between the experimental and control groups (Ceylan, 2012; Ateş, 2019; Aydoğdu-Demir, 2019). In studies reporting non-significant differences, the reason behind this was shown that the method did not affect student attitudes because it needed a longer time. In addition to primary studies, examining the results of secondary studies could offer a comprehensive perspective. For instance, a meta-analysis study conducted by Özer (2009) with 15 comparison data showed that ABI positively has a positive moderate effect on student attitude. In addition, it emphasized that the ABI method was more effective in developing a positive attitude than the teaching method foreseen by the curriculum. From this perspective, one could say that the current study obtained results similar to those in the literature. According to these findings, it could be argued that the ABI method can be used to enable students to develop positive attitudes under appropriate conditions and implementation conditions.

Considering the meta-analysis results in terms of attitude, the heterogeneity among the effect sizes was significant. Therefore, moderator analysis was performed to deeply examine the factors causing heterogeneity. None of the moderators were significant. However, higher effect sizes were obtained in some courses compared to others. As appeared from the findings, the differences were mostly in Science ( $g = 0.779$ , 95% CI [0.487, 1.071]) and Chemistry ( $g = 0.764$ , 95% CI [0.252, 1.275]) courses. This result can be interpreted that the ABI method may affect student attitudes more positively when applied in courses like Science and Chemistry. However, there were few quantitative studies regarding other courses. Given that this method is mostly used in courses like science, it may have affected student attitudes more than in similar courses, in which such methods are used less and discussion activities are rarely used. In other words, the ABI method may have had a greater impact on students' attitudes towards courses such as Science and Chemistry than other courses because of being different and appealing to them. Considering the findings, the intervention duration of the argumentation method was not a significant moderator in predicting student attitude. Herein, it can be concluded that increasing the experiment duration or the class hour for intervention of the ABI does not

significantly affect student attitude. However, there is no study on attitude in the literature with results similar to or contrasting the current study in terms of course type and intervention duration. In addition, the scarcity of primary qualitative studies on other courses, in which a high effect size was obtained, may cause misinterpretation of this result obtained in the present study.

Considering the findings on publication, there was no significant difference between published and unpublished studies in the moderator analysis. In addition, the asymmetry in the funnel plot relating to attitude did not indicate publication bias and there was no difference between the observed and adjusted effect sizes. In light of these findings, one could argue that there is no publication in the meta-analysis on attitude conducted in this study.

### **Meta-Analysis Discussion and Results Regarding the Effect of ABI on Students' Higher-Order Thinking Skills**

The effect of the ABI method on students' higher-order thinking skills was examined through a meta-analysis method. When the effect sizes obtained from 22 studies were combined using a random-effects model, the mean effect was 0.746, 95% CI [0.455, 1.0366]. This mean effect significantly differed from zero ( $z = 5.03, p < .01$ ). According to Thalheimer and Cook's (2002) classification, this value can be considered as a moderate effect size. This result indicates that students who participated in ABI activities scored higher than students who did not participate in such instructional practices. On the other hand, the prediction interval showed that the true effect may vary between -0.621 and 2.112 values. These values could be interpreted that some ABI practices may have a significant effect on students' higher-order thinking skills but may have no effect or negative effect in some cases. Some studies included in this meta-analysis within the scope of higher-order thinking skills report conflicting findings that ABI may have a negative effect in terms of this variable (Temiz-Çınar, 2016; Öç, 2019). Despite these conflicting findings, the combined effect of a great body of research included in the meta-analysis indicated that ABI practices may improve higher-order thinking skills in students. The results of the primary quantitative studies showed that the courses conducted according to the ABI approach in experimental groups improved students' higher-order thinking skills like critical thinking than students exposed to traditional teaching approaches in control groups (Deveci, 2009). In contrast, some studies concluded that higher-order thinking skills were not affected by the method (Kardaş, 2013; Cevger, 2018). These findings indicate the presence of a conflict in this regard in primary studies in the literature. Also, no meta-analysis study examining the effect of the method



on higher-thinking skills was found. In this respect, the result of the current study on higher-order thinking skills may have solved the conflict in the literature. However, in a study conducted by Polat and Emre (2022), the effect of argumentation method on critical thinking skills was examined by meta-analysis method. In the aforementioned study, the overall effect size of the 19 studies included in the meta-analysis was calculated according to the random effects model and a medium-sized ( $d=0.656$ ) effect size was reported.

The heterogeneity test conducted to determine the presence and magnitude of the heterogeneity between the effect sizes was found significant in the meta-analysis results. In order to determine the causes of heterogeneity, moderator analyses were conducted. The moderator analysis showed that the mean effect of articles on higher-order thinking skills was significantly higher than that of thesis studies. This finding may also indicate the presence of publication bias. The moderator analysis results showed that the improvement of some higher-order thinking skills of students participating in ABI practices was higher than those of others (Meral, 2018; Türk Tüysüz & Tüzün, 2018). The findings showed that ABI practices contribute to the development of critical thinking skills more than creative thinking skills. In discussion activities that are a part of the ABI, students may have used their critical thinking skills to refute opposing claims, thereby enabling them to develop these skills better than others. This finding can be interpreted that using discussion activities in the ABI method may give better results in terms of developing students' critical thinking skills. The meta-analysis results showed moderator analysis conducted for the course type was significant. This result showed that students participating in ABI practices demonstrated better performance in terms of higher-order thinking skills in some courses than other students. The difference was mostly observed in Social Science and Chemistry. This finding could be interpreted that using the ABI in courses such as Social Sciences and Chemistry may contribute more to students' higher-order thinking skills. The reason behind this might be that the ABI method is mostly used in science and similar courses. This is because the familiarity provided by the frequent utilization of this method in these courses may have made students feel more comfortable in these courses and therefore had a more positive impact on their higher-order thinking skills. However, there is no meta-analysis study in the literature to compare these results with. Further, the meta-regression results in the study showed that the intervention duration of the argumentation method was a significant moderator in predicting higher-order thinking skills.

An examination of the publication bias regarding the variable of higher-order thinking skills showed that the asymmetry observed in the funnel

plot was not significant and that the difference between the observed and adjusted effect sizes in trim and fill tests was small. Therefore, no publication bias was found.

### **Implications**

The study concluded that the ABI method positively affects students' attitudes and higher-order thinking skills. Therefore, teachers, who want to support their students' higher-order thinking skills and develop positive attitudes in them, are recommended to the ABI in their classes.

In order to determine the effect of the ABI method on different types of courses better in moderator analyses, more studies using the method in different courses are needed. Future studies conducted by researchers in this regard may fill the stated gap.

The current study also examined the effect of the ABI method on higher-order thinking skills. It was seen that critical thinking and problem-solving skills stand out the most among higher-order thinking skills. The same topic can be examined further in the future, exploring through moderator analysis how this method affects all sub-dimensions of one single higher-order thinking skill.

There are few studies on ABI at the primary school level in terms of education level. Thus, in the moderator analysis, it could not be fully determined whether the method made any difference in the stated education level. Future research on this subject is recommended to concentrate on primary school studies.

### **Limitations**

Considering the effect size values, the study concluded that the ABI method influences students' attitudes and higher-thinking skills. In addition, the heterogeneity tests were significant. However, when the prediction intervals relating to true effect sizes are examined, the result can take a value of zero for both variables. In this case, one cannot say that the ABI method will affect student attitudes and higher-order thinking skills in all populations. This is one factor that limits the generalizability of the conclusions reached in the study. The moderator analysis conducted regarding the effect of the ABI method on students' attitudes and higher-order thinking skills yielded significant differences in terms of the course type. It was concluded that using the ABI method in mathematics courses has a greater impact on students' attitudes and using it in biology/genetics courses has a greater impact on their higher-order thinking skills than in other courses. However, there was only one study related to these courses in the analysis, limiting the generalizability of the result obtained.

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## CHAPTER 6

### **GENDER AND SCHOOL-BASED DIFFERENCES ON STUDENTS' SCIENCE TEACHING PERCEPTIONS, NATURE OF SCIENTIFIC INQUIRY VIEWS AND SCIENCE ACHIEVEMENT**

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## Introduction

One of the major obstacles related to raising scientifically literate students in Turkey is a considerable school-based achievement difference noticed both in national and international assessment programs such as Programme for International Student Assessment (PISA) (Dincer & Uysal, 2010; Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı, 2009; Suna et al., 2020). This school-based achievement difference is present both in middle and high school years. Since students are accepted to middle school based on their residence, socioeconomic differences among districts in a city is a major cause of this gap in middle school years. Furthermore students are accepted to high school based on their performance on a nationwide exam, i.e., High School Entrance Examination (LGS), which is administered at the end of middle school which exaggerates this school-based achievement gap in high school years (Suna et al., 2020).

There is also gender-based science achievement gap in favor of girls in Turkey which has been observed in several student assessment programs (Milli Eğitim Bakanlığı, 2010, 2015, 2019). More specifically, Gevrek and Sieberlich (2014) found that this science achievement gap is largest at the 50<sup>th</sup> quantile of the science achievement distribution. In addition, Acar (2020) demonstrated that gender-based science achievement gap is more apparent in schools with high achievement levels compared to the ones with low achievement levels.

Students in schools having different achievement not only differ by their academic achievement but also differ by their students' (addition: students') level of possession of important cognitive and motivational variables. Particularly, after analyzing Trends in Mathematics and Science Study (TIMSS) in 1999, Aypay et al. (2007) found that student-centered science instruction is a characteristic of low achieving schools (LAS) and teacher-centered instruction and having more positive attitudes towards science are characteristics of high achieving schools (HAS) based on student responses to the student questionnaire. From a similar vein, Acar (2017) found that students in HAS have more sophisticated learning and study beliefs compared to their peers in LAS.

## Problem Statement

Although school and gender-based achievement gaps in Turkey have been examined in large scale assessments such as TIMSS and PISA (e.g., Aypay et al., 2007; Gevrek & Sieberlich, 2014), these assessments cover a specific age group and grade-level and neglect other grade-levels. For getting the real picture related to these achievement gaps, other grade-levels should be taken into account especially for secondary education level.



Furthermore, since school and gender-based gaps have been investigated mostly for science achievement, there is a need for extending this research focus to cognitive and motivational variables which have important relations with students' science achievement. If school and gender-based gaps on cognitive and motivational variables are detected with certainty, then instructional interventions may be implemented to develop these variables among disadvantaged school type and gender which would help to the efforts for reducing achievement gaps in turn. Particularly, previous research shows that students' perception of science teaching, their nature of science understanding and epistemological beliefs have significant relations with their science achievement (e.g., Acar, 2019; Hacıeminoğlu et al., 2015; Kalender & Berberoglu, 2009). Based on these considerations, the purpose of this research is to explore if students' perceptions of science teaching, their understanding of nature of science inquiry (NOSI), and science achievement would differ for each grade-level between (deletion: in) low and high achieving schools. Besides, any gender-based difference related to these variables between these school types was also explored in this study.

## **Methodology**

### **Research Design and Participants**

In accordance with the study purpose, first LAS and HAS were selected. Accordingly, high schools, which were located in İstanbul, were selected on the basis of their success on LGS. Three schools from both (addition: both) the lower and upper percentile of the achievement distribution were selected as LAS and HAS, respectively. 12<sup>th</sup> grade was omitted in this study because students at (deletion: in) this grade-level were not attending to school regularly due to their intensive study for a university entrance exam which is used to place students to universities in Turkey. Students who completed all the research instruments were retained in the final sample. As a result, 326 students were retained in LAS and 263 students were retained in HAS. Distribution of research sample by school type, grade-level, and gender can be seen in Table 1. A total of 163 girls and 163 boys constituted the research sample in LAS. On the other hand, 122 girls and 141 boys constituted the research sample in HAS.

*Table 1 Distribution of Research Sample by School Type, Grade-Level, and Gender*

	Grade-Level	Gender	N	Total
LAS	9	Girl	72	114
		Boy	42	
	10	Girl	15	97
		Boy	82	
	11	Girl	76	115
		Boy	39	
HAS	9	Girl	33	85
		Boy	52	
	10	Girl	42	89
		Boy	47	
	11	Girl	47	89
		Boy	42	

### **Data Collection Procedures**

Ethical approval for this research was obtained from a university's research ethics committee. In addition, Directorate of National Education in Kocaeli province also approved the implementation of this research in middle schools. After these procedures, meetings were held with principals of the schools for explaining the research purpose and the methodology. Afterwards, teachers of each class at 9<sup>th</sup>, 10<sup>th</sup>, and 11<sup>th</sup> grade-levels were informed about the research methodology. Finally, these teachers administered the scales to students in a class time which lasted in 40 minutes.

### **Instruments**

*Science teaching perceptions scale.* To measure students' perception of science teaching in their classrooms; a scale consisting of 30 items with a 4-point Likert-type scale, which were imported from 2006 and 2018 PISA student questionnaires (OECD, 2006), were used. Adaptation of this instrument to Turkish was previously made by Acar and Çelik (2019). Acar and Çelik (2019) administered the scale to 6<sup>th</sup> graders and found three subscales as a result of exploratory factor analysis. In accordance with Acar and Çelik (2019), first, exploratory factor analysis with principal axis factoring was performed to investigate if there is any subscale exists under this instrument for high school students. After the examination of the scree plot, eigen values of the factors, and percentages of variance explained by each factor, it was decided to extract four factors. Then same analysis was run with fixing the factor number to four and choosing varimax rotation method with factor loadings upper than .3 for obtaining more identifiable distinct factors. As a result, it was determined that eight items loaded on

the first, 11 items loaded on the second, seven items loaded on the third, and four items loaded on the fourth factor. Internal consistency estimates of Cronbach- $\alpha$  for these factors were found to be .88, .88, .83 and .85, respectively. When the items loaded on each factor were examined in detail, it was determined that items loading on the first factor were about teacher's support for students' learning, the second factor were about science applications done in lessons, the third factor were about students' discussion of their ideas in the lesson and the relationship of the science lesson with daily life, and the fourth factor were about teacher's feedback on students' learning. Accordingly, these factors were named as *teacher-supported classroom environment*, *science lesson practices*, *student-centered classroom environment*, and *teacher feedback on learning*, respectively. Sample items loading to each factor can be seen in Table 2. For data analyses, composite factor scores of each subscale were calculated by adding each item multiplied by its factor loading.

*Table 2 Science Teaching Perceptions Subscales and Their Internal Consistencies*

Factors	Sample Item	Cronbach's $\alpha$
Teacher-supported classroom environment	The teacher gives extra help when students need it.	.88
Science lesson practices	Students are required to design how a <school science> question could be investigated in the laboratory	.88
Student-centered classroom environment	The lessons involve students' opinions about the topics	.83
Teacher feedback on learning	The teacher gives me feedback on my strengths in this subject.	.85

*Nature of scientific inquiry (NOSI) scale.* For measuring students' perceptions of NOSI, a scale consists of 48 4-point Likert-type items which was developed by Nehring (2019) was used. This instrument consisted five informed and five naïve views about NOSI. Initially, it was translated to

Turkish by the first author of this chapter. Then a chemist revised this translation for the appropriateness of the scientific terminology. Finally, a native speaker of Turkish who graduated from English teaching program revised the translation for appropriateness of the Turkish translation. This final version was used in the present study. Examination of the Cronbach's alpha estimate of internal consistency for informed and naïve views showed that Cronbach's alpha of the third naïve view, which had five items (items 6, 7, 8, 9, and 10), was below .50. Therefore this naïve view was removed from further analyses. In addition, two items (items 2 and 5) in the first naïve view did not contribute to the overall Cronbach's alpha level. Therefore these items were also removed from this naïve view. As a result, data analyses were performed for a total of 41 items and four naïve and five informed views. Sample items in each naïve and informed views as well as Cronbach's alpha internal consistency estimates of these subscales can be seen in Table 3.

