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EXAMINATION OF MATHEMATICS TEACHERS' BELIEFS AND ATTITUDES REGARDING TEACHING STATISTICS

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ABSTRACT

This study aimed to examine the beliefs and attitudes of mathematics teachers towards statistics education. The sample of the research consisted of 11 mathematics teachers. A semi-structured interview form was used as the data collection tool, and the data was analyzed using the "cut and sort" technique. Based on the analysis, it was concluded that it is critical to consider both student needs and teacher needs to improve statistics education. Therefore, professional development programs should be organized to help teachers understand and teach basic statistical concepts effectively. In this way, teachers can better equip their students with the skills to think statistically and make rational and informed decisions.

Keywords: Beliefs and attitudes; teaching statistics; mathematics teachers

MATEMATİK ÖĞRETMENLERİNİN İSTATİSTİK ÖĞRETİMİNE İLİŞKİN İNANÇ VE TUTUMLARININ İNCELENMESİ

ÖZET

Bu çalışmanın amacı, matematik öğretmenlerinin istatistik ve istatistik öğretimine yönelik inançlarını ve tutumlarını incelemektir. Araştırmanın örneklemini 11 matematik öğretmeni oluşturmaktadır. Veri toplama aracı olarak yarı yapılandırılmış görüşme formu kullanılmıştır ve verilerin analizi "kesme ve sıralama" tekniği kullanılarak yapılmıştır. Analizlere göre, istatistik eğitimini geliştirmek için hem öğrenci ihtiyaçlarını hem de öğretmen gereksinimlerini göz önünde bulundurmanın kritik önem taşıdığı sonucuna varılmıştır. Bu nedenle öğretmenlere, temel istatistik kavramlarını anlama ve etkili bir şekilde öğretme konusunda yardımcı olacak profesyonel gelişim programları düzenenmelidir. Bu sayede öğretmenler, öğrencilerini istatistiksel düşünme ve rasyonel ve bilinçli kararlar alma becerileriyle daha iyi donatabilirler.

Anahtar Kelimeler: İnanç ve tutumlar; istatistik öğretimi; matematik öğretmenleri

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1. INTRODUCTION

Each branch of science has its problems and methods for solving them, making them separate disciplines. Statistics is a separate discipline and science, consisting of many techniques. British Sir Francis Galton (1822-1911), one of the scientists who contributed significantly to the development of statistics, said of the importance of statistics: “There is a great deal to be written on tatistics; however, I feel that my explanation will be insufficient to present it in a way that is easily understood, without compromising on rigour, without missing any of its aspects. It is thought that statistics today sheds light on the future with the collection, analysis, and interpretation of data, and plays an important and critical role in analyzing data from different segments of society, determining future decisions, and evaluating current situations. However, statistics has the potential to be easily used as a tool for deception. Huff (2002) stated that abused statistics can distort many facts, and a well-made statistic is more effective in Hitler's 'big lie'. He also emphasized that these statistics can lead society in the wrong direction and that no one can blame those who put it forward.

When it is considered that statistics, beyond being just an academic field, can guide citizens in the analysis of situations encountered in daily life and in decision-making processes, the teaching of statistics is brought to a critical point. Herbert G. Wells' statement that "Statistical thinking will one day be one of the most necessary elements of being a good citizen, just like being literate" summarizes the importance of statistics education (Huff, 2002). In light of this, students with a good statistics education can be expected to have the following characteristics:

i. They may be more resistant to misleading information (they know how to evaluate and critically examine the data sets they come across, how to draw conclusions. Statistical data is often used for various purposes and can sometimes be distorted. Statistics education is a critical approach to statistics that children encounter in the media or in their daily lives. aids in their evaluation).
ii. They can make better decisions about many situations they encounter throughout their lives (such as academic success, hobbies, social relationships, career plans. For example, it can help them understand which course/courses they need to devote more time to in order to increase academic success).
iii. They can better understand trends occurring in society (data related to issues such as economic inequality, environmental change or health habits can help them understand and find solutions to problems, and encourage them to act more consciously and effectively on such issues).
iv. Statistical skills are highly valued in many professions today. For example, marketing, finance, healthcare, sports, etc. Individuals who can understand and interpret statistical data in many fields may be more competitive in the business world. Therefore, basic statistical skills acquired during childhood can give them an advantage in their future careers.

In this context, considering the important benefits of statistics education for children, it is thought that teaching them basic statistics concepts from an early age will help them improve their cognitive thinking and decision-making abilities.

Tanilli (2012) stated that training and teaching are different and sometimes independent activities and that both should not be done at the same time and should not be left to a single person. In addition, Mother and Father emphasized that, although they are knowledgeable, they are not enough to teach and educate their children, as they can be too impatient, nervous, and passionate. On the other hand, she stated that a teacher is neither a father nor a second mother, and their role is to teach something, not to love or endear themselves. In this case, the teacher's beliefs and attitudes towards statistics and teaching are important in teaching statistics, which are thought to have important contributions to children's lives. Beliefs affect the behaviour of teachers who teach statistics (Estrada, Batanero, & Lancaster, 2011). When teaching statistics, the teacher is interested in whether it is important for students to master the math skills of central tendency units, whether statistics are relevant to real-world situations, and whether technology can help students learn. It is important to let students choose the appropriate tools. Examining students' and teachers' views on mathematics education has a long and detailed history. However, when it comes to statistics education and especially focusing on teachers' beliefs, the number of studies is negligible (Pierce & Chick, 2011).