*Table 3 NOSI Subscales and Their Internal Consistencies*

NOSI Subscales and their Items	Sample Item	Cronbach's $\alpha$
1. Naive View (1, 3, 4)	If scientists carry out an investigation, then they start the investigation without preparation.	.64
2. Naive View (21, 22, 23, 24, 25)	If scientists carry out an observation or measurement, then they have no assumptions about the result.	.75
4. Naive View (26, 27, 28)	If scientists carry out an experiment to find out if a variable affects a property, then they change all the variables that could have an impact once.	.67
5. Naive View (44, 45, 46, 47, 48)	If scientists work with a model, then the model is an exact copy of the reality.	.76
1. Informed View (11, 12, 13, 14, 15)	If scientists carry out an investigation, then they formulate an assumption they want to test.	.76

2. Informed View (16, 17, 18, 19, 20)	If scientists carry out an observation or measurement, then they have a theory that specifies what they want to observe or measure.	.69
3. Informed View (29, 30, 31, 32, 33)	If scientists carry out an experiment to find out if a variable affects a property, then they change only one variable at a time.	.73
4. Informed View (34, 35, 36, 37, 38)	If scientists work with a model, then they transfer findings from the model to the original.	.76
5. Informed View (39, 40, 41, 42, 43)	If scientists work with a model, then they use the model as a tool for illustrating features of the original.	.74

*Science achievement measures.* Students’ end of year grades in physics, chemistry, and biology were used as their science achievement measures. These grades were computed as an average of end of semester grades in each lesson and end of semester grades were computed as an average of student’ scores on exams and class performance.

## Results

### School-Based Differences on Students’ Perceptions of Science Teaching

Table 4 Descriptive Statistics of Students’ Perceptions of Science Teaching at each Grade-Level in LAS and HAS

		Teacher-supported classroom environment		Science lesson practices		Student-centered classroom environment		Teacher feedback on learning	
		M	SD	M	SD	M	SD	M	SD
LAS	9	13.70	3.62	11.95	3.92	9.13	2.37	5.63	1.79
	10	11.76	3.72	10.30	3.91	7.75	2.38	5.29	2.03
	11	12.05	3.43	10.30	3.51	8.15	2.31	5.07	1.94
HAS	9	13.29	3.32	13.66	3.76	9.40	2.12	5.33	1.79
	10	13.21	3.78	11.37	3.90	8.85	2.29	5.77	2.05
	11	14.17	3.92	11.02	3.77	8.78	2.86	6.33	2.09

A MANOVA was applied to the set of students’ perceptions of science teaching factors for each grade-level. Results showed that school type had an effect on the set of dependent variables at the 9<sup>th</sup>, 10<sup>th</sup>, and 11<sup>th</sup> grades

( $F(4, 194) = 5.69, p < .001, \eta^2 = .11$ ;  $F(4, 181) = 2.94, p < .05, \eta^2 = .06$ ;  $F(4, 199) = 6.07, p < .001, \eta^2 = .11$ , respectively). Follow-up ANOVA results for the 9<sup>th</sup> grade showed a significant effect of school type on only the science lesson practices factor ( $F(1, 197) = 9.66, p < .01; \eta^2 = .05$ ). As can be seen from Table 4, this significance was in favor of HAS. Other results for teacher-supported classroom environment, student-centered classroom environment, and teacher feedback on student learning did not yield a significance ( $F(1, 197) = 0.70, p > .05$ ;  $F(1, 197) = 0.72, p > .05$ ;  $F(1, 197) = 1.36, p > .05$ , respectively). Besides, follow-up ANOVA results for the 10<sup>th</sup> grade showed that school type had a significant effect on teacher-supported classroom environment and student-centered classroom environment ( $F(1, 184) = 6.98, p < .01; \eta^2 = .04$ ;  $F(1, 184) = 10.31, p < .01; \eta^2 = .05$ , respectively). As can be seen from Table 4, both significant results were in favor of HAS. However other ANOVA results for science lesson practices and teacher feedback on student learning did not reach significance ( $F(1, 184) = 3.46, p > .05$ ;  $F(1, 184) = 2.53, p > .05$ , respectively). Finally, follow-up ANOVA results showed a significant effect of school type which was in favor of HAS (see Table 4) on teacher-supported classroom environment and teacher feedback on student learning factors at the 11<sup>th</sup> grade ( $F(1, 202) = 16.86, p < .001; \eta^2 = .08$ ;  $F(1, 202) = 19.79, p < .001; \eta^2 = .09$ , respectively). However the same inquiry did not reach to significance for science lesson practices and student-centered classroom environment ( $F(1, 202) = 2.00, p > .05$ ;  $F(1, 202) = 3.06, p > .05$ , respectively).

### School-Based Differences on Informed NOSI Views

Table 5 Descriptive Statistics of Students' Informed Views on NOSI at each Grade-Level in LAS and HAS

		1. Informed View		2. Informed View		3. Informed View		4. Informed View		5. Informed View	
		M	SD	M	SD	M	SD	M	SD	M	SD
LAS	9	10.43	1.54	8.85	1.18	8.31	1.65	9.61	1.54	9.29	1.50
	10	10.40	1.51	8.66	1.19	8.57	1.92	9.28	1.38	9.13	1.39
	11	10.36	1.45	8.85	1.12	8.86	1.63	9.56	1.32	9.16	1.46
HAS	9	11.06	1.32	9.16	1.24	9.80	1.55	9.65	1.89	9.78	1.44
	10	10.91	1.51	9.34	1.33	9.72	1.63	9.98	1.89	9.64	1.80
	11	10.74	1.56	9.02	1.43	9.05	1.76	9.62	1.56	9.50	1.57

MANOVA was performed for each grade-level for investigating the effect of school type on the set of NOSI informed views. Results showed that school type had a significant effect on the set of NOSI informed views at the 9<sup>th</sup> and 10<sup>th</sup> grade but not at the 11<sup>th</sup> grade ( $F(5, 193) = 8.85, p < .001, \eta^2 = .19$ ;  $F(5, 180) = 5.67, p < .001, \eta^2 = .13$ ;  $F(5, 198) = 0.96, p > .05$ , respectively). Follow-up ANOVA results showed that school type had a significant effect on the first, third and fifth informed NOSI views

( $F(1, 197) = 9.22, p < .01, \eta^2 = .05$ ;  $F(1, 197) = 41.60, p < .001, \eta^2 = .17$ ;  $F(1, 197) = 5.49, p < .05, \eta^2 = .03$ , respectively) but not on the second and fourth informed NOSI views at the 9<sup>th</sup> grade ( $F(1, 197) = 3.24, p > .05$ ;  $F(1, 197) = 0.03, p > .05$ , respectively). As can be seen from Table 5, all of these significant effects were in favor of HAS. On the other hand, follow-up ANOVA results for the 10<sup>th</sup> grade showed a significant effect of school type on the first, second, third, fourth, and the fifth informed NOSI views ( $F(1, 184) = 5.49, p < .05, \eta^2 = .03$ ;  $F(1, 184) = 13.65, p < .001, \eta^2 = .07$ ;  $F(1, 184) = 19.21, p < .001, \eta^2 = .10$ ;  $F(1, 184) = 8.41, p < .01, \eta^2 = .04$ ;  $F(1, 184) = 4.68, p < .05, \eta^2 = .03$ ). All of these significant effects were in favor of HAS (see Table 5).

### School-Based Differences on Naïve NOSI Views

Table 6 Descriptive Statistics of Students' Naïve Views on NOSI at each Grade-Level in LAS and HAS

		1. Naïve View		2. Naïve View		4. Naïve View		5. Naïve View	
		M	SD	M	SD	M	SD	M	SD
LAS	9	3.42	1.15	5.34	1.62	5.06	1.19	7.15	1.92
	10	3.04	0.99	5.26	1.65	4.95	1.36	6.53	1.93
	11	3.44	1.29	5.24	1.48	4.81	1.15	6.92	1.77
HAS	9	3.17	1.22	5.18	1.36	3.77	1.38	6.34	1.98
	10	3.42	1.54	4.98	1.81	4.47	1.54	7.03	2.27
	11	3.20	1.05	5.00	1.44	4.33	1.40	6.69	1.75

For the examination of the effect of school type on the set of naïve NOSI views, separate MANOVA's were performed for each grade-level. Results of these analyses showed that school type had a significant effect on the set of dependent variables at the 9<sup>th</sup> and 10<sup>th</sup> grades but not at the 11<sup>th</sup> grade ( $F(4, 194) = 14.21, p < .001, \eta^2 = .23$ ;  $F(4, 181) = 4.79, p < .01, \eta^2 = .10$ ;  $F(4, 199) = 2.24, p > .05$ , respectively). Follow-up ANOVA results showed a significant effect of school type on the fourth and fifth naïve views ( $F(1, 197) = 49.43, p < .001, \eta^2 = .20$ ;  $F(1, 197) = 8.42, p < .01, \eta^2 = .04$ , respectively) but not on the first and second naïve NOSI views ( $F(1, 197) = 2.26, p > .05$ ;  $F(1, 197) = 0.52, p > .05$ , respectively) at the 9<sup>th</sup> grade. As can be seen from Table 6, students in HAS had lower scores both on fourth and fifth naïve views than their counterparts in LAS. On the other hand, the results showed a significant effect of school type on the first and fourth naïve NOSI views ( $F(1, 184) = 4.13, p < .05, \eta^2 = .02$ ;  $F(1, 184) = 5.19, p < .05, \eta^2 = .03$ , respectively) but not on the second and fifth views ( $F(1, 184) = 1.29, p > .05$ ;  $F(1, 184) = 2.61, p > .05$ , respectively) at the 10<sup>th</sup> grade. As can be seen from Table 6, students in HAS had higher scores on the first naïve view but had lower scores on the fourth naïve view than their peers in LAS.

### School-Based Differences on Science Achievement

Table 7 Descriptive Statistics of Students' Science Achievement at each Grade-Level in LAS and HAS

		Physics		Chemistry		Biology	
		M	SD	M	SD	M	SD
LAS	9	68.04	14.17	74.48	13.40	71.18	15.56
	10	74.13	12.53	76.15	11.80	75.04	11.46
	11	65.94	17.45	72.86	15.50	84.13	12.71
HAS	9	91.94	5.86	90.11	8.07	76.52	15.22
	10	75.28	13.37	80.58	13.07	83.27	9.46
	11	86.25	10.15	79.35	13.84	82.18	11.27

Separate MANOVA's were performed for each grade-level to examine the effect of school type on the set of science achievement measures. Results showed that school type had a significant effect on the dependent variables at the 9<sup>th</sup>, 10<sup>th</sup>, and the 11<sup>th</sup> grades ( $F(3, 195) = 97.31, p < .001, \eta^2 = .60$ ;  $F(3, 182) = 13.32, p < .001, \eta^2 = .18$ ;  $F(3, 200) = 49.42, p < .001, \eta^2 = .43$ , respectively). Follow-up ANOVA results for the 9<sup>th</sup> grade showed that school type had a significant effect on students' physics, chemistry, and biology grades ( $F(1, 197) = 214.40, p < .001, \eta^2 = .52$ ;  $F(1, 197) = 90.83, p < .001, \eta^2 = .32$ ;  $F(1, 197) = 5.85, p < .05, \eta^2 = .03$ , respectively). As can be seen from Table 7, all of the significant differences were in favor of HAS. On the other hand, same analyses showed that school type had no significant effect on students' physics achievement but had a significant effect on chemistry and biology achievement at the 10<sup>th</sup> grade ( $F(1, 184) = 0.37, p > .05$ ;  $F(1, 184) = 5.90, p < .05, \eta^2 = .03$ ;  $F(1, 184) = 28.24, p < .001, \eta^2 = .13$ , respectively). As can be seen from Table 7, all of the significant differences were in favor of HAS. Finally, follow-up analyses for the 11<sup>th</sup> grade demonstrated that students in LAS and HAS significantly differed on physics and chemistry achievement but not on biology achievement ( $F(1, 202) = 95.42, p < .001, \eta^2 = .32$ ;  $F(1, 202) = 9.64, p < .01, \eta^2 = .05$ ;  $F(1, 202) = 1.30, p > .05$ , respectively). As can be seen from Table 7, significant differences were in favor of students in HAS.

### Gender Differences on Perceptions of Science Teaching in Each School Type

Table 8 Descriptive Statistics of Students' Perceptions of Science Teaching by Gender in LAS and HAS

		Teacher-supported classroom environment		Science lesson practices		Student-centered classroom environment		Teacher feedback on learning	
		M	SD	M	SD	M	SD	M	SD
LAS	Girls	12.49	3.45	10.96	3.85	8.52	2.21	5.22	1.89
	Boys	12.60	3.71	10.79	3.85	8.23	2.60	5.44	1.96
HAS	Girls	14.10	3.84	11.90	3.93	9.33	2.63	5.81	2.07
	Boys	13.10	3.69	12.08	4.01	8.73	2.27	5.82	1.98



A MANOVA with gender as independent variable was performed on the set of students' perceptions of science teaching factors in LAS. Result showed that girls and boys did not differ on the set of these dependent variables ( $F(4, 321) = 1.38, p > .05$ ). Therefore, no follow-up ANOVA was run for LAS. On the other hand, same analysis yielded a significant effect of gender on the set of dependent variables in HAS ( $F(4, 258) = 3.65, p < .01, \eta^2 = .05$ ). However, follow-up ANOVA results showed that gender had an effect on only teacher-supported classroom environment and student-centered classroom environment ( $F(1, 261) = 4.59, p < .05, \eta^2 = .02$ ;  $F(1, 261) = 3.97, p < .05, \eta^2 = .02$ , respectively) but not on science lesson practices and teacher feedback on student learning ( $F(1, 261) = 0.13, p > .05$ ;  $F(1, 261) = 0.00, p > .05$ , respectively). As can be seen from Table 8, both of these differences were in favor of girls.

### Gender Differences on Informed NOSI Views in Each School Type

Table 9 Descriptive Statistics of Students' Informed Views on NOSI by Gender in LAS and HAS

		1. Informed View		2. Informed View		3. Informed View		4. Informed View		5. Informed View	
		M	SD	M	SD	M	SD	M	SD	M	SD
LAS	Girls	10.29	1.57	8.76	1.20	8.55	1.54	9.54	1.48	9.10	1.52
	Boys	10.50	1.41	8.83	1.12	8.62	1.93	9.44	1.36	9.29	1.37
HAS	Girls	11.15	1.42	9.47	1.37	9.74	1.53	9.90	1.70	9.92	1.53
	Boys	10.69	1.48	8.92	1.26	9.32	1.78	9.62	1.85	9.40	1.64

Separate MANOVA's were run for LAS and HAS for the examination of the effect of gender on the set of informed NOSI views. Result of the first MANOVA showed that gender had no effect on the set of dependent variables ( $F(5, 320) = 0.90, p > .05$ ) in LAS. On the other hand, the result of the second MANOVA showed a significant effect of gender in HAS ( $F(5, 257) = 2.73, p < .05, \eta^2 = .05$ ). Accordingly, follow-up ANOVA results showed a significant effect of gender on all of the informed views except the fourth informed view ( $F(1, 261) = 6.65, p < .05, \eta^2 = .03$ ;  $F(1, 261) = 11.56, p < .01, \eta^2 = .04$ ;  $F(1, 261) = 4.20, p < .05, \eta^2 = .02$ ;  $F(1, 261) = 1.65, p > .05$ ;  $F(1, 261) = 6.99, p < .01, \eta^2 = .03$ , starting from the first to the fifth respectively). As can be seen from Table 9, girls scored higher than boys on the informed views that showed significant effect of gender.

**Gender Differences on Naive NOSI Views in Each School Type**

*Table 10 Descriptive Statistics of Students' Naive Views on NOSI by Gender in LAS and HAS*

		1. Naive View		2. Naive View		4. Naive View		5. Naive View	
		M	SD	M	SD	M	SD	M	SD
LAS	Girls	3.43	1.25	5.32	1.57	4.88	1.23	6.92	1.86
	Boys	3.20	1.07	5.24	1.58	4.99	1.23	6.85	1.90
HAS	Girls	2.96	0.94	5.02	1.37	4.16	1.42	6.46	1.95
	Boys	3.53	1.48	5.08	1.69	4.23	1.51	6.90	2.08

A MANOVA was performed for the investigation of the effect of gender on the set of naïve views for each school type. Result of the first MANOVA showed that gender had no significant effect on students' naïve NOSI views in LAS ( $F(4, 321) = 1.03, p > .05$ ). However same analysis showed a significant effect of gender on dependent variables in HAS ( $F(4, 258) = 4.59, p < .01, \eta^2 = .07$ ). On the other hand, follow-up ANOVA results confirmed this significance for only first naïve view ( $F(1, 261) = 13.89, p < .001, \eta^2 = .05$ ) but not for the second, fourth, and the fifth views ( $F(1, 261) = 0.09, p > .05$ ;  $F(1, 261) = 0.17, p > .05$ ;  $F(1, 261) = 3.11, p > .05$ , respectively). As can be seen from Table 10, boys scored higher than girls on the first naïve view.

**Gender Differences on Science Achievement in Each School Type**

*Table 11 Descriptive Statistics of Students' Science Achievement by Gender in LAS and HAS*

		Physics		Chemistry		Biology	
		M	SD	M	SD	M	SD
LAS	Girls	64.68	15.66	72.39	15.02	77.45	15.84
	Boys	73.54	13.63	76.43	12.11	76.34	13.09
HAS	Girls	85.16	11.54	85.47	11.39	83.91	10.46
	Boys	83.69	13.08	81.32	13.76	77.96	13.42

Separate MANOVA's were run for the investigation of gender effect on the set of science achievement measures for each school type. Result of the MANOVA for LAS showed a significant effect of gender on the set of dependent variables ( $F(3, 322) = 14.28, p < .001, \eta^2 = .12$ ). Follow-up ANOVA results confirmed this result for physics and chemistry achievement but not for biology achievement ( $F(1, 324) = 29.68, p < .001, \eta^2 = .08$ ;  $F(1, 324) = 7.16, p < .01, \eta^2 = .02$ ;  $F(1, 324) = 0.47, p > .05$ , respectively). As can be seen from Table 11, these differences were in favor of boys. The result of the second MANOVA also showed a significant effect of gender in HAS ( $F(3, 259) = 5.70, p < .01, \eta^2 = .06$ ). Follow-up ANOVA results showed that this significance is valid for chemistry and biology

achievement but not for physics achievement ( $F(1, 261) = 6.96, p < .01, \eta^2 = .03$ ;  $F(1, 261) = 15.73, p < .001, \eta^2 = .06$ ;  $F(1, 261) = 0.92, p > .05$ , respectively). As can be seen from Table 11, significant differences were in favor of girls.

## Discussion

Results regarding school-based differences on students' science teaching perceptions demonstrated that students in HAS had higher scores on science lesson practices factor at the 9<sup>th</sup> grade, teacher-supported classroom environment and student-centered classroom environment factors at the 10<sup>th</sup> grade, and teacher-supported classroom environment and teacher feedback on student learning factors at the 11<sup>th</sup> grade than their peers in LAS. In addition, results regarding school-based differences on informed NOSI views showed that students in HAS had more sophisticated views on theory-investigation and model-reality relationships and controlling variables strategy than their peers in LAS at the 9<sup>th</sup> grade. This advantage of students in HAS continued at the 10<sup>th</sup> grade on all of the five informed NOSI views which cover views related to theory-investigation and model-reality relationships and controlling variables strategy. On the other hand, students in LAS had more naïve views on controlling variables strategy and model-reality relationship at the 9<sup>th</sup> grade. Furthermore students in LAS had more naïve views on controlling variables strategy at the 10<sup>th</sup> grade. Surprisingly, students in HAS had more naïve views than the students in LAS on theory-investigation relation at this grade-level. Results related to school-based science achievement difference showed that students in HAS had higher end of year grades in physics, chemistry, and biology than their counterparts in LAS at the 9<sup>th</sup> grade. Additionally, students in HAS scored higher than students in LAS in chemistry and biology at the 10<sup>th</sup> grade and in physics and chemistry at the 11<sup>th</sup> grade.

Examination of gender differences at each school type showed that girls' and boys' scores in LAS were not different from each other on their perceptions of science teaching, informed and naïve NOSI views. However, girls scored higher than boys in HAS on teacher-supported classroom environment and student-centered classroom environment factors. Besides, girls scored higher than boys on most of the informed NOSI views and scored less on the first naïve NOSI view which was related to theory-investigation relationship. On the other hand, boys had higher physics and chemistry achievement than girls in LAS. Same inquiry for HAS showed a different direction. More clearly, girls had higher chemistry and biology achievement than boys in HAS.

Previous research showed that students in LAS and HAS have different science teaching perceptions (Acar, 2017; Aypay et al., 2007; Kal-

ender & Berberoglu, 2009). However these studies mostly cover specific grade-levels and neglect others. Results of this study extend our knowledge base by showing an advantage of students in HAS over their peers in LAS on specific subscales of science teaching perceptions at certain grade-levels. That is to say, students in LAS scored less on science lesson practices factor than their counterparts in HAS at the 9<sup>th</sup> grade. This result alerts caution about providing laboratory and hands-on science to students in LAS to prevent widening of the achievement gap between LAS and HAS. On the other hand, students in LAS reported less teacher-supported classroom environment and teacher feedback on student learning in the following grade-levels. Keeping in mind that the curriculum of each scientific discipline gets more abstract at senior grade-levels in high school, this result implies that these students do not get enough teacher support from their science teachers and (deletion: because) they do not understand the content. In addition, they reported less student-centered classroom environment compared to students in HAS at the 10<sup>th</sup> grade.

Overall results regarding school-based differences on NOSI views showed that students in HAS had more sophisticated NOSI views and less naïve views than the students in LAS at the 9<sup>th</sup> grade. Similar results were also found for the 10<sup>th</sup> grade. However, students in HAS had more naïve view about planning of a scientific investigation than their peers in LAS at this grade-level. On the other hand, no significant school-based difference related to NOSI views were observed at the 11<sup>th</sup> grade. According to these results following recommendations can be made. Explicit and reflective teaching of nature of science approach (Lederman & Abd-El-Khalick, 1998) may be used more often by science teachers in LAS for enhancing their students' views especially on theory-investigation and model-reality relationships and controlling variables strategy. In addition, views on constructing and presenting scientific models can be fostered among students in LAS by encouraging them to construct scientific models in science classrooms. On the other hand, for making students in HAS understand that a scientific investigation is a planned activity, historical instances related to important scientific discoveries can be taught by teachers of these students.

Since students were selected to high school based on their performance on a nation-wide exam administered at the end of middle school and also students in HAS reported more positive science teaching practices occurred in their classrooms in this study, the result regarding advantage of students in HAS on physics, chemistry, and biology achievement is not surprising. Although several initiatives have been taken by Turkish (addition: Turkish) Ministry of Education to prevent widening of achievement gap between schools such as canceling out a nation-wide exam which was administered

after elementary school for placing students to middle schools and providing reinforcement courses for students who have difficulty in understanding the lesson content, these initiatives seem to be not sufficient. As Suna et al. (2020) emphasized, LAS should also be supported academically, financially, and socially.

Study results showing a significant gender effect on science teaching perceptions and NOSI views in HAS but not in LAS can be explained in light of previous literature findings about the gender effect in secondary schools of LAS and HAS. Particularly, Acar (2017) found that girls and boys did not differ on their epistemological beliefs and science teaching perceptions in LAS but girls had more sophisticated epistemological beliefs and reported more positive science teaching environment than boys in HAS in secondary schooling. Since NOSI views and epistemological beliefs may share common theoretical foundation, it is not surprising that similar results were obtained from this study and Acar (2017). Besides, results about gender effect on science teaching perceptions are also similar in both studies. Then, one question comes to mind: How can gender effect or no effect found in middle school years for both school types continue to be present in high school years? A response to this question is a straight forward one but it is thought to be an important cause: It is because mostly gender effect has not been examined specifically for LAS and HAS but instead it has been examined without taking the school-based achievement differences into account (e.g., Önal, 2015; Özmusul, 2012). As a consequence of this situation, no specific gender-based cautions were taken for LAS and HAS which result in repetition of findings found in middle school regarding gender to high school. Although limited number of studies drew attention to the significant gender effect on several motivational and cognitive variables in middle school years in LAS and HAS (e.g., Acar, 2017, 2019), no policy actions have been taken to reduce the gender effect in LAS and HAS according to the results obtained from these studies.

Another interesting finding was that boys' physics and chemistry achievement was higher in LAS and their chemistry and biology achievement was lower than girls in HAS. The latter result is not surprising because there are studies reporting girls outperformance over boys in general science in middle school years in HAS and also in PISA studies (e.g., Acar, 2020; Gevrek & Seiberlich, 2014). However former result needs an interpretation. Although total number of girls and boys were equal in LAS in this study, examination of gender distribution by grade-level reveals that gender ratio had substantially changed from one grade-level to the other at this school type. For instance, whereas there were 15 girls and 82 boys at the 10<sup>th</sup> grade, there were 76 girls and 39 boys at the 11<sup>th</sup> grade in LAS. This unequal distribution of gender by grade-level may have inflated the

study results regarding achievement. Therefore more research is needed to validate the results of this study with having similar gender ratio across grade-levels in LAS (addition: in LAS).

### **Limitations**

Since genders were not homogenously distributed across grade-levels in LAS compared to HAS, we could not explore the gender effect at each grade-level for both school types. Future studies can explore this research issue by having approximately equal number of girls and boys at each grade-level both in LAS and HAS. On the other hand, although LAS and HAS were selected in a metropolitan city in Turkey, they may not be representative of these school types because three schools were selected for both LAS and HAS. Future studies may conduct this type of research with having higher number of (deletion: more) schools for both school types.

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## CHAPTER 7

### THE INVESTIGATION OF SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS CAREER İNTEREST OF SECONDARY STUDENTS IN TERMS OF VARIOUS VARIABLES

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## 1. INTRODUCTION

STEM; It is an approach that is formed by bringing together the first letters of the concepts of Science, Technology, Engineering and Mathematics and is based on the understanding of using these disciplines together as a philosophy. STEM was originally designed as a process that includes all stages of cognitive taxonomy.

STEM Education; means educating students in these four specific disciplines: Science, Technology, Engineering and Mathematics (STEM). Rather than educating students in any of these areas, using STEM education combines these four disciplines with a hands-on approach so that students are better equipped to have a career and consider real-world applications.

STEM education focuses on project-based learning in the classroom. It offers real-time apps and learning experiences. Students apply various areas of STEM in a way that helps them make a connection between the classroom and the world around them.

STEM education is an approach that covers all grade levels, from pre-school to higher education. In order to increase the awareness of individuals in their career choices, STEM activities should be applied from an early age and a basis should be gained (Gülhan & Şahin, 2016). It aims to enable students to look at problems from an interdisciplinary perspective and to gain knowledge and skills with a new generation education approach. STEM aims to empower individuals with their ability to succeed and adapt to this changing world. Students learn by doing research and questioning away from rote. Since the four disciplines are used by transferring them to daily life in an intertwined manner, permanence in learning is ensured.

STEM also contributes to the development of students' 21st century skills. Increases Science, Mathematics and Technology literacy levels. It gives critical and critical thinking skills. It helps them become aware of the life problems they will encounter in daily life. The aim of STEM education is to provide permanent and meaningful learning as a result of establishing a connection between the learned information and the information encountered in real life in an integrated structure of disciplines (Smith & Karr-Kidwell, 2000). It contributes to being productive individuals and increases creativity. It strengthens collaborative working skills. Develops interpersonal communication skills. It arouses a sense of curiosity towards change and innovation. It supports the development of entrepreneurial skills.

STEM makes it easy to meet the need in career fields. STEM education contributes to raising individuals who produce creative solutions to

problems at an early age, adapt to changes, have strong communication skills, are equipped and self-confident. In STEM studies, students can not only patent the STEM products they have designed, but also evaluate career opportunities in this field when they go to the job site. On the other hand, professions in the field of STEM are seen as “the professions of the future” as they are necessary for a country’s economic growth, superiority in global competition and improvement of living standards (Gülhan & Şahin, 2016).

STEM education and the application of technology give each student the ability to use their creativity, develop critical thinking skills, and think numerically. It is stated that in the integration of STEM education, which is considered in this direction, into the current curriculum, the principle of equality should be given importance while preparing the programs as well as determining the national criteria (Akgündüz et al., 2015). The point that distinguishes STEM from traditional education is that it shows students how the scientific method can be applied to daily life by focusing on real-life applications of problem-solving skills with a blended learning environment. In order to gain these skills, it is important to start STEM education in early childhood. Applied science unit gains were added to the science curriculum at the 5th, 6th, 7th and 8th grades within the scope of science and engineering applications, and it was aimed to present the products that emerged in the science fair applications (MEB, 2017).

The realization of the STEM education approach is related to increasing the interest in providing orientation to professions in STEM fields. On the other hand, it is thought that variables such as the educational status of the parents, academic success, having their own field of study, and economic conditions may be effective in the career choice of students related to STEM. In this direction, it is expected that the study will provide data to the curriculum developers and the studies to be done to increase the interest of the students towards STEM.

In the light of all these, the aim of this study was to investigate whether different variables are effective on secondary school students’ interest in STEM professions.

### **Sub Problems**

Secondary school students’ interest in STEM careers;

- a. Genders,
- b. Grade levels,
- c. The status of having their own computer or tablet,
- d. The status of having their own smartphone

- e. The status of having internet at home.
- f. Last semester's science and mathematics course grade
- g. Educational status of mothers and fathers
- h. Does it vary according to the number of siblings?

## **2. METHOD**

In this section, information about the model of the research, the study group, the data collection tools used in the research and the collection and analysis of the data obtained in the research are included.

### **2.1. Model of the research**

In this study, it is aimed to examine secondary school students' interest in STEM careers in terms of some variables. In accordance with this purpose, the relational survey model, which is one of the quantitative research approaches, was used in the study. The relational screening model is a research model that aims to determine the existence and/or degree of co-variability between two or more variables (Karasar, 2013). In this study, data were collected with Google forms for 2 months in the first semester of the 2022-2023 academic year.

### **2.2. Working group**

A total of 532 secondary school students were reached by simple random sampling method, since the implementation was based on volunteerism within the limitations of the study. In the study, the link of the survey form created via Google Forms was shared with the science teachers in the city center of Mus, and the student groups were asked to send the link. Data were obtained from returning students. In this direction, in the first semester of the 2022-2023 academic year, various public schools in the city center of Muş have completed the 5th, 6th, 7th grades. A total of 532 volunteer secondary school students, 235 boys and 297 girls from 8th and 8th grades, were determined as participants.

### **2.3. Data Collection Tool**

Two forms were used in the questionnaire prepared to obtain the data in the research. "Personal Information Form" was used to obtain the information constituting the independent variables of the research, and the "Interest for STEM careers Scale" was used to collect data on the interest in STEM careers, which is the dependent variable of the research.

Information on these forms is given below.

#### **2.3.1. Personal Information Form**

Within the scope of the research, a personal information form was cre-

ated in order to obtain the demographic information of the participants. In this form, students; their gender, grade level, having a study room, owning their own computer or tablet, owning their own smart phone, participating in STEM application before, whether there is internet in the house they live in, science and mathematics course grades of the previous semester. Questions were asked to determine the educational status of their mothers and fathers, the profession of their mothers and fathers, and the number of siblings.

### **2.3.2.STEM Careers Interest Scale (STEM-CIS)**

In order to reveal secondary school students' interest in STEM careers, the "STEM Careers Interest Scale" developed by Kier, Blanchard, Osborne, and Albert (2014) and adapted into Turkish by Koyunlu Ünlü, Dökme and Ünlü (2016) was used.

The Cronbach's Alpha internal consistency coefficient of the entire scale, whose validity and reliability studies were conducted by the researchers, is 93. It is a 5-point Likert-type scale consisting of 10 questions belonging to the sub-dimensions of Science-Technology-Engineering-Mathematics and a total of 40 items. The reliability of the total scale was calculated as 0.93, 0.86 for the science sub-dimension, 0.88 for the technology sub-dimension, 0.94 for the engineering sub-dimension, and 0.90 for the mathematics sub-dimension.

As a result of the analysis of the data obtained in this study, the Cronbach Alpha internal consistency coefficients for the Science, Mathematics, Technology and Engineering sub-dimensions of the scale were determined as 0.85, 0.89, 0.89 and 0.93, respectively. The Cronbach Alpha internal consistency coefficient for the overall scale was found to be 0.94. In this respect, the scale is accepted as a valid and reliable measurement tool.