According to Philipp (2007), belief; is defined as the facts considered, psychologically held understandings, premises, or propositions about the accepted world. Beliefs are somewhat recognizable because they are cognitively accepted, can be accepted with varying degrees of confidence, and appear inconsistent or contradictory from an observer's perspective. As a result, beliefs cannot be measured using scales. Philipp (2007) also compares beliefs with emotional attitudes. Attitudes are defined as "behaviours, feelings and thoughts that reflect one's temperament or thinking". Contrary to a common misconception, attitudes are often evaluated using a variety of scales. A person's beliefs affect, but do not definitively determine their attitudes. Attitudes are considered a reflection of a person's beliefs, but they can often change according to beliefs. The influence of environment and culture plays a big role. For example, while a person is expected to act according to cultural norms, they may act contrary to their own beliefs. Similarly, attitudes can directly affect interactions between people. Establishing relationships with other people, sharing a common feeling or thought, and as a result, can lead to changes in people's attitudes. Therefore, the relationship between beliefs and attitudes is quite complex and multifaceted (Philipp, 2007; Tavşancıl, 2014).

In the studies, the importance of students' beliefs about statistics was emphasised (Hirsch & O'Donnell, 2001; Hulsizer & Woolf, 2009; Schau et al., 1995). Gal et al. (1997) emphasize that students' beliefs affect their teaching-learning processes and their relationship with statistics outside the classroom. Teaching-learning processes are also valid for teachers' beliefs. Relationships with statistics outside the classroom, emphasized by Estrada and Batanero (2008), are influenced by teachers' beliefs. In this context, it is considered important to examine teachers' beliefs about teaching statistics. Previous studies conducted in Turkey, unlike this study, are generally related to pre-service teachers' attitudes towards statistics or the statistics courses they take. In this study, it was aimed to examine mathematics teachers' beliefs about statistics and statistics teaching.

2. LITERATURE REVIEW

Pfannkuch and Wild (2008) conducted a study on the development of statistical thinking skills of teachers and concluded that teachers play a critical role in the development of their students' statistical thinking skills, and should have sufficient statistical content knowledge to do so. He also noted that teachers do not differ much from students in terms of statistical thinking, which is a worrying situation. Cobb and Moore (1997) highlighted the uniqueness of statistics by stating that "statistics requires a different way of thinking because data are not only numbers but also numbers with context". Wild and Pfannkuch (1999) further emphasised that statistical reasoning includes features such as inquiry cycles, unique thinking styles and characteristic tendencies that make mathematical reasoning distinct. This supports Pfannkuch and Wild's (2008) statement that "being a statistics teacher is different from teaching mathematics" and "statistical thinking, reasoning and literacy are especially important skills for those who teach statistics".

Pierce and Chick (2011) stated that teachers' beliefs about statistics can affect their teaching methods. For example, if a teacher believes that a statistics course consists only of data collection and analysis, they may teach only these topics to their students and ignore a broader understanding of statistics. Similarly, if a teacher believes that statistics is tightly linked to mathematics, they may use mathematical approaches to teach mathematical concepts to their students. However, teachers' beliefs about statistics can also have an impact on students' learning process and their engagement with statistics. Teachers' beliefs about the importance of statistics education can be influenced by many factors, such as external factors such as curriculum or policy, which can shape teachers' beliefs about the importance of statistics education. While some teachers believe that an informed citizen in today's world should have a basic understanding of statistics, others may question its importance. In addition, teachers' own statistical education experiences may also influence their beliefs. Teachers with statistics training may appreciate the importance of statistics more, while those without statistics training may appreciate it less. Understanding teachers' beliefs about statistics can help to improve statistics education for students. Teachers' beliefs about statistics can influence students' attitudes and achievement in the subject. For instance, if a teacher believes that statistics is only connected to mathematics, students' attitudes towards statistics may be adversely affected and their performance in the subject may be poor. However, understanding teachers' beliefs about statistics can help to devise suitable strategies to enhance students' attitudes towards and achievement in statistics. For example, professional development activities can be organized to alter teachers' beliefs about statistics or research can be conducted to comprehend teachers' beliefs about statistics. In this way, a more effective statistics education can be provided to students.

Lovett and Lee (2017) stated in their evidence-centered design approach study with pre-service mathematics teachers that some pre-service mathematics teachers view statistics as a "grey area" where "uncertainty" or "the correct answer is uncertain". They also highlighted that some pre-service teachers think of statistics as "an art" and that pre-service teachers' ideas about statistics can be altered through

different learning experiences that will help them to improve their teaching of statistics. The researchers stated that providing pre-service teachers with learning opportunities in statistics can increase their interest in statistics and alter their thoughts about statistics. They also stated that providing pre-service teachers with different resources to help them improve their teaching of statistics can also change their thinking about statistics.

Harrell-Williams et al. (2015) measured the statistics self-efficacy of 208 secondary school mathematics teachers in the United States using the Statistics Teaching Efficacy Survey (SETS) questionnaire. The findings of this study suggest that teacher education programs focusing on statistics education need to develop a better strategy for teaching statistical concepts to help teachers better understand statistical concepts and increase their self-efficacy. Statistical concepts that are associated with high levels of self-efficacy for teaching statistics at the secondary school level include central measures, data variation, probability, and graph interpretation and construction.