### **2.4. Data Collection**

The prepared data collection tool was delivered to secondary school students through a digital questionnaire designed on the internet. The questionnaire link was sent to the science teachers in Muş, together with the ethical permission, and they were asked to ask their volunteer students to fill it out. At the beginning of the questionnaire, necessary information was given about the purpose of the study and no identity information, where the data will be used, how long it will take, and the essentiality of volunteering. After the information, data were collected from the students who wanted to participate in the study voluntarily. The survey link remained active for two months from the beginning of the 2022-2023 first semester. At the end of this period, a total of 532 secondary school students from different state schools in Muş filled the form.

## 2.5. Analysis of Data

SPSS 24 package program was used in the analysis of the data obtained in this study, in which quantitative patterns were used. Data entries were made by coding the independent variables in the personal information form and the items in the scales. Frequency (f), percentage (%), mean ( $\bar{x}$ ) and standard deviation values were used to describe the personal characteristics of secondary school students and their interest in STEM professions. In order to determine the statistical methods to be used before the relational data analysis was employed, the homogeneity of the obtained data was examined and it was examined whether it showed a normal distribution. The normality assumption and central distribution of the data were examined. As a result of the analysis, when the Histogram and Q-Q Plot graphs were examined, it was seen that they formed a distribution close to normal. Afterwards, the skewness and kurtosis coefficients were examined. The Kurtosis - Skewness and Cronbach Alpha Values of the STEM Professions Interest Scale are given in Table 1.

*Table 1. Skewness – Kurtosis and Cronbach Alpha Values of the STEM-CIS*

Scale	Sub-Dimensions	N	$\bar{X}$	SS	Skewness	Kustosis	Cronbach Alpha
STEM-CIS	Science	532	34.72	6.127	-.563	.562	.85
	Maths	532	39.93	7.286	-.750	.509	.89
	Technology	532	39.52	7.079	-.815	1.269	.89
	Engineering	532	35.98	8.971	-.443	-.171	.93
	All Scale	532	150.16	22.614	-.439	.590	.94

As a result of the normality test in Table 1, the Skewness value of STEMIÖ was -0.439, and the Kurtosis value was 0.590. If these values are between -1.5 and +1.5, it is accepted that they provide normality (Büyüköz-türk, 2012). As a result, it was seen that the data were normally distributed, so when analyzing the data, parametric tests were preferred, assuming that they were normally distributed. In order to determine whether the scores obtained by the students from the scale differ significantly according to the sociodemographic variables in the personal information form, two variables such as gender, having a study room, owning a computer or tablet, owning a smart phone, having participated in the STEM application before or not. , t-test for independent groups for whether there is internet at home, grade levels with more than two variables, science and mathematics course grades in the previous term, education level of mothers and fathers, occupation of mothers and fathers, one-way analysis of variance for number of

siblings (ANOVA) ) was tested. Scheffe test was also used to determine between which groups the significance found in ANOVA was. In all tests, judgment was reached depending on the significance level of 0.05 ( $p < .05$ ).

### 3. FINDINGS

In this section, STEM-CIS and its sub-dimensions are discussed under separate headings in terms of some independent variables (Gender, grade level, owning a computer or tablet, owning a smart phone, having internet at home, previous science and mathematics grades, educational status of mothers and fathers, number of siblings).

#### 3.1. Examination of STEM-CIS According to the Gender Variable Related Findings

Independent groups t-test was conducted to determine whether secondary school students' interest in STEM careers differed significantly according to the gender variable. The obtained results are presented in Table 2.

*Table 2. Independent groups t-test results for gender variable*

STEM Career Interest	Gender	N	$\bar{x}$	SS	t	p	Significant Difference
All Scale	Woman	297	148.06	22.511	-2.414	0.016	Man*-Woman
	Man	235	152.80	22.514			
Science	Woman	297	34.77	6.308	0.222	0.824	NON
	Man	235	34.66	5.903			
Mathematics	Woman	297	39.90	7.149	-0.125	0.900	
	Man	235	39.98	7.470			
Technology	Woman	297	38.47	7.290	-3.874	0.000	Man*-Woman
	Man	235	40.84	6.585			
Engineering	Woman	297	34.91	9.001	-3.114	0.002	
	Man	235	37.33	8.768			

\*: Indicates the variable in favor of the significant difference.

When the t-test results according to the “gender” variable of STEM-CIS are examined in Table 2; middle school students' STEM-CIS's overall scale ( $F_{(530)} = -2.414$ ;  $p < 0.05$ ), technology ( $t_{(530)} = 3.874$ ;  $p < 0.05$ , and engineering ( $t_{(530)} = -3.114$ );  $p < 0.05$ ), while the scores they got from the sub-dimensions differed according to gender, in the sub-factors of science ( $F_{(530)} = 0.222$ ;  $p > 0.05$ ) and mathematics ( $F_{(530)} = -0.125$ ;  $p > 0.05$ ) no significant difference was found.

### 3.2. Examination of STEM-CIS According to the Grade Level Variable Related Findings

One Way ANOVA was conducted to determine whether secondary school students’ interest in STEM careers differed significantly according to the class variable. The obtained results are presented in Table 3.

*Table 3. One-Way ANOVA results for grade level variable*

STEM Career Interest	Grade Level	N	$\bar{x}$	SS	F	P	Significant Difference
All Scale	5 <sup>th</sup> grade	142	155.19	18.994	9.667	0.000	5 <sup>th</sup> grade*-7 <sup>th</sup> grade 6 <sup>th</sup> grade*-7 <sup>th</sup> grade 5 <sup>th</sup> grade*-8 <sup>th</sup> grade
	6 <sup>th</sup> grade	158	154.06	21.603			
	7 <sup>th</sup> grade	155	143.65	22.643			
	8 <sup>th</sup> grade	77	145.96	26.786			
	Total	532	150.16	22.614			
Science	5 <sup>th</sup> grade	142	35.15	5.462	9.515	0.000	5 <sup>th</sup> grade*-7 <sup>th</sup> grade 6 <sup>th</sup> grade*-7 <sup>th</sup> grade 6 <sup>th</sup> grade*-8 <sup>th</sup> grade
	6 <sup>th</sup> grade	158	36.47	5.408			
	7 <sup>th</sup> grade	155	33.05	6.571			
	8 <sup>th</sup> grade	77	33.71	6.753			
	Total	532	34.72	6.127			
Mathematics	5 <sup>th</sup> grade	142	44.20	5.927	12.379	0.000	5 <sup>th</sup> grade *-7 <sup>th</sup> grade 6 <sup>th</sup> grade*-7 <sup>th</sup> grade 5 <sup>th</sup> grade*-8 <sup>th</sup> grade 6 <sup>th</sup> grade*-8 <sup>th</sup> grade
	6 <sup>th</sup> grade	158	40.91	6.466			
	7 <sup>th</sup> grade	155	37.97	7.429			
	8 <sup>th</sup> grade	77	37.71	9.116			
	Total	532	39.93	7.286			
Engineering	5 <sup>th</sup> grade	142	37.05	8.277	2.305	0.076	NON
	6 <sup>th</sup> grade	158	36.66	8.592			
	7 <sup>th</sup> grade	155	34.63	9.348			
	8 <sup>th</sup> grade	77	35.34	9.922			
	Total	532	35.98	8.971			
Technology	5 <sup>th</sup> grade	142	40.79	6.080	4.312	0.005	5 <sup>th</sup> grade*-7 <sup>th</sup> grade
	6 <sup>th</sup> grade	158	40.02	6.913			
	7 <sup>th</sup> grade	155	38.01	7.558			
	8 <sup>th</sup> grade	77	39.19	7.669			
	Total	532	39.52	7.079			

\*: Indicates the variable in favor of the significant difference.

When the One-Way ANOVA results according to the “grade level” variable of STEM-CIS are examined in Table 3; middle school students’ STEM-CIS overall scale ( $t_{(3-530)}=9.667$ ;  $p<0.05$ ), science ( $t_{(3-530)}=9.515$ ;  $p<0.05$ ), mathematics ( $t_{(3-530)}=12.379$ ;  $p<0.05$  and technology ( $t_{(3-530)}=4.312$ ;  $p<0.05$ ) scores differed according to the class variable, while engineering ( $F_{(3-530)}=2.305$ ;  $p>0.05$ ), no significant difference was found in the sub-factor. A significant difference is in favor of 5th and 6th grades between 5th and 6th grades and 7th grades, and 5th grades between 5th and 8th grades in the whole scale. Significant difference is in favor of 5th and 6th grades



between 5th and 6th grades and 7th grades in science sub-dimension, and 6th grades between 6th grades and 8th grades. In the mathematics sub-dimension, the scale is in favor of 5th and 6th grades between 5th and 6th grades and 7th grades, in favor of 5th grades between 5th and 8th grades, and in favor of 6th grade between 6th and 8th grades. . The significant difference is in favor of the 5th grades between the 5th and 7th grades in the technology sub-dimension.

### 3.3. Examination of STEM-CIS According to the Science Course Grade in the Last Term Variable Related Findings

One Way ANOVA was conducted to determine whether secondary school students' STEM careers interest differed significantly according to the science course grade variable of the previous term. The obtained results are presented in Table 4.

*Table 4. One-Way ANOVA results for the science course grade variable*

STEM Career Interest	Science Course Grade	N	$\bar{x}$	SS	F	P	Significant Difference
All Scale	0-24	10	145.60	26.044	7.440	0.000	(75-100)*-(25-49) (75-100)*-(50-74)
	25-49	35	138.89	27.744			
	50-74	167	146.22	22.568			
	75-100	320	153.59	21.226			
	Total	532	150.16	22.614			
Science	0-24	10	34.40	7.245	8.335	0.000	(75-100)*-(50-74)
	25-49	35	32.60	6.967			
	50-74	167	33.19	6.407			
	75-100	320	35.77	5.626			
	Total	532	34.72	6.127			
Mathematics	0-24	10	36.10	8.672	12.514	0.000	(75-100)*-(25-49) (75-100)*-(50-74)
	25-49	35	35.40	8.654			
	50-74	167	38.43	7.145			
	75-100	320	41.33	6.770			
	Total	532	39.93	7.286			
Engineering	0-24	10	36.40	6.186	0.376	0.771	NON
	25-49	35	34.46	10.331			
	50-74	167	36.19	8.272			
	75-100	320	36.03	9.253			
	Total	532	35.98	8.971			
Technology	0-24	10	38.70	6.290	5.682	0.001	(75-100)*-(50-74)
	25-49	35	36.43	9.098			
	50-74	167	38.41	7.797			
	75-100	320	40.46	6.264			
	Total	532	39.52	7.079			

\*: Indicates the variable in favor of the significant difference.

In Table 4, when the One-Way ANOVA results are examined according to the “ Science Course Grade “ variable of STEM-CIS; The whole scale ( $F_{(3-528)} = 7.440$ ;  $p < 0.05$ ), science ( $F_{(3-528)} = 8.335$ ;  $p < 0.05$ ), mathematics ( $F_{(3-528)}$ ) of secondary school students’ STEM-CIS = 12.514;  $p < 0.05$ ) and technology ( $F_{(3-528)} = 5.628$ ;  $p < 0.05$ ) sub-factor scores differed according to the science course grades of the previous semester, while engineering ( $F_{(3-528)} = 0.376$ ;  $p > 0.05$ ), no significant difference was found in the sub- dimensions. Significant difference is 75-100 points in all scale and mathematics sub- dimensions and 75-100 in favor between 25-49 and 50-74. Significant difference in science and technology sub- dimensions is in favor of 75-100 between 75-100 and 50-74.

### 3.4. Examination of STEM-CIS according to the Mathematics Lecture Grade Variable of the Last Term Related Findings

One-way analysis of variance (One Way ANOVA) was conducted to determine whether secondary school students’ interest in STEM career differed significantly compared to the variable of last semester’s mathematics course grade. The obtained results are presented in Table 5.

*Table 5. One-Way ANOVA results for the Maths Course Grade variable*

STEM Career Interest	Maths Course Grade	N	$\bar{x}$	SS	F	P	Significant Difference
All Scale	0-24	29	144.03	28.217	7.919	0.000	(75-100)*-(25-49) (75-100)*-(50-74)
	25-49	91	146.45	19.623			
	50-74	168	145.86	22.951			
	75-100	244	155.22	21.749			
	Total	532	150.16	22.614			
Science	0-24	29	34.76	7.424	4.055	0.007	(75-100)*-(50-74)
	25-49	91	34.30	5.098			
	50-74	168	33.58	6.113			
	75-100	244	35.66	6.207			
	Total	532	34.72	6.127			
Mathematics	0-24	29	34.21	9.770	33.275	0.000	(75-100)*-(0-24) (75-100)*-(25-49) (75-100)*-(50-74)
	25-49	91	36.92	7.148			
	50-74	168	38.04	6.535			
	75-100	244	43.05	6.100			
	Total	532	39.93	7.286			
Engineering	0-24	29	35.62	9.202	0.162	0.922	NON
	25-49	91	35.93	7.943			
	50-74	168	35.67	9.033			
	75-100	244	36.26	9.302			
	Total	532	35.98	8.971			
Technology	0-24	29	39.45	6.822	1.918	0.126	NON
	25-49	91	39.30	7.117			
	50-74	168	38.58	7.770			
	75-100	244	40.26	6.558			
	Total	532	39.52	7.079			

\*: Indicates the variable in favor of the significant difference.

When the One-Way ANOVA results according to the “Mathematics Course Grade” variable of STEM CIS are examined in Table 5; middle school students’ STEM CIS for the whole scale ( $F_{(3-528)} = 7.440$ ;  $p < 0.05$ ), science ( $F_{(3-528)} = 8.335$ ;  $p < 0.05$ ) and mathematics ( $F_{(3-528)} = 12.514$ ;  $p < 0.05$ ) sub-dimensions scores differed according to the previous semester’s mathematics course grade, while engineering ( $F_{(3-528)} = 0.376$ ;  $p > 0.05$ ) and technology ( $F_{(3-528)} = 0.376$ ;  $p > 0.05$ ), no significant difference was found in the sub-factor. Significant difference is 75-100 points in the whole scale, with 75-100 in favor between 25-49 and 50-74. In the science sub-factor, between 75-100 points and 50-74, 75-100 is in favor. In the mathematics sub-dimensions, 75-100 is in favor of 0-24, 25-49 and 50-74 is in favor of 75-100.

### **3.5. Examination of STEM CIS According to the Mother’s Educational Status Variable Related Findings**

One Way ANOVA was conducted to determine whether secondary school students’ interest in STEM career differed significantly according to the mother’s educational status variable. The obtained results are presented in Table 6.

*Table 6 . One-Way ANOVA results for the mother's educational status variable*

STEM Interest	Career	Mother's educational status	N	$\bar{x}$	SS	F	p	Significant Difference
All Scale		Can't read	42	142.52	23.565	2.630	0.011	Secondary school* Can't read
		Can read (illiterate)	27	142.63	27.156			
		Primary school	187	149.23	21.024			
		Secondary school	99	155.30	23.180			
		High school	114	148.91	22.993			
		Vocational school	28	152.82	24.188			
		University	28	156.68	18.463			
		Post Graduate	6	162.33	8.335			
		Total	532	150.16	22.614			
		Science		Can't read	42			
Can read (illiterate)	27			33.30	5.649			
Primary school	187			34.40	6.031			
Secondary school	99			35.17	6.758			
High school	114			34.24	6.153			
Vocational school	28			36.71	5.503			
University	28			37.36	5.272			
Post Graduate	6			37.33	4.132			
Total	532			34.72	6.127			
Mathematics				Can't read	42	35.93	7.260	4.398
		Can read (illiterate)	27	36.48	9.141			
		Primary school	187	40.00	7.224			
		Secondary school	99	41.38	7.048			
		High school	114	40.06	6.728			
		Vocational school	28	39.39	7.345			
		University	28	43.39	5.846			
		Post Graduate	6	41.50	5.958			
		Total	532	39.93	7.286			
		Engineering		Can't read	42	34.83	8.906	
Can read (illiterate)	27			35.11	8.045			
Primary school	187			35.35	9.195			
Secondary school	99			38.13	8.120			
High school	114			35.73	8.919			
Vocational school	28			36.00	10.694			
University	28			35.36	9.358			
Post Graduate	6			40.00	8.556			
Total	532			35.98	8.971			
Technology				Can't read	42	37.90	8.090	1.510
		Can read (illiterate)	27	37.74	8.401			
		Primary school	187	39.48	5.936			
		Secondary school	99	40.62	7.187			
		High school	114	38.89	7.641			
		Vocational school	28	40.71	7.200			
		University	28	40.57	8.212			
		Post Graduate	6	43.50	4.461			
		Total	532	39.52	7.079			

\*: Indicates the variable in favor of the significant difference.

When the One-Way ANOVA results according to the “Mother’s Educational Status” variable of STEM CIS are examined in Table 6; While the scores of secondary school students in the whole scale ( $F_{(7-524)}=2.630$ ;  $p<0.05$ ) and mathematics ( $F_{(7-524)}=4.398$ ;  $p<0.05$ ) sub-dimensions of STEM CIS differ according to their mothers’ educational status, science ( $F_{(7-524)}=1.920$ ;  $p>0.05$ ), engineering ( $F_{(7-524)}=1.291$ ;  $p>0.05$ ) and technology ( $F_{(7-524)}=1.510$ ;  $p>0.05$ ), no significant difference was found in the sub-factors. Significant difference is in favor of secondary school between secondary school and illiterate on the whole scale. In the mathematics sub-factor, the significant difference is in favor of secondary school between secondary school and, can’t read and in favor of university between university and can’t read.

### 3.6. Examination of STEM CIS according to the Variable of Father's Educational Status Related Findings

One Way ANOVA was conducted to determine whether secondary school students' interest in STEM professions differed significantly according to their fathers' educational status. The obtained results are presented in Table 7.

*Table 7. One-Way ANOVA results for the father's educational status variable*

STEM Career Interest	Father's educational status	N	$\bar{x}$	SS	F	p	Significant Difference
All Scale	Can't read	11	136.65	18.859	2.095	0.042	High school*-Can't read High school*-Primary school University*-Can't read University*-Primary school
	Can read (illiterate)	17	151.24	20.783			
	Primary school	109	144.83	25.241			
	Secondary school	111	150.08	20.953			
	High school	173	152.22	23.217			
	Vocational school	40	151.10	20.649			
	University	58	154.86	18.853			
	Post Graduate	13	154.15	24.141			
	Total	532	150.16	22.614			
Science	Can't read	11	32.18	6.063	0.921	0.490	NON
	Can read (illiterate)	17	35.47	5.980			
	Primary school	109	33.98	6.675			
	Secondary school	111	34.44	5.605			
	High school	173	35.06	6.273			
	Vocational school	40	34.65	5.559			
	University	58	35.67	5.945			
	Post Graduate	13	36.00	6.442			
	Total	532	34.72	6.127			
Mathematics	Can't read	11	34.64	6.345	2.271	0.028	Can read (illiterate)*-Can't read Secondary school*-Can't read High school*-Can't read High school*-Primary school Vocational school*-Can't read University*-Can't read University*-Primary school Post Graduate*-Can't read
	Can read (illiterate)	17	40.41	6.820			
	Primary school	109	38.50	8.452			
	Secondary school	111	39.95	6.480			
	High school	173	40.25	7.715			
	Vocational school	40	40.38	5.878			
	University	58	42.05	5.568			
	Post Graduate	13	40.62	6.615			
	Total	532	39.93	7.286			
Engineering	Can't read	11	33.55	8.335	0.901	0.505	NON
	Can read (illiterate)	17	37.41	7.107			
	Primary school	109	34.32	9.421			
	Secondary school	111	36.32	8.386			

	High school	173	36.49	9.275	
	Vocational school	40	36.10	8.802	
	University	58	36.55	8.656	
	Post Graduate	13	37.54	10.469	
	Total	532	35.98	8.971	
	Can't read	11	36.27	9.122	
	Can read (illiterate)	17	37.94	5.673	
Technology	Primary school	109	38.03	7.421	1.791 0.087
	Secondary school	111	39.36	6.781	
	High school	173	40.42	6.940	
	Vocational school	40	39.98	7.553	
	University	58	40.59	5.994	
	Post Graduate	13	40.00	9.548	
	Total	532	39.52	7.079	

\*: Indicates the variable in favor of the significant difference.

In Table 7, when the One-Way ANOVA results are analyzed according to the “Father’s Educational Status” variable of STEM CIS; The scores of secondary school students on the whole scale ( $F_{(7-524)}=2.095$ ;  $p<0.05$ ) and mathematics ( $F_{(7-524)}=2.271$ ;  $p<0.05$ ) sub-dimensions of STEM CIS were determined according to their fathers’ education level. differed, while engineering ( $F_{(7-524)}=0.901$ ;  $p>0.05$ ), technology ( $F_{(7-524)}=1.791$ ;  $p>0.05$ ) and science ( $F_{(7-524)}=0.921$ ;  $p>0.05$ ), no significant difference was found in the sub-dimensions. The significant difference is in favor of high school graduates among high school graduates and primary school graduates, and in favor of undergraduate graduates between university and can’t read and primary school graduates in all scales. In the mathematics sub-factor, there was a significant difference between can read (illiterate) and can’t read in favor of can read (illiterate), between secondary school graduates and can’t read in favor of secondary school graduates, between high school graduates and can’t read and primary school graduates in favor of high school graduates, and between vocational school and vocational school graduates. between can’t read and can’t read in favor of vocational school, between post graduate and can’t read and primary school graduate in favor of post graduate graduate, between university and can’t read in favor of university graduate.

In the study, it was determined that the interests of secondary school students in STEM career did not differ statistically significantly according to the variables of owning their own computer and tablet, owning their own smart phone, having internet at home and the number of siblings.

#### 4. CONCLUSION and DISCUSSION

In this section, the findings of the study are interpreted and compared with previous studies.

In the study, when the interests of secondary school students in STEM professions were examined according to the gender variable, there was no significant difference in the science and mathematics sub-factors, while a significant difference was found in favor of men in the technology and engineering sub-factors throughout the scale. Finding a significant difference across the scale indicates that the gender factor is a factor on the interest in STEM professions and that male students are more interested in STEM careers than female students. The significant difference in favor of male students in the sub-dimensions of technology and engineering is similar to some research findings in the literature (Azgın & Şenler, 2019; Bozgeyikli, Durmuşçelebi & Akyar, 2018; Christensen & Knezek, 2017; Ergün, 2019; Ing, Aschbacher & Tsai, 2014; Koyunlu Ünlü & Dökme, 2020; Wyss et al., 2012). This may be because women develop professional beliefs about gender in the form of ‘male occupations’ and this is a dangerous situation for the female population in the future job field (Liben & Bigler, 2002). On the other hand, there are also studies in the literature that conclude that students’ STEM career interests do not differ by gender (Brown, Concannon, Marx, Donaldson & Black, 2016; Karakaya, Avgin & Yılmaz, 2018; Kırıktaş & Şahin, 2019).

In the study, when the interest of secondary school students in STEM careers was examined according to the grade level variable, there was no significant difference in the engineering sub-dimension, while a significant difference was found in the science, mathematics and technology sub-dimensions throughout the scale. In the research, it was concluded that the interests of the 5th and 6th grades were significantly higher than the 7th and 8th grades. As the grade level increases, the subject density in the lessons increases. It is thought that this situation causes a decrease in students’ interest in STEM professions. There are studies on this situation in the literature. Knezek et al. (2013), as a result of their study, determined that 6th grade students mostly preferred careers in STEM fields. Karakaya and Avgin (2016), in their research, determined that the increase in grade level had a negative effect on secondary school students’ attitudes towards STEM.

In the study, when the interest of secondary school students in STEM careers was examined according to the science and mathematics grades of the previous term, there was a significant difference in the whole scale and mathematics, science and technology sub-dimensions, but no significant difference was found in the engineering sub-dimension. Studies have shown

that there is a positive and high relationship between student achievement in science and mathematics courses and student attitudes towards these courses (Turhan et al., 2008). This situation affects the career goals of students (Choi & Chang, 2011). When the literature is examined, Olivarez (2012) in her doctoral study concluded that there is an effective connection between students' academic achievement in science, mathematics and reading and STEM programs. Dabney et al. (2012) stated that students with higher grades in science and mathematics are more interested in careers in Science, Technology, Engineering and Mathematics professions.

In the study, when the interest of secondary school students in STEM professions was examined according to the educational status of their mothers and fathers, there was a significant difference in the whole scale and mathematics sub-dimensions, while no significant difference was found in the science, mathematics, engineering and technology sub-dimensions. In the study, it was concluded that as the education levels of mothers and fathers increased, students' interest in STEM careers increased. It has been observed that there are similar results in the relevant literature (Akgün, 2015; Gelbal, 2008). Family is one of the most important environmental factors that direct young children. Creating supportive environments for children's development, meeting their spiritual needs, and providing the right direction may have increased their interest.

## **5. RECOMMENDATIONS**

In this section, the results obtained from the findings of the research are stated and recommendations are made in this direction.

The study was limited to one province. This situation makes it difficult to predict the study for Türkiye in general. For this reason, sample selections from seven regions of the country may make the study more effective and predict the general population more strongly.

In order for our country to gain a stronger position in education and economy, a burden falls on women as well as men. Despite this, women lag behind men in STEM fields in our country, as in the rest of the world. In this context, activities and organizations that will arouse interest in the fields of STEM professions, encourage them and increase their interest in STEM, especially for female students, can be organized and their participation can be ensured.

Due to the effect of parents' education level on the formation of professional interest at a young age, guidance studies can be carried out to raise awareness on the effects of STEM professional fields and their effects on future generations, in order to meet this need, especially for parents with a low level of education.



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## CHAPTER 8

### **META-ANALYTICAL RESEARCH ON THE INFLUENCE OF PARENTAL INVOLVEMENT ON STUDENTS' ACADEMIC SUCCESS**

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## Introduction

The current research presents and discusses meta-analyses and their findings related to the impacts of parental involvement and participation on academic success of students. Parental involvement is recognized as a social need for children and adolescents. Parents regard it as their right and responsibility to be involved in the education of their children and adolescents and endeavor to promote, nurture and enhance their educational and academic development. In general, positive family-school collaboration may contribute to the educational and academic development and achievement of children and adolescents. In a general sense, parental involvement can be defined as the efforts and active participation of parents in all aspects of children and adolescents to provide them better and more successful social, emotional and academic development. Parental educational involvement refers to a broad series of issues, such as parents' expectations about academic future of their children, controlling homework, helping them to learn schoolwork or do homework, as well as the frequency or degree of parents' physical presence at school. Educational involvement may come forth depending on the personal parental decisions and indicate the attitudes and behaviors parents have developed for their children and adolescents. Promoting academic success through socializing, adopting, internalizing, enhancing and supporting values such as holding high expectations for educational achievement and acquisition, parental involvement such as helping with homework and volunteering require direct parental involvement along behavioral and psychosocial dimensions. Parents may contribute to the learning process through home-based activities and can directly take part in education of their children by helping them with their homework assignments (Chen & Gregory, 2010). When parental involvement is regarded as a tool that improves and increases children's academic success, its nature as an independent variable and its potential degree of influencing students' educational outcomes turns into a research topic in itself.

Many studies have proposed that parental involvement and participation can function as a protective factor against negative and harmful effects in poor SES families and disadvantaged, vulnerable groups (Chen & Gregory, 2010; Hango, 2007; Lee & Bowen, 2006; Strayhorn, 2010). Research studies have focused on the effectiveness of programs aimed at promoting parental educational involvement (Jeynes, 2010), possible alternatives to encourage parental involvement (LaRocque, Kleiman, & Darling, 2011), perception of different members in educational communities to have the nature and connotation of parental involvement (Anderson & Minke, 2007; Barinyak & McNeelly, 2009; Tekin, 2011) or the most effective style of parental involvement and participation (Park, Byun & Kim,

2011). Studies have examined parental involvement and participation as a factor influencing educational success of students, or at least as a catalyst of other relevant reasons, facilitating, accelerating, and enhancing academic achievement. It has been stated that parental involvement and participation is a versatile phenomenon as it encompasses minor differences and a wide range of topics.

The meta-analyses examined studies focusing on different aspects of parental involvement, sometimes with different and varying results, and strived to synthesize across groups and understand the causal chain linking variables. The researchers set out to determine the extent to which parental involvement and participation in the education of their children and adolescents may contribute to developing and enhancing academic achievement through meta-analytical studies; the size of its impacts; and how different ways conceiving its characteristics might influence the consequences. Consequently, the research findings could be useful for parents, teachers and politicians etc.

### **The Method Used in Meta-analyses**

In order to investigate the association between parental participation and students' academic success, the meta-analyses selected the studies to be discussed employing database of scientific literature in this field, such as ERIC, Sociological Abstracts and Psych Info. In line with the conceptual index, the keywords used in the initial searches to examine the association between parental educational involvement and participation, and students' educational success included parental educational involvement, parental participation, parental educational support, family involvement, educational success, and educational consequences. The meta-analyses have selected and incorporated research, mostly published in scientific journals, to review and investigate. Selected studies encompassed some measures of parental involvement and participation in children's education and included students from kindergarten to the end of compulsory schooling. Research studies included in the meta-analysis have established the association between parental involvement and participation, and students' academic success by calculating correlation coefficients or estimates of regression models. The research sample comprised students and their families from studies addressed by the meta-analysis. The research sample was selected and included in studies that confirmed the influence of parental involvement and participation in the meta-analysis on the academic achievement of students in different populations, or analyzed the influence of different styles of parental involvement and participation on students' educational success as a dependent variable. Thus, the meta-analyses compiled correlation coefficients and beta coefficients from the studies they reviewed and analyzed, and as a result, they calculated the effect sizes of

parental involvement and participation on educational success of students.

The researchers coded each research study they included in their meta-analyses. They recorded the related sample size for each effect size and tried to establish various aspects and dimensions of parental involvement as independent variables. The following categories of parental involvement have been identified for the study: (1) General definition of parental involvement and participation. Such a definition includes a general measure of family involvement and participation. (2) Communicating with children on school-related topics. Frequency with which parents talk about and discuss school-related topics with their children. (3) Parents controlling and supervising homework and schoolwork. Frequency with which parents supervise or aid their children with homework. (4) Parents' educational expectations from their children. The highest level of studies that parents expect from their children and their expectations for education and academic success of their children. (5) Reading to children. The frequency of parents' reading to their children. (6) Parents attending and participating in school activities. Frequency of parents' participation in school-related activities. (7) The style of socializing, educating and raising children. Attitudes and behaviors of parents supporting and helping their children at home. Existence of rules laid down by parents for their children to deal with homework and determine their leisure time. Meta-analyses established parental involvement and participation as independent variables, and students' academic performance and academic achievement as dependent variables. Types of academic skills used as various measures of success included (1) general academic achievement, (2) reading, (3) mathematics, (4) sciences, (5) social sciences, (6) foreign language, (7) skills in other subjects such as art, painting, music.

### **Meta-Analytical Research Studies and Research Findings**

There are numerous meta-analyses that examine various aspects of the association between parental educational involvement and participation, and the educational achievement of children and adolescents. These meta-analyses focused on explaining various aspects of parental educational involvement such as (a) general parental involvement and participation, (b) talking about and discussing different aspects of school-related topics with their children, (c) control and supervision of homework related to school subjects, (d) parental expectations for children's education and academic success, (e) reading to children, (f) taking part in school activities, and (g) socializing, educating and rearing children (Fan & Chen, 2001). It has been asserted that researchers should display a holistic approach that keeps in view its multidimensionality and combines both behavioral and psychological aspects in order to explain parental involvement (Chen & Gregory, 2010). The meta-analytical studies conducted so far may be divided into



two main groups. Some meta-analyses have investigated the general association between parents' spontaneous involvement and participation, and academic success of students (Jeynes, 2003, 2005b, 2007). Yet some other meta-analyses have assessed programs of parental involvement and participation (Erion, 2006; Patall, Cooper, & Robinson, 2008; Jeynes, 2012). In 2001, Fan and Chen carried out a study titled "Parental Involvement and Students' Academic Achievement: A Meta-Analysis," to synthesize research. 25 studies published between 1982 and 1997 were participated in the meta-analysis. Their meta-analysis revealed that parental educational involvement had a positive influence on educational outcomes of students and discovered a small to moderate significant association between parental educational involvement and educational outcomes of students. The analysis, with an effect size of 0.25, confirmed the relationship between parental educational involvement and participation and educational achievement. The relationship was stronger with an effect size of 0.33 when academic success was measured by grade points average (GPA) compared to other course grades such as math grade. Parental educational and academic expectations demonstrated the strongest impact on academic success of students with an effect size of 0.40. Parental aspirations and expectations for their children's educational success displayed the strongest relationships with students' academic success, while parental control and supervision of children at home showed the weakest relationships. Mattingly et al. (2002) carried out a synthesis entitled "Evaluating Evaluations: The Case of Parent Involvement Programs" on 39 studies published between 1969 and 1998, and they evaluated different programs for parental involvement and participation in their children's education from kindergarten to secondary school. Nevertheless, they failed to find evidence to support a link between parental interventions that reflected parental involvement and participation, and improvements and enhancements in learning of students.