In a study conducted by Begg and Edwards (1999), 22 New Zealand primary school teachers and 12 pre-service teachers participated. In the study, teachers' views on statistics is devided into four main categories as; beliefs and attitudes about statistics, statistical field information, their beliefs and attitudes about teaching statistics, their knowledge and understanding of statistics teaching. In this study, data collection methods included unstructured, semi-structured and clinical interviews, discussion-orientated questionnaires and concept maps. It was emphasised that teachers generally agreed that a good understanding and knowledge of statistics is important for teaching statistics, but they generally disagreed that statistical knowledge is less important for providing students with appropriate statistical activities.

Watson (2006) stated in his study that the curriculum covers statistical subjects and that because students may have different levels of statistical literacy skills, it may require teachers to develop teaching strategies suitable for their different learning styles. He also stated that it is important for teachers to use real-life examples and applications to help students understand statistical concepts, but that teachers do not feel competent in statistics and do not have enough equipment to train students on this subject. He also stated that some teachers may think that statistical concepts are complex and that it is difficult for students to understand these issues. For this reason, he emphasized that teachers should improve their knowledge of statistics and develop appropriate teaching strategies to increase students' statistical literacy.

Carvalho's (2008) study includes research on the development of statistical thinking skills by analyzing the dialogues of seventh-grade students during their collaborative work. The research was conducted with the participation of 533 students and examined how students' statistical and cognitive performance could be improved through peer interaction. The results showed that collaborative work plays an important role in developing students' statistical thinking skills and helps to foster students' positive orientations towards statistics. Additionally, each teacher's understanding of statistics, statistical knowledge, and didactic statistical knowledge determines how their work with students will proceed.

In the study conducted by Sedlmeier and Wassner (2008), teachers were asked how effective statistics education should be, and it was determined that teachers generally believed that student's special interests and activities should be included. However, it was also determined that teachers were reluctant to include student activities, as they are time-consuming and require preparation. Furthermore, the teachers thought that the use of computers and appropriate software was essential for students to develop their data collection and analysis skills.

Leavy et al., (2013) stated in their study that pre-service teachers thought it was difficult to learn statistics and that they misunderstood statistical terms. They also noted that pre-service teachers had positive attitudes towards statistics, but they still perceived it as difficult to learn, which could be reflected in their students. In order to develop students' statistical thinking skills, they suggested that teachers should teach students data collection, data analysis, and interpretation skills; students should learn statistical concepts with real-life examples; students should interpret statistical graphs, and students should present examples that students can use their statistical thinking skills in daily life.

Shin (2021) conducted a study with eight pre-service mathematics teachers at a major public university in the southeastern United States. These pre-service teachers took a statistics course for statistics teachers and a statistics teaching pedagogy course for secondary and high school teachers during another semester. As a result of this research, it was emphasized that the pre-service teachers focused more on the teacher's pedagogy than on the statistical thinking of the students, which could make it difficult for the students to fully understand and learn. In addition, it was revealed that pre-service teachers do not have the professional knowledge to help them understand the statistical thinking of students when teaching statistics. Therefore, teacher education programs have reported that prospective teachers should include professional knowledge in their curriculum to help them understand students' statistical thinking when teaching statistics.

Batanero and Díaz (2011) stated in their study that some teachers think that students' mathematical skills are insufficient when teaching statistics, resulting in difficulty for students in understanding the subject. Furthermore, teachers have difficulty in finding enough examples and applications to demonstrate real-life applications of statistics. Additionally, it was also stated that while teaching statistics, students had difficulty understanding statistical terminology, thus making it difficult for them to comprehend the subject.

3. METHOD

This study uses basic qualitative research methods commonly used in educational settings. Yıldırım and Şimşek (2011) defined qualitative research as research in which qualitative data collection methods such as document analysis, observation, and interviews are used, and a qualitative process is followed to reveal perceptions and events in a natural environment. The phenomenology design, one of the qualitative research designs, was used in the study. The phenomenology design allows us to focus on the facts that we are aware of but do not have in-depth and detailed knowledge and understanding

(Yıldırım & Şimşek, 2011). This study, it is aimed to examine the beliefs and attitudes of mathematics teachers towards statistics and statistics education in depth.

3.1. Working Group

For this study, 11 mathematics teachers working in the Ministry of National Education were selected using the purposive sampling method. Bernard et al. (2016) describe the purposive sampling method as the researcher identifying and communicating with people who will provide rich data suitable for the purpose of the study. In order to participate in the study, the participants had to have graduated from the Department of Mathematics of the Faculty of Education, have taken a course in Statistics, and volunteered to work. A total of 11 teachers, 7 of whom were at secondary school and 4 at high school level, participated in the study voluntarily. The teachers participating in the study were all mathematics teachers working under the Ministry of National Education. Five of the participants were male, six were female, and their ages ranged from 30 to 40. Although it is not possible to determine the exact number of participants in qualitative studies, it is stated that approximately 20 to 60 participants may be sufficient to provide detailed information about their situation or experiences. However, in this study, 11 participants were considered sufficient because the data saturation was reached, as when the pilot study and after it were evaluated together, no new or different information emerged (Bernard et al., 2017; Yıldırım & Şimşek, 2011).

3.2. Data Collection Tool

A semi-structured interview form was used as a data collection tool for the working group. This form was determined by a literature review on the subject and focused on the relationships between teachers' beliefs and attitudes about statistics education. The final interview form, consisting of 11 questions about the beliefs and attitudes of mathematics teachers on statistics and statistics education, was obtained by removing some questions from the draft form of 15 questions, in accordance with the opinions of two expert faculty members. A pilot study was conducted with four mathematics teachers, two of whom were from middle school and two from high school, who were not participants in this study.