Jeynes carried out four meta-analyses. In his 2003 meta-analysis, Jeynes analyzed 21 studies published between 1988 and 1999 to establish the effects of parental educational involvement and participation on the academic success of minority children. The meta-analysis focused on the effect of general and specific parental educational involvement (such as communicating with children; control and supervising of schoolwork and homework; educational expectations of parents; encouraging for reading outside the classroom; leisure time activities; parental style in socializing, educating and rearing children; as well as love) on the academic performance of students across compulsory education. In the meta-analysis, both the overall effects and specific elements of parental involvement obtained for each study were identified. Grades, standardized tests, and assessment scales generally evaluated by teachers as well as other scales consisting of

indicators of academic attitudes and behaviors were used as four different measures of academic success. The results revealed that parental involvement was significant for all minority groups.

Jeynes included 41 studies published between 1969 and 1999 in his 2005 meta-analysis and investigated the association between parental educational involvement and the academic success of elementary school students in urban areas. The analysis exposed effect sizes for general parental educational involvement as well as subcategories of this parental involvement. The results indicated a significant association between general parental involvement and students' academic success. Despite differences in ethnic minorities or gender, parental involvement affected students' academic performance as a whole with an effect size of 0.7 to 0.75 and a standard deviation of one. Parental educational expectations had the greatest effect on students' academic achievement, with an average influence size of 0.58. The mean influence sizes of parents were 0.42 for reading to their children, 0.24 for communicating, talking about and discussing school topics with children, 0.31 for the style of socializing, educating and rearing children, while it was found to be negative for parental control regarding homework (-.08).

In his 2007 meta-analysis, Jeynes focused on 52 studies published between 1971 and 2002 to examine the influence of parental educational involvement on the educational success of secondary school students. He conducted statistical analyzes to determine the overall effect of both parental involvement and specific elements of this parental involvement. Grades, standardized tests, and assessment scales generally evaluated by teachers as well as other scales consisting of indicators of academic attitudes and behaviors were used as measures of academic achievement. As a whole, parental involvement affected all academic variables with effect sizes of 0.5 to 0.55 and a standard deviation of one. The mean effect sizes of general parental involvement were .46 for general academic achievement, 0.40 for grades, 0.47 for standardized tests, and 0.43 for others, respectively. Once again, parental involvement confirmed its positive influence on the academic success of secondary school students with an effect size of 0.46. Also, effect sizes were determined for various elements of parental involvement. The largest impact sizes were linked to parents' educational expectations of their children. The mean effect size was found to be 0.88 with one standard deviation regarding parents' educational expectations. Average effect sizes were found to be .40 for the parental style of socializing, educating and rearing children, 0.24 for communicating, talking about and discussing school-related topics with children, and 0.32 for controlling homework with one standard deviation. Socioeconomic factors had a great impact on parental involvement. Besides, parental involvement differed

according to ethnicity and SES. A high correlation was found between socioeconomic status and parental involvement. Well educated parents often supported the education of their children and adolescents and played a decisive role in their education. High SES parents attached more value on the importance to a decent education to be successful in life (Grayson, 1999; Mulroy, Goldman, & Wales, 1998). The results demonstrated that overall parental involvement was significant for secondary school students.

Erion (2006) reviewed 37 studies published until 2004 in his meta-analysis and explored the effectiveness of parents providing private tutoring and academic education to their children in basic skills such as reading and mathematics across grade level. The mean effect size was found to be 0.55 for group design studies. Patall et al. (2008) included 14 studies published between 1987 and 2004 in their meta-analysis and examined parental involvement in homework. In this meta-analysis of 14 studies using parent education for homework involvement, educated parents were more involved and engaged in their children's homework. Children of educated parents who were more involved and engaged in homework of their children could usually complete their homework assignments, encountered fewer problems doing their homework, and displayed more improved and enhanced academic performance. The meta-analysis reported positive relationships for elementary and high school students yet a negative one for secondary school students. It revealed a stronger relationship for parental rulemaking strategy and a negative one for mathematics achievement; however, there was a positive relationship for verbal achievement outcomes compared with other parent involvement strategies. Both empirical and correlational studies have suggested that parental involvement in homework produces desirable effects for elementary school students. Considering that younger students displayed less developed study habits, parental involvement could serve as an opportunity to learn academic content and to develop and internalize study skills as well as effective types of self-direction that parents modeled. Parental involvement in homework could be influential to a certain extent for academic success in elementary school, as parents have greater proficiency and expertise in the school subjects included in the first grades (Cooper, 2001).

Both empirical and correlational studies have revealed that secondary school students often do not benefit from their parents' involvement in homework. It has also been noted that parents should be conscious and aware of their children's developmental stages while they get involved and engaged in their children's homework. Adolescents have tried to develop some level of independence and autonomy from their parents in many areas during adolescence (Erikson, 1968; Gutman & Midgley, 2000). The transition to secondary school has been a potentially difficult time for

many children (Gutman & Midgley, 2000), often with an increase in the intensity of parent-child conflicts (Laursen, Coy, & Collins, 1998). When parents offered behavioral strategies for doing homework or provided direct assistance with homework, this style of parental involvement was found to be more effective for elementary school students and they were able to benefit more from this style of involvement. It has been deemed important that parents progressively withdraw from the homework process for students who reach adolescence and change their style of involvement to support children's own autonomous initiatives and efforts more. Patall et al. (2008) indicated the presence of a significant and positive correlation between parental educational involvement in homework and educational success of high school students. Parental involvement could have an effect on students, as parents provided assistance and support, which became highly individualized and specialized during high school years. Parents started to display direct involvement in homework, especially when they shared knowledge in a particular field with their children. Hence, although parents' involvement in homework became less frequent as students grew older (Eccles & Harold, 1996; Hoover-Dempsey & Sandler, 1997), parents could be more effective when they were involved in homework of their children. These results seemed somewhat inconsistent with the research findings obtained by Jeynes (2005, 2007), who asserted that parental involvement in homework was not related with the academic success of elementary school students, but had a significant and positive relationship with the academic success of secondary school students. The inconsistency between the results of meta-analyses undertaken by Jeynes's (2005, 2007) and Patall et al.'s (2008) could be explained by the fact that Jeynes used only urban student communities and combination of secondary and high school students in their analysis; whereas, Patall et al. (2008) reviewed secondary and high school students separately in their meta-analysis. Although overall impacts of parental educational involvement in children's homework on students' educational success are often small or non-existent, various styles of involvement have displaced varying effects. Setting rules about doing homework *in the right place at the right time* had the strongest positive association with students' academic success. When parents set rules for homework, they clearly conveyed their expectations, provided suggestions, and reinforced, supported, and strengthened behavior when the rules were followed. In consequence, these strategies can be a particularly effective way of increasing efficacy of the time students engage in homework and the time they use, or both. In due course, this involvement strategy has been able to provide long-term benefits for children's academic success to the extent that it helps to develop self-regulation skills and children abide by, engage in, adopt, and internalize homework rules. Parental control and supervision of children's homework was negatively

related to students' academic success, whereas direct parental assistance to homework was positively related to students' academic success.

In their meta-analysis, Senechal and Young (2008) synthesized studies published between 1970 and 2005, focusing on 16 studies. All had a control group and involved 1340 families. They examined studies testing whether parents' reading to their children increased children's reading acquisition. Their meta-analysis discovered that parental involvement and participation had a positive impact on children's reading acquisition. Parents who provided private tutoring to their children using certain literacy activities produced greater effects compared to their peers who listened to their children read. Programs that trained parents to teach their children to read had the strongest effect on reading acquisition, with an effect size of 0.65. Reading to children at home required more resources from educators. They provided information about reading in a statement and made sure that parents were able to use their children's books in a purposeful manner. Training parents to listen to their children's reading required further resources. There was a need for educators to prepare and equip parents with necessary information to learn certain techniques and to offer workshops. Once the techniques were acquired, parents wanted to implement them while listening to their children read. Training parents to tutor their children by means of specific activities and structured programs required many resources offered by educators. Educators trained parents to plan or select effective programs and activities, relevant reading materials for the purpose of providing their children with reading skills and reading acquisition. When parents provided private tutoring to their children with activities and listened to their children read, children improved their literacy skills. More particularly, when compared to listening to their children read aloud, parents who tutored their children using various activities was twice as effective in increasing literacy. However, three studies in which parents read to their children did not produce significant reading outcomes.

In 2009, Hill and Tyson carried out a meta-analysis entitled "Parental Involvement in Middle School: A Meta-Analytic Assessment of the Strategies That Promote Achievement" and reviewed 50 studies published between 1986 and 2006 in their study. The analysis determined that parental educational involvement and participation affected educational achievement of students, and that the styles of involvement and participation were related to academic achievement. These research findings once again confirmed the existence of a positive association between parental involvement and participation and students' educational success. Although the global influence size seemed statistically significant, if very small (0.04), analysis of the conclusions demonstrated a high heterogeneity in influence sizes when stated as a function of operationalizing parental educational in-

volvement and participation. While the academic socialization dimension demonstrated the strongest association with the academic success of the students with an effect size of 0.39, aiding with homework had the greatest negative impact on academic success with an effect size of -0.11. Parental involvement was positively related to students' academic success throughout secondary school. The styles of parental involvement were also important and parents led to an understanding in children about the objectives, goals and meaning of their academic performance by engaging in their education. Academic socialization, which requires conveyance of educational expectations to children and providing them with strategies that they can use effectively, has had the strongest positive association with students' academic success. By means of academic socialization, parents conveyed to their children and adolescents the value and significance of education and their expectations for academic success, promoted, nurtured and enhanced their educational and professional aspirations and expectations; on the other hand, they talked about and discussed learning strategies with them and met their areas of interest and goals. They made preparations and plans for the future in connection with the topics addressed and discussed at school. Parental involvement could socialize children academically in terms of educational goals and objectives, and such socialization was most significantly associated with academic achievement and provided adolescents with useful strategies that they could make use of while making semi-autonomous decisions. Academic socialization, which is a specific style of involvement, had the strongest positive relationship with students' academic success throughout secondary school. Involvement in helping with homework and supervising or checking homework emerged as the only style of involvement that was not consistently associated with students' academic success. School-based parental involvement was less strongly associated with students' academic success. School-based involvements such as visiting school, volunteering at school, and taking part in school organizations were moderately associated with students' academic achievement. Parental involvement in helping with homework was not consistently related to students' academic success, while other styles of home-based parental involvement were positively related to academic success of students

In another meta-analysis, Jeynes (2012) included 51 studies published between 1964 and 2006 and explored the association between various styles of parental involvement programs and the academic success of students from kindergarten to the 12<sup>th</sup> grade. The analysis revealed a significant association between parents' general involvement programs and the educational achievement of both pre-elementary and elementary school students and secondary school students. Parental involvement programs as

a whole were related to higher academic success of students. Various styles of parental involvement programs as well as effect sizes for certain general parental involvement programs were established. The overall effect sizes were found to be 0.30 for general parental involvement programs, .29 for pre-elementary and elementary school students and 0.35 for secondary school students. Furthermore, the effect sizes of different styles of parental involvement on students' academic success were also determined. Shared reading program, which requires parents and their children to read together, was most strongly associated with students' academic success with an effect size of 0.51. The collaboration and collective work of parents and teachers as equal partners to improve and enhance children's academic and behavioral outcomes had the second largest impact on academic achievement of students, with an influence size of 0.35. With their school-based orientation, parents collaborated and cooperated with teachers to develop common strategies, rules, suggestions and expectations that could be essential, appropriate and constructive in order to develop and expose students' full potential and help them live up to this potential. In the meta-analysis, other effect sizes were determined as 0.27 for homework control and 0.28 for parent-teacher communication.

Castro et al. (2015) included 37 studies published between 2000 and 2013 in their meta-analysis in which they examined the total influence of parental involvement and participation on the academic success of kindergarten, elementary, and secondary school students. Table 1 presents extracted information about the meta-analysis. Researchers sought answers to the following research questions: (1) What is the power of the association between parental educational involvement and students' educational success? (2) What are the factors that affect this association? The meta-analysis found the strongest links between parental educational involvement and students' academic success when families had high educational expectations for their children, improved and maintained communication with them about school-related activities, and helped them strengthen their reading habits. The parents who were most closely related to high academic achievement often focused on control and supervision of learning activities of their children. In the meta-analysis, the researchers established several variables, including education level, type of community, type of publication, which may affect the association between parental educational involvement and participation and educational achievement of children. In an effort to demonstrate the educational level and stages they focus on, the researchers used the following codes: kindergarten (1), elementary school (2), secondary school (3), kindergarten and elementary school (12), kindergarten and secondary school (13), elementary and secondary school (23), kindergarten, elementary and secondary school (123). In the

meta-analysis, the type of community was divided into two categories: 1 = the general community and 2 = specific groups, such as communities at risk of exclusion, inequalities or discrimination, or groups of people in need of special education. The author/s, the year and the title of the studies that were selected and examined were recorded and types of publications contained articles, books, doctoral theses, research reports et al. While the research sample included great cultural differences among families from Egypt, Korea, the United States, or Mexico, the largest number of studies came from the United States, with families from different social and ethnic backgrounds. Each of these studies corresponds to a separate cultural background; however, we do not have a sufficiently large number of studies.

Table 1 Meta-analysis by Castro et al. (2015)

	Mean	Median	Standard deviation
Sample Size	1423.69	424	2670.91

	Number of Research N	Percentage (%)	Mean Effect Size
General Involvement of Parents	108		0.124
<b>Type of Parental Involvement</b>			
(1) General description of parental involvement and participation	37	% 34,26	0.167
(2) Communication, conversations and discussions with children about school-related issues	6	% 5,56	0.200
(3) Parent's controlling, supervising and supporting children's homework and schoolwork	18	% 16,67	0.024
(4) Educational expectations of parents	8	% 7,41	0.224
(5) Reading with children	4	% 3,70	0.168
(6) Parent's participation in school activities and meetings	21	% 19,44	0.010
(7) Parental style of socializing, educating and rearing children	14	% 12,96	0.130
<b>Measure of Academic Success</b>	N	Percentage (%)	
General Academic Success	51	% 47,22	0.142
Reading	19	% 17,59	0.084
Mathematics	22	% 20,37	0.063
Sciences	2	% 1,85	-0.013
Foreign language	8	% 7,41	0.045
Other subjects such as art, painting, music, etc.	6	% 5,56	0.391
<b>Type of Academic Success Measure</b>	N	Percentage (%)	
Standardized tests	57	% 52,78	0.146
Unstandardized tests	49	% 45,37	0.091
Not specified	2	% 1,85	0.326
<b>Educational Level</b>	N	Percentage (%)	
Kindergarten	11	% 10,19	0.050
Elementary	33	% 30,56	0.125
Secondary	55	% 50,93	0.138
Kindergarten and elementary	3	% 2,78	-0.050
Elementary and secondary	6	% 5,56	0.091
<b>Type of Population</b>	N	Percentage (%)	
General population groups	44	% 40,74	0.134
Special population groups such as groups at risk of exclusion, inequalities or discrimination, or groups with special educational needs	64	% 59,26	0.119
<b>Type of Publication</b>	N	Percentage (%)	
Article	93	% 86,11	0.104
Doctoral thesis	13	% 12,04	0.150
Others, (dissertation etc.)	2	% 1,85	0.194

Source: Castro, et al. (2015) pp. 39, 40



Table 1 shows the correlation coefficients or beta-coefficients obtained from studies that form the sample of Castro et al.'s meta-analysis, as well as the variables and means of the effect size in the association between parental educational involvement and students' academic achievement. At this point, some categories included a very limited number of studies. The number of studies accepted as sufficient is connected to the significance of this associated impact. Although only four studies addressed examining 'reading with children' status, the related error was minimal and, consequently, the results appeared statistically significant. Conversely, only two studies have accepted "science" as a dependent variable, with a relatively large error in the sense that these conclusions were not statistically significant. For this reason, the negative sign related to its influence could not be sufficiently interpreted. It was concluded that parental involvement was not so important for success in science. Curiously, the influence of parental involvement and participation in school activities, a category addressed by the 21 studies, was very small and insignificant for children's academic achievement due to error size. It was concluded that when parental involvement only suggests participation in school activities, it does not have an significant impact on the academic success of children.