3.3. Data Collection Process

The data for the study was collected in February 2023. During the data collection process, mathematics teachers were informed about the purpose of the research and many teachers refused to participate due to the relevance of the study to statistics. Interviews were conducted with those who volunteered to participate. The use of audio recordings of the interviews was preferred to shorten the interview time and help to accurately record the answers of the pre-service teachers, and all participants agreed to the audio recording. The interviews were conducted one-on-one in suitable environments where the participants would feel comfortable, thus taking their comfort and safety into account.

3.4. Data Analysis

First of all, the recorded interviews were analyzed. To ensure the reliability of the study, the data were analyzed by two people: the researcher and a faculty member experienced in qualitative data analysis.

The "cutting and sorting" technique (Lincoln and Guba, 1985) was used for data analysis. This method involved cutting quotes from the data and writing the participant's code name (e.g. L1, O1) behind each quote. These quotes were then randomly sorted on a table and those with similar emphasis were brought together. After this, two coders examined the resulting codes together and evaluated them. When there was no consensus in the discussion regarding the differences between the codes, the relevant code was removed from the findings. This allowed for a deeper examination of the data and increased the reliability of the study.

4. FINDINGS

In this section, the teachers' opinions about statistics and statistics education and the findings about the level of statistical content knowledge are given.

4.1. Findings on teachers' views on statistics education

The findings of the teachers' views on the necessity of statistics education are given in Table 1.

Table 1. The results of the answers to the question, "Is statistics education necessary?"

	Frequency	Participant Code
Required	11	O1, O2, O3, O4, O5, O6, O7, L1, L2, L3, L4
It is necessary for raising inquisitive individuals	5	O1, O2, O4, O6, L1, L2
It is necessary to interpret the data	3	O3, L1, L2

When we look at Table 1, all the answers reflect different perspectives on the necessity of statistics education, while emphasizing that statistics education is necessary and that it can be used in many areas of life. Seven participants stated that statistics education is necessary and justified their reasoning, stating that the purpose of this education is to train individuals who can question and interpret data. One participant (L4) even stated that they considered it necessary even if not for every profession. For example, O6 coded teacher answered this question.

> *If thinking, questioning and researching individuals are to be trained, this job will pass by predicting where the results of the events can lead. This job also provides statistics.*

While answering as L1 coded teacher;

> *Statistics education. Of course, I think it is necessary. We already had this training in college. Why it is necessary? Because companies can have prior knowledge of what they should invest in, what they should focus on according to the needs of their customers, what it is, which company and which products they should focus on. That's why it's necessary.*

replied as. The findings of the teachers' views on the level of statistics education should be given in Table 2.

Table 2. Results related to the answers given to the question "At what level should statistics education be?"

	Frequency	Participant Code
Explained from simple to difficult	10	O2, O3, O4, O5, O6, O7, L1, L2, L3, L4
It should be given at a medium level	1	O1

When the answers were examined, 10 participants who agreed with the view that "statistics education should be explained from simple to difficult" emphasized that it should start from the basic level and be presented according to the level. It was suggested that basic concepts be explained in simple ways, that students gain statistical thinking skills, and that increasingly complex topics be covered at advanced levels. According to these views, the view that statistics education should be given with a gradually increasing level of difficulty, starting from the basic level, is dominant. In other words, teachers think that children should be familiar with basic statistics concepts at an early age. They suggest that a basic understanding should be established to teach the basic statistical concepts that have practical use in daily life and to move on to further analysis. A teacher (O1) stated that statistics education should be given at least at an intermediate level to be able to make inferences. For example, O3 coded teacher.

I think Statistics is a difficult course to understand, so it should be started early. Maybe even downgraded to elementary school. In other words, I think that it should be given at a very simple level in this way, by increasing the level a little more in secondary school. Maybe that's why we find it difficult. Because we never took such classes. I mean, when I think of my own school life, not only in terms of mathematics but also in terms of statistics, I do not remember such a course.

O1 coded teacher;

So I think it may not be enough to make simple-level inferences. Yes. It needs to be a little more advanced.

replied as. The findings regarding the methods suggested by teachers for statistics education are presented in Table 3.

Table 3: "What kind of method do you think should be used in statistics education?" answers the question.

	Frequency	Participant Code
Using ready-made data with traditional methods	2	O1, O5
Using computer programs	2	O1, O2
It should be done with real-life examples.	4	O2, O7, L3, L4
They should do it by collecting their data	6	O2, O4, L1, L2, L3, L4
Project-based processing	2	O4, L3
No action should be taken until assimilated	1	O6

When we look at Table 5 regarding how statistics education should be conducted, the view that it should be done with an applied and case-based approach, allowing students to work with real-life data and develop their ability to analyze it, is prominent. One participant (O1) stated that contrary to this view, it is necessary to reinforce theoretical knowledge by using ready-made data and computer programs, and by giving some theoretical information using traditional methods. He also emphasized that using technology tools and visual materials can be effective. Another participant (O6) stated that in statistics subjects, students should not proceed to the process part without learning the subject well. Additionally, he emphasized that, as statistics is a field based on reasoning, although it includes

mathematical operations, it would be more beneficial to first give students the ability to interpret statistical data and then teach calculations. For example, O2 coded teacher is expressing it as

> *While we teach the statistics lesson. In other words, different methods can be followed according to class levels. But I think it is more permanent and understandable to use data from real life no matter what grade level it is. In other words, it can make the data more understandable with the data it reaches, not with ready-made data. Technology support is available. Definitely in terms of making calculations easier. Because calculations can be daunting sometimes. Such methods can be used.*

O1 coded teacher;

> *In other words, the subject of the method, that is, the method may change according to the age group. In other words, we can change the method according to the level of the group that the student will give. In other words, sometimes it is determined by traditional methods and sometimes by using such technological tools, at least by doing it visually or by using old statistics. Ready. Data usage is the same as using data.*

and O4 coded teacher emphasised the importance of project-based teaching as;

> *I think it should be applied, for one thing, very little place is given in mathematics. It can be a separate elective course. In other words, I think it would be more beneficial if it was given as a lesson rather than in a course, that is, it could be done in a project style.*

Finally, O7 coded teacher is expressed an opinion as;

> *In my opinion, statistics education should be given more practically in all education levels and programs based on concrete data and case studies. I think that information that is not associated with daily life is not permanent and effective.*

The teachers were then asked a question about whether Probability is a subfield of statistics.

Table 4. "Is probability a subfield of statistics?" answers the question.

	Frequency	Participant Code
Subfield	8	O1, O2, O3, O4, O5, O6, O7, L2
Not subfield	3	L1, L3, L4

The views of eleven mathematics teachers reflect a generally accepted understanding of the complexity and interdependence between probability and statistics. While these views state that probability is a part of the field of statistics, they also suggest that these two disciplines have a close relationship. It is emphasized that both fields are used together to solve real-world problems. However, there are disagreements among the participants as to whether probability is only a subcomponent of statistics, or whether these two disciplines should be considered separately. While some opinions suggest that probability and statistics should be handled separately (O3, L3, L4), others argue that these two disciplines complement each other. It can be thought that these differences stem from individual experiences, pedagogical approaches, and general perspectives. The complexity of the relationship

between probability and statistics and the ability of these two fields to collaborate are evaluated by the participants from various perspectives. L4 commented on this subject.

> *Probability. They are interconnected fields, but I think they can be taught separately at first and then combined.*

O2 coded teacher expressed the following opinion;

> *I mean, since we look at statistics as probability, I think that it is a sub-field. I mean, it is like a part of statistics.*

The findings related to the opinions of the teachers about the level at which a possible statistics course should be implemented by the Ministry of National Education are given in Table 5.

Table 5. "At what level should a possible statistics course begin?" Answers to the question:

	Frequency	Participant Code
It should start from primary school	1	L3
Starting from middle school	5	O1, O2, O3, O4, L4
Starting from high school	2	L1, L2, O6, O7
There is no need for a separate course.	1	O5,

The question of which school level the statistics course should be given points to different perspectives. The answers examined show varying perspectives on which levels of statistics topics should be presented in more meaningful ways. According to the view shared by most of the participants (7 participants), statistical concepts should be studied more comprehensively at secondary or high school levels, where abstract thinking can develop. These views suggest that to be able to understand these topics, students should have already grasped some basic mathematical concepts. There is also a belief that it is more accessible to introduce the basic principles of statistics at primary or pre-school levels. From this perspective, introducing children to these topics from an early age can contribute to a better understanding of more complex issues in the future. There are varying approaches to the complexity of the content of the statistics course and the level of education among different perspectives. According to one view (L3), these subjects should be taught at primary school level and included in general mathematics education. However, there is a consensus among the answers that while determining the education level of statistics courses, factors such as the education level and abstract thinking abilities of students should be taken into consideration, as well as complexity. Overall, there are marked differences in opinion on this basis.L3 on this subject;

> *Especially when we look at our students. In other words, I think that it should be started in the fourth grade of primary school, at least in the fourth grade. Because people who meet statistics at an early age can behave more realistically in terms of determining their careers. Otherwise, statistics made in high school years and there are definitely benefits. Since the past life of the child cannot be changed, it is of course great in shaping the future life of the child, but at least in order to benefit from it, I think it should be started from primary school.*

On the other hand, O2;

In other words, I think that statistics education as a separate course should be included in the lives of children starting from primary school and even pre-school. But for it to be taught as a separate course, it is given at slightly larger grade levels, that is, within the mathematics course in primary school, but I think that it should be taught as a separate course in secondary school, at least from the fifth grade.

He stated that statistics should be taught to students starting from Kindergarten, but it should be at least secondary school level as a course.

And L2 is,

So it can be at least 10th Grade. It should be given at least in the 10th grade, but as I said in mathematics, 1-2 times in every fifth or seventh. This should be shown to children little by little, then it can be considered as a separate lesson.

4.2. Findings on teachers' beliefs and attitudes about statistics education

In the interview form, some questions were included to see the beliefs and attitudes of teachers about statistics education. First, the participants were asked, "What is statistics? What does it mean to you?" questions were asked. The findings regarding the teachers' views on the subject are given in Table 6.

Table 6. "What is statistics? What does it mean to you?" results in the answers to the question.