As seen in Table 1, Castro and colleagues found the mean influence size for all studies to be 0.124 in their meta-analysis. This result indicated a positive correlation between greater educational involvement and engagement of parents and better academic outcomes of students. However, it is especially noted that this effect size is small on the basis of the criteria of Cohen (1969) or moderate on the basis of the criterion of Baumert et al., (2006) in its practical significance. The effect size mean of 0.124 was lower than the effect size mean found in Jeynes' (2003, 2005, 2007, 2012) meta-analysis and closer to the value obtained in Fan and Chen's (2001) meta-analysis. Castro et al.'s meta-analysis revealed that all educational involvements of parents were significant, with the exception of parental involvement and participation in school activities, and the magnitude of the notified impacts did not surpassed 0.224. Thus, all other factors being equal, the educational and academic success of children could be higher than 59 % of the distribution, with one standard deviation above the mean, when their parents were involved and engaged in education of children. Statistically significant differences in effect sizes showed up as a function of different variables regulating the influence of parental educational involvement on academic success of children. Variables such as the style of parental involvement and participation, the extent of educational and academic achievement, the educational level of students, and the type of community regulated the influence of parental involvement in academic success of children. Different styles of parental involvement produced dif-

ferent influence sizes on achievement of students. Compared with other parental involvement styles, the effect of parental expectations of educational and academic success was the largest, with an average effect size of 0.224. This result was compatible and consistent with the findings in previous meta-analyses (Fan & Chen, 2001; Jeynes, 2005, 2007), which proved that parental educational aspirations and expectations for their children displayed the strongest connection with students' academic achievement. The average effect size determined in previous meta-analyses was even larger than the average effect size of 0.224 obtained in the meta-analysis performed by Castro, et al. (2015).

As shown in Table 1, the meta-analysis performed by Castro et al. found that the effect of parental control and supervision of schoolwork and homework on students' academic performance was very small with an effect size of 0.024, and the effect size was proved to be statistically insignificant for parental involvement and participation in school activities. These results were surprising when compared to the findings in the study conducted by Jeynes (2003). In his meta-analysis, Jeynes (2003) found that the effect of parental control and supervision of their children's homework on academic performance of students was the largest with an effect size of 0.72, and that the effect size of parental involvement and participation in school activities on students' academic performance ranged between 0.51 and 0.62. Conversely, Hill and Tyson (2009) emphasized in their meta-analysis the negative magnitude of the influence of helping with homework on academic performance of students was (-0.11). As shown in Table 1, Castro and colleagues found in their meta-analysis that communicating, talking about and discussing school activities with children was the factor with the second largest influence on academic outcomes of students, with a mean influence size of 0.2. The analysis unveiled mean effect sizes of 0.168 for reading to children, 0.167 for parental involvement and participation, and 0.130 for the style parents use to socialize, educate, and rear their children. All of them were variables with significant influence on students' academic outcomes. These results seemed compatible and consistent with other meta-analyses (Jeynes, 2003, 2005b). Differences in mean influence size were observed when academic success was measured globally or through some particular aspects of it. When various courses were accepted as the measure of academic success, the effect sizes varied and differed in subjects and were found to be 0.391 for art and music etc, 0.142 for academic success, 0.084 for reading, 0.063 for mathematics, 0.045 for foreign language. The greater correlation between parental involvement and participation and global measures of academic success or other program topics was compatible and consistent with the results obtained in Fan and Chen's (2001) meta-analysis with effect sizes of 0.40 and 0.30, respectively. In

studies using a standard measure of academic success, the mean effect size (0.146) was found to be higher than the mean effect size (0.091) obtained in studies including non-standard measures. Jeynes (2007, 2012) also obtained similar results in their meta-analysis and showed that the association between parental educational involvement and academic outcomes can be slightly stronger in studies using standard measures of student success. With reference to preschool, elementary and secondary school levels, Castro et al. (2015) determined in their meta-analysis the mean effect size as 0.138 for secondary school education, 0.125 for elementary school education and 0.05 for kindergarten; whereas, the mean effect size was 0.134 for the general community and, 0.119 for specific groups, such as communities at risk of exclusion, inequalities or discrimination, or groups of people who need special education. Jeynes (2005, 2007, 2012) also obtained similar results in their meta-analysis. Community has been one of the factors mediating the association between parental educational involvement and academic outcomes of students. There has been a slight decrease in the impact size when taking into account specific groups, such as communities at risk of inequalities, exclusion or discrimination, or groups of people who need special education. Castro and colleagues also discovered differences in the effect size related to the type of publication used in the meta-analysis. The average effect size was established as 0.104 for research published in scientific journals, 0.15 for doctoral theses, or 0.194 for other publications. Publication bias has emerged as one of the main methodological difficulties related to research reviews and meta-analyses. Differences defined in the relationship in the direction of publication type could lead to publication bias. Studies published in prestigious scientific journals could indeed influence the publication bias considering and most of the influence sizes came from them. Studies exhibiting non-significant conclusions may not be easily published or may not be published at all, and their results may not often be included in reviews of research conclusions. Besides, the significance of the influence has been sensitive to sample magnitude, and studies with larger samples generally generate significant conclusions without regard to the size of the influence. Examination of the relationship between the effect size and the sample magnitude has been important. A positive correlation between the sample magnitude of the study and the impact size was an indicator of the existence of publication bias. Castro et al.'s meta-analysis was conducted on 37 major studies between 2000 and 2013. It involved kindergarten, elementary and secondary school students and did not seem to be influenced by methodological conceptions such as publication bias.

## Discussion and Results

Research reviews have indicated that the relationship between parental involvement and participation and children's academic outcomes was significant, albeit a moderate one. It was observed that only the results obtained by Mattingly et al. (2002) did not seem to reflect this at all. Scores, academic success determined by standardized tests, and rating scales generally evaluated by teachers, as well as other scales consisting of indicators of academic behaviors and attitudes were used as measures of academic success by the meta-analyses. The predicted magnitudes of the influences of parental involvement on academic success of students in these meta-analyses could vary depending on the function of variables such as measures of academic achievement, style of parental involvement and participation, and subjects' educational level and ethnic groups. The strongest relationships between parental involvement style and academic success of students were found when parents had high academic expectations for their children, communicated, talked about and discussed school activities and schoolwork with them, and enhanced and promoted the development of their reading habits. Accompanying, monitoring and supervising children and adolescents has been the most effective form of involvement so that parents can work towards and learn the main goals of schooling. Nevertheless, attention should also be attached to the smaller effect sizes of parental involvement revealed in the meta-analyses in terms of the academic success of children and adolescents. In the meta-analysis conducted by Castro et al. (2015), especially two types of parental involvements, such as control and supervision of homework and participating in school activities, did not seem to be associated with academic success of children. The research emphasizes that children's need for aid with homework or parents' participation in school activities is important and has priority when children experience some difficulties in learning, behaving and socializing in the educational process; and this has a negative impact on school success despite parents' cooperation, collaboration and participation (Wilder, 2014).

Some of the contradictory results obtained in the meta-analyses could be elucidated by the complex quality of parental educational involvement and participation. For students, it seemed reasonable to state that the higher the educational involvement and participation of their parents, the better the academic success of the students. Meanwhile, less talented students in certain groups required stronger parental involvement and participation to be successful in school. It could be expected that when the students had the lower academic success, parents could be more frequent present at school or displayed higher school-based involvement. This clear and obvious contradiction has been observed in many other cases. Controlling for different

trends could be done by experimental design or by inserting correct covariates in the model. Correlations always appeared positive when meta-analyses contained only experimental or quasi-experimental studies (Jeynes, 2005; Senechal & Young, 2008) or studies that control covariates such as intelligence of children (Topor, Keane, Shelton, & Calkins, 2010). Wilder (2014) disclosed that when children's abilities, socio-economic status, and ethnicity were controlled for, Zellman and Waterman's (1998) findings showed a significant positive correlation between parental school involvement and reading scores of students. Topor et al. (2010) asserted that after controlling for intelligence of children, parental involvement was closely associated with academic performance and children's perceptions of cognitive ability. As in the meta-analysis by Hill and Tyson (2009), the probability of observed negative correlations seemed higher in some gleaned studies that were non-experimental or did not provide information on statistical control of significant covariates. In their meta-analysis, Hill and Tyson (2009) stated that parental involvement was positively associated with academic success of students, except for aiding with homework. Academic socialization has been the strongest relationship with students' academic success. Strategies reflecting academic socialization were effective for adolescents' tasks and characteristics of their developmental stages. While helping with homework was negatively associated with academic success, other styles of parental involvement at home appeared to be significantly and positively associated with academic success.

The meta-analyses have revealed that the strongest association was between parental educational expectations and students' academic success (Castro et al., 2015; Fan & Chen, 2001; Jeynes, 2005, 2007; Wilder, 2014). Parental educational expectations reflected their beliefs and attitudes toward education, school, lessons, and teachers as a whole. As children are most likely to hold, resort to, connect, adopt, internalize and assimilate similar attitudes and beliefs as their parents, it has been vital and important for children's academic success that parents have high educational expectations. Nevertheless, since socio-economic status and cultural background can affect the educational expectations of parents and children, it has been asserted that three variables should be examined simultaneously as socio-economic status, cultural origin, and educational expectations of parents and children. In his meta-analysis, Jeynes (2003) discovered differences in the intensity of the relationship, although there was a positive association between parental expectations and students' educational achievement in 6 minority groups, without regard to ethnicity and academic level. Cultural background reflected a set of values regarding not only the roles of the individuals in life, the attitudes and behaviours of adults, the roles of children in the family, the behaviors allowed inside and outside

the home, but also the degree of effectiveness of education and school for the individual and family to gain social status, as well as expectations for children's academic performance. Parental aspirations and expectations for educational success of their children have affected the degree of control and supervision of parents at home.

More talented students from wealthier families tended to score better or higher grades and have parents with higher educational expectations for them, whereas other students tended to obtain lower grades and have parents with lower educational expectations. At this point, a positive correlation was observed between the higher educational expectations of higher SES parents from their children and adolescents and the academic success of children and adolescents. On the other hand, the association between lower educational expectations of lower SES parents from their children and adolescents and lower academic achievement of children and adolescents was another point that was emphasized. It has not been determined whether a variable such as the educational expectations of parents is valuable and important in any individual. Parental educational expectations of parents appeared more as a passive attitude of parents compared an active behavior. Considering the strength and continued existence of the association between parental educational expectations and academic success of students in the meta-analyses, parents have attempted to influence their children and adolescents and introduce opportunities offered by education for the enhancement of their lives and improve their perceptions. The meta-analyses indicated that parental involvement and participation aimed at encouraging academic success and improving basic skills such as reading, was one of the most effective and successful parenting practices.

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## CHAPTER 9

### **TROLLING AND FLAMING BEHAVIORS THAT PLASTIC SURGEONS ARE EXPOSED TO ON SOCIAL MEDIA PLATFORMS<sup>1</sup>**

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## Introduction

Cyberbullying has become an important problem affecting all areas of life in the digital age, and it has also affected many professionals in varying fields. Plastic surgeons have also been the victims of such attacks as trolling and flaming, being targeted on social media platforms. This not only damages their professional reputation but also negatively affects their personal and professional lives. Plastic surgeons are highly skilled professionals dedicating their lives to helping people look physically and mentally feel good. They receive long years of training to acquire the necessary skills to perform complex surgical procedures in their professional lives. However, the increase in online harassment and bullying experienced by plastic surgeons has led many surgeons to consider quitting their professions or reducing their online presence.

This study aims to contribute to the current literature on plastic surgeons by examining online trolling and flaming cases on some social media platforms such as Twitter, Instagram, Google Reviews and YouTube.

Online bullying is a multidimensional issue that appears in various ways, such as trolling and flaming (Bishop, 2014). Trolling is the name given to the act of intentionally sending provocative, humiliating or provocative messages with the aim of getting emotional reactions from those exposed to the act (Buckels, Trapnell & Paulhus, 2014). Flaming, on the other hand, is a hostile and aggressive form of online communication carried out using insults, offensive language and personal attacks (O'Sullivan & Flanagan, 2003). Both trolling and flaming are important fields of study in the context of cyberbullying, as they have the potential to cause significant damage to the individuals exposed to trolling and flaming.

There has been an increasing interest in the issue of cyberbullying recently, and many studies having been conducted in this field are focused on the prevalence, causes and methods of intervention of cyberbullying (Patchin & Hinduja, 2015; Tokunaga, 2010). However, the studies that are specifically focused on the experiences of plastic surgeons regarding cyberbullying are quite few, so more information is needed on this topic due to the high-profile nature of their work and possible negative outcomes on their patients. This research aims to fill the gap in the relevant literature by examining cases of online bullying against plastic surgeons experienced on social media platforms.

The research in the relevant literature reveals that online bullying occurs for various reasons, such as personal hostility, jealousy, competition, and psychological problems that bullies have (Hinduja & Patchin, 2013; Kowalski, Giumetti, Schroeder & Lattanner, 2014). When considered from the perspective of plastic surgeons, these motivations could be further in-

creased due to the competitive nature of the field as their work is in the public eye, and their work could have some potential negative outcomes on patients. This study aims to examine the specific tactics used by cyber bullies, methods such as slander, humiliation and threats that they use to damage the reputation of plastic surgeons, as well as make some examples of unsuccessful operations visible in the public eye.

The impact of cyberbullying on the targeted individuals has been studied well in the relevant literature and it has been found that the victims experience various psychological problems such as depression, anxiety and stress (Patchin & Hinduja, 2015; Tokunaga, 2010). For plastic surgeons, these consequences could lead to some damage to plastic surgeons since their work is in the public eye and the potential implications for their professional reputation and careers. This study aims to examine the impact of trolling and flaming on plastic surgeons' mental health and professional lives.

Various measures could be taken to deal with cyberbullying experienced by some professionals including plastic surgeons. First of all, it is important to implement strict regulations and policies for the behaviour of the people who commit bullying (Patchin & Hinduja, 2015). For this purpose, legal measures should be taken to deal with cyberbullying, and relevant mechanisms should be established to address and report online harassment (Citron, 2014). In addition, education and awareness-raising activities could contribute to the establishment of a culture of empathy and support in online communities by encouraging individuals to identify and report any cyberbullying case (Kowalski, Limber & McCord, 2019).

Relevant resources and support should also be provided for plastic surgeons and other professionals so that they can use them to manage the consequences of cyberbullying and thus they can protect their professional reputation. This will help to support plastic surgeons subjected to cyberbullying by strengthening communication and solidarity among colleagues and professional organizations. It is also important to provide mental health services and counselling for professionals suffering from cyberbullying, because these services can help them cope with the psychological effects of bullying, such as stress, anxiety and depression that they experience (Patchin & Hinduja, 2015).

While dealing with the problem of cyberbullying on social media platforms, it is also necessary to draw attention to the responsibilities of social media platforms. Social media platforms such as Twitter, Instagram, Google and YouTube have the responsibility to provide safe online environments for users and create effective reporting and control mechanisms (Patchin & Hinduja, 2015). Therefore, policymakers should cooperate to

develop and implement strategies to combat cyberbullying directed at plastic surgeons and other professionals through cooperation between social media platforms and professional organizations.