	Frequency	Participant Code
Interpreting the data	6	O1, O3, O6, L2, L3, L4
Is to see the future	6	O1, O2, O4, O5, L2
It is a science	6	O4, O5, O6, O7, L2, L3, L4
It doesn't mean anything	3	L1, L3, L4

When the answers given by the teachers were examined, it was seen that they discussed statistics from different perspectives with concepts such as data, interpretation, estimation, profit, comparison, and probability. The common points of the definitions made were that statistics is the process of making meaning through the collection and interpretation of data and is often used to make predictions for the future or to understand events in the past. In some answers, it was emphasized that statistics is accepted as a science and that it works with mathematical methods. In addition, it can be said that the view that statistics is a part of daily life and helps in decision-making processes was expressed in common. In the answers given to the question of what is statistics, it can be said that instead of defining statistics in a narrow sense, such as tables, graphs, and numbers, teachers tried to define it from a broader framework. When asked what statistics means to them, six participants started to explain by stating that they see statistics as a branch of science. Contrary to expectations, three participants, who are high school teachers, tried to make a definition, although they stated that statistics did not mean anything to them, and they used the concepts of interpretation and profit in their definitions. For example, L4 coded participants.

Statistics. So it doesn't mean much to me, but you know, it is used as a science to compare general situations. I think it is a science used to compare some situations, that is, to interpret data.

It can be said that the attitudes of high school teachers towards statistics stem from the exam-oriented education system. Because in the university entrance exam, probability calculations are at the forefront. It is thought that probability and statistics courses given in mathematics teaching undergraduate programs are one of the courses that teacher candidates generally have difficulty with, and this situation has a negative effect on teachers' beliefs and attitudes towards statistics.

The findings of the teachers' views on what (how) statisticians do their job are given in Table 7.

Table 7. Results of the answers to the question "What do statisticians do (How do they do)?".

	Frequency	Participant Code
Examines data	6	O2, O4, L1, L2, L3, L4
Analyzes data	8	O2, O3, O4, O6, O7, L1, L2, L3
Supports institutions	3	L1, L2, L3
Collects data	6	O1, O2, O3, O4, O5, L3
Interprets data	5	O1, O2, O3, O6, O7
Helps shape the future	7	O1, O2, O4, O5, O7, L1, L2
I don't know	1	L4

Accordingly, we can think that teachers generally consider statisticians to be field experts who attempt to predict future events by using data collection, analysis, and interpretation processes, making sense of the results, and contributing to decision-making processes. From this point of view, we can say that teachers have a belief that statisticians shape the future. For example, O2 coded teacher answered this question;

This collects the data I just mentioned and displays that data in different fields with different display methods. He establishes relationships between them, analyzes them, makes predictions, and makes inferences for the future. We can say that he is the executor of all of them. It actually does the process of executing all of them.

In addition, the L2-coded teacher answered this question;

Statisticians give us an idea of how often this might happen in the future by recording the transcripts of certain events, past and present, and the frequency with which they occur. Or states or institutions, holdings, and companies. If anyone is interested now, it's about the future. to possible situations. I can also say employees who give ideas to them.

replied as..

Afterwards, the teachers were asked whether they considered themselves competent in statistics.

Table 8. “Do you consider yourself sufficient in statistics education?” answers the question.

	Frequency	Participant Code
I see enough	3	O7, L2, L3
I see enough at the level I teach	3	O4, O6, L1,
I don't see enough	2	O5, L4
I am not sure	2	O1, O3”
i need education	1	O2,

When the answers were examined, it was seen that there were various approaches to beliefs and attitudes towards statistics courses. Some of the participants emphasized that they needed more learning and development in the field of statistics. Some participants emphasized that they were sufficient in teaching only the statistical gains given at the school levels they worked at (middle school, high school), but that they could have difficulties when it came to higher levels. L4-coded teacher on this subject:

I don't see it enough.

gave the answer. In addition, the L1-coded teacher answered this question;

Since it is the subject of probability, there are only variance probability, statistics and certain subjects at the high school level. The most basic subjects are more than that for our teachers at the university level only, we do not give them in high school. It's more advanced in that regard in its current state. Of course, I consider myself sufficient.

In addition, the O2-coded teacher answered this question;

Do I see it as enough, that is, since we have always focused on formulas and calculations since the years we started teaching, I think there should be more as a requirement of the curriculum. In other words, we can be trained in the prediction interpretation part to make these inferences, I think teachers, so I can get extra training on this for myself.

replied as.

4.3. Findings Related to Statistics Content Knowledge of Mathematics Teachers

In the interview form, some questions about basic concepts, which were thought to be very important in statistics education, were included in order to assess the teachers' knowledge of the field of statistics. First, the participants were asked what the universe and sample were, and after their answers were given, they were asked to provide information about how the sample would be selected. According to the answers given, the teachers' knowledge of the subject is shown in Table 9.

Table 9. "What is the Universe and Sample?" answers to the question.

	Frequency	Participant Code
True	9	O1, O4, O3, O7, O2, O5, L1, O6, L2
False	2	L4, L3

As a result of the evaluation of the answers given in Table 9, it was determined that the participant's knowledge of the concepts of universe and sample was incomplete. The participants' answers generally only went as far as the fact that the universe is large and the sample is a smaller subgroup. In general, the participants stated that the sample should have the power to represent the universe. Two participants misunderstood these concepts. When asked how the sample should be selected, only a few of the participants stated that they did not know; the rest stated that they were not sure and only knew that random selection could be made. O4 coded teacher about the universe and sample;

The universe is the largest set we are curious about, and the sample is a part of the universe. The homogeneous piece we try to take from the universe.

Teacher coded L3;

> *The universe, of course. The universe is where we live. When we look at it as communities, it is not just the world. So it existed in an eternity. Within systems. I think this should be appreciated. We shouldn't just look at the world. There is a system. We actually call this system a universe. The sample is small dots in this universe. Actually, think of it this way. Imagine an ocean, for a grain of sand in an ocean, if the ocean is the universe, a grain of sand is a sample. It is a part of it, it is born out of it.*

Teacher coded O2;

> *The universe is the largest set that contains all of the possible situations and everything that can happen, and a smaller group that we will choose from the sample universe that we think can best represent the universe in their samples. And how? We can choose, we choose. So we need to choose it in a way that represents it in the best way possible. Different methods can be used for this.*

Afterwards, teachers were asked about their knowledge of central tendency and distribution measures.

Table 10. "What are the measures of Central Tendency and Distribution? Can you give a brief description?" answers to the question.

Measures of Central Tendency			Measures of Central Distribution		
	Frequency	Participant Code		Frequency	Participant Code
True	10	L4, O1, O4, O3, O7, O2, O5, O6, L1, L2	True	7	L4, O4, O3, O7, O5, L1, L2
False	1	L3	False	4	L3, O1, O2, O6,

When the answers are examined, it is evident that there is a general understanding of central tendency and distribution measures, but there are differences in the details. Among the answers, there are similar thoughts regarding what the measures of central tendency are. Responses containing measures such as the arithmetic mean, median, and mode were expressed as measures of central tendency, which are commonly encountered. The geometric mean was also suggested by some participants. There is a similar framework for measures of dispersion. Responses containing measures such as the standard deviation and variance were seen. Additionally, dispersion measures such as openness, quarterly gap, and coefficient of variation were also specified. Although the level of remembering these measures and conceptual understandings varied in the answers, the participants put forward general ideas instead of providing an explanation about the meanings of the measures.

O3 in this regard;

> *Central tendency arithmetic, mean, median, mode. Measures of distribution were standard deviation and what was it? There was also clarity.*

L1 in this regard;

Central tendency and distribution central distribution. central tendency. Arithmetic mean. Mode median. Measures of central distribution are variance, standard deviation, range, span, and quartile range.

Finally, "What comes to your mind when you say normal distribution?" question was posed.

Table 11. "What comes to mind when you say normal distribution?" answers to the question.

	Frequency	Participant Code
I don't know	6	L4, O1, O3, L1, L2, L3
Equal means	2	O2, O4
Bell curve - Gaussian	3	O7, O5, O6

When the answers given by the participants were examined, it was seen that there were similar and different understandings about some basic aspects of the concept of normal distribution. Some participants (O7, O5, O6) stated that the normal distribution is a general statistical term that refers to a certain shape or a bell-like curve and that it is also known as the Gaussian distribution. Some participants (O2, O4) emphasized a feature of the normal distribution and stated that the arithmetic mean, median, and mode are equal. Unexpectedly, not all of the high school teachers were able to provide information about the normal distribution.

O2 on this subject;

Normal distribution, that is, the arithmetic mean and standard deviation are equal to each other. Distributions. Mean mode median. Yes, yes.

He replied as L3 is on this subject;

Normal distribution is standard in my opinion. So is it normal now? When we look at the meaning of the word, it may appear socially as well. It's a normal situation. When we say a normal understanding, your standards. I think it's a situation.

5. DISCUSSION AND CONCLUSION

In teaching statistics, the beliefs and attitudes of teachers towards statistics and statistics teaching are of great importance, as beliefs influence people's behavior (Estrada et al., 2011). The aim of this study was to determine the attitudes and beliefs of mathematics teachers regarding statistics and statistics teaching.

When teachers were asked to talk about statistics, their initial reaction was negative due to their past experience. As stated in the study of Begg and Edwards (1999), this situation is caused by the continuation of teachers' beliefs from their undergraduate education. Furthermore, the belief in using statistics to direct the future and/or make accurate predictions about the future has emerged among teachers.

In the interviews with the teachers, it was agreed that statistics education can help students make better decisions in their daily lives and improve their analytical thinking skills. Additionally, it was generally accepted that statistics education will enable students to understand, interpret, and think statistically about data. Different approaches were proposed according to the teachers' views on how

statistics education should be applied. The first approach is Applied Statistics Education. This approach is proposed as a method supported by practical examples that will enable students to understand statistical concepts and skills with examples from daily life. It was also stated that students could better understand the abstract concepts of statistics if the practices were age-appropriate, supported by using technology, and supported by field studies. The second approach is the Spiral Learning Approach. In this approach, statistics education can be organized as a repetitive spiral learning starting from the basic level and progressing to more advanced levels. It was suggested to the students that more permanent learning could be achieved by repeating the same subjects in different periods, increasing the dose each time. In both approaches, teachers emphasized that statistics education should not remain solely at the theoretical level and that theoretical knowledge should be combined with practical applications.

It is possible to say that probability and statistics are subjects that appear to be different fields but are closely related. From a theoretical point of view, it is not wrong to say that probability is the basis of statistics. This view was also shared by secondary school teachers. However, high school teachers do not agree. While high school teachers included the acquisitions for probability in the mathematics program, they excluded the acquisitions for statistics in a sense. In exam-oriented education systems, teachers and learners naturally expect the subjects they teach and learn to be tested in the exam. It is thought that the fact that statistics subjects have fewer questions compared to probability and other mathematics subjects may have caused this belief. Another reason for this situation may be related to the teachers' level of statistical content knowledge.