In brief, more research should be conducted to better understand the specific experiences and needs of plastic surgeons as victims of cyberbullying. Long-term studies could help assess the long-term effects of trolling and flaming on the mental health and professional conduct of plastic surgeons, while qualitative research can provide valuable information about coping strategies and the kind of support that they need. In addition, the development and evaluation of interventions to be employed for plastic surgeons, such as training programs and support services, can contribute to the evidence-based knowledge related to the best field practices.

This study highlights the negative effects of cyberbullying on plastic surgeons, raising awareness about the issue and calling for action to address the problem of cyberbullying that plastic surgeons experience on social media platforms. The importance given in the research to protect plastic surgeons and other professionals from the harms of cyberbullying also reveals the significance of the study in this regard.

### **Purpose of the Research**

Cyberbullying has become a major problem affecting all professions, including plastic surgeons, with the widespread use of technology. This study was conducted to examine the cases of trolling and flaming that doctors working as plastic surgeons experience on Twitter, Instagram, Google Reviews and YouTube, which are among the leading social media channels. The research questions to be answered for this purpose are stated below.

1. On which social media platforms are plastic surgeons exposed to cyberbullying most?
2. What are the types of cyberbullying that plastic surgeons are exposed to?
3. Are plastic surgeons more exposed to cyberbullying from their personal accounts or anonymous account?

### **Significance of The Research**

This study highlights the issue of cyberbullying against plastic surgeons and its negative effects on plastic surgeons and provides recommendations on how to cope with them. This research is significant as it deals with this problem and protects relevant professionals from the harm caused by cyberbullying.

## **Research Method**

This section explains how trolling and flaming behaviours that plastic surgeons are exposed to on social media in Turkey through content analysis to come up with answers to the research questions stated. For this purpose, the research model was first defined and then the universe and sample of the research are explained in detail

### **Research Model**

Screening models generally aim to investigate and explain the existing cases or realities as they are (Şimşek, Doğanay, Ataizi, Balaban Salı, & Akbulut., 2014, p.92). General screening models aim to make predictions and generalizations about the universe using the sampling method. In the screening models, the researcher can also use tools such as documents, audio, video, and images to obtain detailed data. In this study, a general screening model was used to measure trolling and flaming cases that plastic surgeons have experienced on social media.

Content analysis was conducted on the data collected through the general screening model in the study. Content analysis is a convenient way of converting the data gathered from the participants into the field of social sciences as numerical data. The main purpose of the studies adopting content analysis is to guide future academic studies to be carried out within the scope of the studied subject and to determine the general trend related to the studied subject (Ültay, Akyurt, & Ültay, 2021, p.190).

The content analysis method was first presented to the literature for the use of researchers as a systematic scientific method with the release of Berelson's famous book "Content Analysis in Communication Research" published in 1952 (Yıldırım, B.,2015, p.117). While the quantitative perspective seemed to have dominated the early stages of content analysis, following the 1960s, there has been a shift towards critical qualitative methods based on Marxist theories, instead of remaining limited to counting and superficial evaluations, Within the framework of this explanation, the content analysis could be examined periodically as "classical" and "contemporary" (Yıldırım, 2015, p.119).

### **Research Universe and Sample**

Considering the sample size calculated within the scope of the research, 83 surgeons who actively used their social media accounts between January and April 2023 were reached. 708 comments were randomly chosen from the accessed social media accounts and they were examined in line with the research purpose.

Conceptually, the universe is the whole of individuals or elements with similar characteristics. The universe covers all the individuals or elements related to the research problem. The universe is the group that the researcher thinks will best represent the event or phenomenon to be studied. The universe consists of elements and groups in which different elements coexist and have a fairly comprehensive data range (individual, class, unit, element, event or phenomenon) (Baltacı, A., 2018, p.234).

As the universe is very comprehensive, this research needed to make a separate classification in the form of “research population” and “research universe”. The group is formed by all the individuals who will deliver their responses to answer the research problem, which is called the “research universe”. In cases when it is not possible to reach every member of the universe due to its being abstract and extremely big in size, the researcher is supposed to limit the universe based on some criteria (Şimşek, et al., 2014, p.111). This limited universe is called the “research universe”.

The sample is a subgroup selected according to the pre-set criteria from the universe and assumed to represent the universe. The most important characteristic of the research sample is its ability to represent the universe. (İSAPS, 2021) This study used the method of taking samples from the universe.

The snowball sampling method was used in the study with the latest data released by ISAPS in 2021 (İSAPS, 2021). The snowball sampling method was applied to the 1300 plastic surgeons:

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

The sample size was calculated as 297 and the research was limited to 83 surgeons who actively used their social media accounts considering the usage frequency of the plastic surgeon that this research aimed to reach did not significantly change between January and April 2023. For this purpose, 708 comments were randomly selected out of the comments posted on the social media accounts of the 83 surgeons and the accessed comments were categorised into two “individual accounts” and “anonym accounts” Then all the accessed comments were examined under the title of “hate” “threats”, “criticism”, “insults”, “advice” and “praise”.

This study aimed to examine the social media platforms such as Google Reviews, YouTube, Instagram and Twitter. Comments posted on Google reviews were easily accessible as plastic surgeons did not have any access to edit the posted comments. Comments posted on the accessed



YouTube channel were about the instantly posted comments in response to the content of the video. On the other hand, since plastic surgeons have access to edit the comments posted on Instagram, it was found that the posted messages for surgeons were generally positive. Due to the nature of Twitter, humour, threats and sarcastic language were found to be dominant in the posted comments.

In this context, after obtaining the frequency of the comments accessed on Google Reviews, YouTube, Instagram and Twitter, fit analysis was conducted to analyze the relationships between categorical data; a Chi-square test was conducted to explain whether the variables are independent of each other and T-test was conducted to examine significance. The statistical data obtained were analyzed quantitatively and qualitatively and presented in tables and graphs in the results section.

### **Fit Analysis**

Fit analysis, one of the multivariate statistical techniques, can be simply defined as a technique that allows the detailed analysis of the relationships between categorical data and the graphical representation of the results obtained in a two-dimensional environment. Fit Analysis is used in cases when categorically obtained or categorically tabulated frequencies are insufficient due to the insufficiency of chi-square, when the significance of the order and column signals is not simultaneous among the variable categories through the chi-square analysis, when the combination is needed for the frequencies in the crosstab as the frequencies are insufficient, and it is also a method used instead of chi-square analysis in the contingency tables often seen in establishments together with the grey correlation analysis and fit analysis (Özdamar, 2004: 462). In the fit analysis, there is no hypothesis test to test the model and an assumption about the probability distributions corresponding to the values that the variables can take. The results obtained could be displayed on two-dimensional maps and examined and interpreted more easily than numerical results (Clausen, 1998: 5). In addition, with the size reduction feature such as factor analysis, it also allows analysis to be performed using fewer data (Hair, Black, Babin, Anderson, & Tatham, 2006: 548)

### **Results**

The studies accessed within the framework of this research were examined, and thus, the comments posted for plastic surgeons were examined under six themes. Among these themes, four sub-themes were created under the theme of cyberbullying types. The findings related to themes, and social media account types are presented in Table 1. As a result of the research, 253 comments were accessed on Google Reviews with 35.7%,

while the least comments were accessed on Twitter with 109 comments with 15.4%. The most accessed type of comment is praise with 33%, while the least accessed type of comment is a threat with 2%. 39.3% of the accessed comments were communicated through an anonymous account with 278 comments, while 430 comments were accessed through a personal account with 60.7%.

*Table 1. Social platform, Comment and account type*

Variables	Frequency	Percentage
<b>Social Platform</b>		
YouTube	220	31,1
Google Reviews	253	35,7
Twitter	109	15,4
Instagram	126	17,8
<b>Comment</b>		
Hate	97	13,7
Threat	14	2,0
Criticism	125	17,7
Insult	60	8,5
Suggestion	173	24,4
Praise	239	33,8
<b>Account Type</b>		
Anonym	278	39,3
Personal	430	60,7

There was no significant difference between the account type (anonymous, personal account) and comments. Considering the comments posted, it could be claimed that individuals do not tend to hide their opinion or avoid sharing their opinion.

*Table 2. Account Type T-Test Table conducted on Comments*

	N	Average	Standard Deviation	t	df	p
Anonym	278	4,2662	1,70400	-0,323	706	0,162
Personal	430	4,3093	1,75270			

A significant difference was found between the account type (anonymous, personal account) and the social media of the posted comments. When examining the social media platforms where comments are posted, as seen in Table 3, it draws attention that the media affects the phenomenon of creating a social identity on a person, and at this point, the person posts comments with the created identity created considering the characteristics of the media.

**Table 3.** *T-Test for Social Media Account Type*

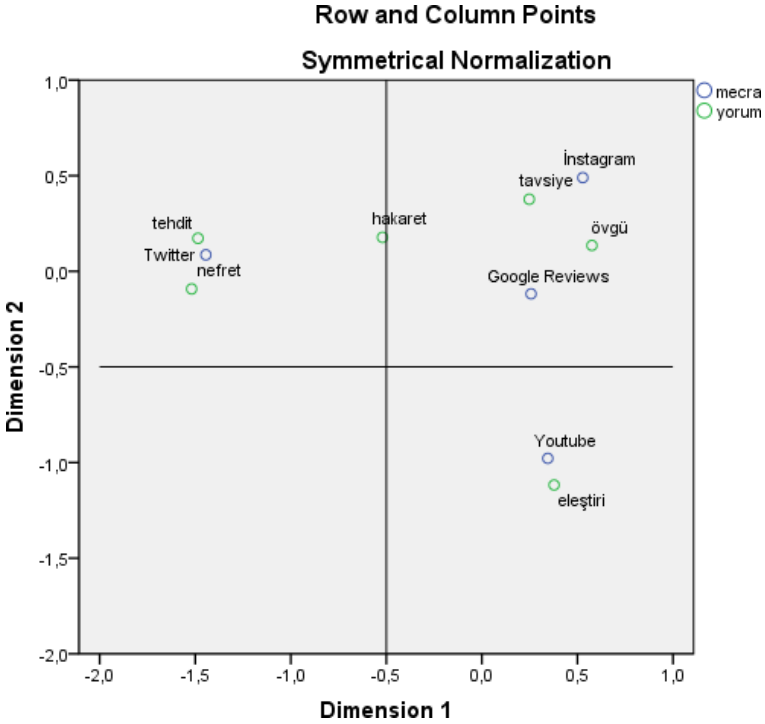
	N	Average	Standard Deviation	t	df	p
Anonym	278	2,5468	1,04914	7,217	706	0,001
Personal	430	1,9744	1,01816			

When we examine the results of the chi-square test performed on the comments posted on YouTube, the theme of praise (f=95) is seen the most against the plastic surgeons and then the criticism (f=63) sub-theme comes next. In Google Reviews, recommendation (f=94) comes first and it is followed by praise (f=73). On Twitter, it is seen that cyberbullies make the most hateful (f=52) statements. The praising statements (f=63) are seen on Instagram.

**Table 4.** *Chi-square Test*

		Hate	Threat	Criticism	Insult	Suggestion	Praise	Total
Youtube	<b>f</b>	19	2	63	18	23	95	220
	<b>%*</b>	8,6	0,9	28,6	8,2	10,5	43,2	100,0
	<b>%**</b>	30,1	4,4	38,8	18,6	53,8	74,3	220,0
Google Reviews	<b>f</b>	23	3	47	13	94	73	253
	<b>%*</b>	9,1	1,2	18,6	5,1	37,2	28,9	100,0
	<b>%**</b>	34,7	5,0	44,7	21,4	61,8	85,4	253,0
Twitter	<b>f</b>	52	8	5	18	18	8	109
	<b>%*</b>	47,7	7,3	4,6	16,5	16,5	7,3	100,0
	<b>%**</b>	14,9	2,2	19,2	9,2	26,6	36,8	109,0
Instagram	<b>f</b>	3	1	10	11	38	63	126
	<b>%*</b>	2,4	0,8	7,9	8,7	30,2	50,0	100,0
	<b>%**</b>	17,3	2,5	22,2	10,7	30,8	42,5	126,0
<b>Total</b>	<b>f</b>	97	14	125	60	173	239	708
	<b>%*</b>	13,7	2,0	17,7	8,5	24,4	33,8	100,0
	<b>%**</b>	97	14	125	60	173	239	708,0
	Pears on Chi-Square	253.54	Sig(p)	,000				

It has been seen in the graph that cyberbullies on Twitter usually troll plastic surgeons under the sub-themes of threat and hate. The platform on which cyber bullies troll plastic surgeons in the subtype of criticism was found to be YouTube. On Instagram, it was observed that plastic surgeons receive messages and comments related to advise and praise at a close rate. Insulting comments are the most common in Google Reviews, and it was followed by Instagram and Twitter respectively



**Figure 1.** *Fit Analysis*

## Discussion and Conclusion

This study examined the rate of trolling comments and cyberbullying experienced on four social media platforms. In total, 708 comments posted on 83 plastic surgeons' accounts were accessed. Which social media are used for trolling purposes, which types of comments are frequently posted on which social media and the account types of trolls have been examined?

A significant difference was found between the account type used by trolls for trolling behaviour and the social media platforms that they chose to troll. However, no significant difference was found between the account

type and the comment.

Social media platforms are used by billions of people every day as an important part of their daily life. The interactive communication facilities offered by social media technology, the synchronicity and the ease with which social media users can have anonymous social media accounts have caused the lynching culture to be seen in digital environments as well. (Karataş, 2022) Bullying and lynching have become easier as opening an anonymous account on social media without having a personal account is easy. Technological advancement makes it easier for many people to create fake accounts to conduct bullying activities on social media.

Therefore, there is a need for concrete solutions that can be implemented depending on the perpetrators' motivations for engaging in hate and cyberbullying acts. With the development of technology and the increasing sophistication of social media, the likelihood of bullying and flaming is likely to increase. Therefore, the motivational attitudes of people engaged in bullying and flaming act should be examined. According to a study conducted by Arisanty and Wiradharma (2022), it has been found that there are six main motivations for a person to scold and bully on social media: (1) Excessive fanaticism, (2) Self-interest, (3) Spontaneous Emotions and Excessive Anxiety, (4) Poor Digital Literacy, (5) Anonymity on social media through Second Accounts, and (6) Lack of Empathy.

With the increase in the number of social media platforms, different types of bullying and trolling are observed to have increased on different platforms. However, although there are differences such as that trolling does not always carry malicious purposes, cyberbullying contains completely malicious intentions, both cyberbullying and trolling are similar in shaping the perceptions of others and being able to move them in line with their own goals (Gönülşen, 2022).

We have observed that social media, which covers most of the day in many people's lives, deliberately causes communication disruptions and trolling from time to time. Trolling and cyberbullying are the most common and annoying problems encountered on social media platforms (Kayaduman, 2020). As can be seen in the 708 comments examined in this study, bullying comments such as hate and insults are used by many people on social media platforms every day.

According to Kaya and Cenkseven Önder (2022); the methods of coping with cyberbullying are grouped under 6 categories as secure internet, legal ways, supportive resources, education, personal resources and non-constructive ways. Based on these findings, the strengthening of Internet law and the application of sanctions against negative situations will prevent bullying and lynching culture on social media platforms.

When all the results are considered together, it should be accepted that trolls are a fact of the online world and awareness-raising activities should be carried out through education to effectively deal with cyberbullying. Suggestions have also been presented in the study for the researchers to guide them.

### **Suggestions**

Based on the research findings, the following suggestions can be made:

1. More research should be conducted on trolling in our country, the more cyberbullying is mastered by social media users, and the more it will be possible for them to reduce trolling.

2. Providing accurate information about mass lynching and cyberbullying instead of counteracting by trolling, in the same way, will lead to healthier results.

3. With the decrease in the age of access to phones and social media platforms, it should be ensured that school-age children are trained through seminars on cyberbullying.

4. With the awareness-raising training to be conducted, the chaotic environment that will result from social media trolling can be neutralized more easily.

5. In this study, the data were collected according to the type of comments, social media and account type. Future studies to be conducted on this subject could examine the subject according to some other variables such as age and gender.

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