Teachers may not be familiar with basic statistical concepts such as universe, sample, measures of central tendency, and normal distribution. These concepts form the basis of statistical analysis and may require more training and awareness for teachers to better understand this area. Pfannkuch (2008) stated that teaching statistics is different from teaching mathematics and that statistics is an independent cognitive method. He also emphasized that when teachers do not have sufficient content knowledge, the statistical thinking skills that we expect their students to develop cannot develop sufficiently. Pierce and Chick (2011) stated that teachers' thinking that statistics consist only of data collection and analysis means that they can only teach this subject to their students, and this will ignore a broader understanding of statistics. In this context, teachers also stated that they mostly lacked knowledge in the interviews. In general, teachers seem willing to learn more about statistics and receive training, which is considered a positive situation. The literature on statistics education points to concerns about teachers' readiness to teach statistics (Greer & Ritson, 1994), which is linked to their lack of statistical content knowledge. It is understood that some of the teachers do not see the lack of statistical knowledge as a problem in terms of their teaching. For example, although the teachers did not respond to the question about central tendency and distribution measures at the level expected from them, they stated that the lack of interpreting what they told was caused by the students and/or the system.

Consequently, it is essential to take into account both student and teacher needs when designing a statistics education program. Professional training on the fundamentals of statistics and their teaching

should be organized for teachers. This way, teachers will be able to enhance their student's ability to think statistically and make more informed and accurate decisions.

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GENİŞLETİLMİŞ TÜRKÇE ÖZET

MATEMATİK ÖĞRETMENLERİNİN İSTATİSTİK ÖĞRETİMİNE İLİŞKİN İNANÇ VE TUTUMLARININ İNCELENMESI

GİRİŞ

Her bilim dalı kendi problemlerine ve bu problemlerin çözümü için kendi yöntemlerine sahiptir. Bu özellikleri bilim dallarını ayrı bir disiplin yapar. İstatistikte birçok teknikten oluşan ayrı bir disiplin ve bilimdir. İstatistiğin gelişimine önemli katkısı olan bilim insanlarından biri olan İngiliz Sir Francis Galton (1822-1911) istatistiğin önemi ile ilgili olarak düşüncelerini "Üzerinde yazacak büyük bir konum var: İstatistik; ancak, anlatımımın, titizlikten ödün vermeden, hiçbir yönünü eksik bırakmadan, kolayca anlaşılacak biçimde sunmakta yetersiz kalacağını hissediyorum" biçiminde ifade etmiştir. İstatistiğin günümüzde, verilerin toplanması, analizi ve yorumlanmasıyla geleceğe ışık tutmakta olduğu ve toplumun farklı kesimlerinden gelen verilerin analiz edilmesinde, geleceğe yönelik alınacak kararların belirlenmesinde ve mevcut durumların değerlendirilmesinde önemli ve kritik bir rol oynamakta olduğu düşünülmektedir. Ancak istatistik kolaylıkla bir aldatama aracı olarak kullanılma potansiyeline sahiptir. Huff (1993), kötüye kullanılan istatistiklerin birçok gerçeği olduğundan farklı hale getirebileceğini ve iyi makyajlanmış bir istatistiğin Hitler'in büyük yalanında daha etkili olduğunu belirtmiştir. Ayrıca bu istatistiklerin toplumu hem yanlış yöne götürdüğünü hem de bunu ortaya atanları kimsenin suçlayamayacağını vurgulamıştır.

İstatistiğin, sadece bir akademik alan olmanın ötesinde, günlük hayatta karşılaşılan durumların analizinde ve karar verme süreçlerinde vatandaşlara rehberlik edebileceği düşünüldüğünde, istatistiğin öğretimi de çok önemli bir noktaya taşınmış olur. Hebrert G. Wells'in "İstatistiksel düşünce, gün gelecek tıpkı okuryazar olmak gibi iyi yurttaş olmanın en gerekli ögelerinden olacaktır" şeklindeki ifadesi istatistik eğitiminin önemini özetleyen bir ifadedir (Huff, 1993).

Bu bağlamda, istatistik eğitiminin çocuklar için önemli yararları göz önünde bulundurulduğunda, onlara erken yaşlardan itibaren temel istatistik kavramlarını öğretilmesinin, onların bilişsel düşünme ve karar verme kabiliyetlerini geliştirmelerine yardımcı olacağı düşünülmektedir.

Tanilli (2012), yetiştirme ve öğretme işinin birbirinden farklı ve kimi zaman bağımsız etkinlikler olduğunu ve her ikisinin aynı zamanda yapılmaması ve tek bir kişiye bırakılmaması gerektiğini belirtmiştir. Ayrıca, Anne ve Baba bilgili de olsalar, çocuklarını okutup öğretmekte, onları yetiştirmekte yeterli olmadıklarını çünkü fazla sabırsız, sinirli ve tutkulu olabileceklerini vurgulamıştır. Buna karşılık, bir öğretmenin, ne bir baba ne de bir ikinci anne olmadığını, rolünün sevmek ya da kendini sevdirmek değil bir şeyleri öğretmek olduğunu belirtmiştir. Bu durumda çocukların yaşamlarına önemli katkıları olduğu düşünülen istatistiğin öğretilmesinde, öğretmenin istatistik ve öğretimine yönelik inanç ve tutumları önemlidir. İnançlar, istatistik dersleri veren öğretmenlerin davranışlarını etkiler (Estrada vd., 2011). Öğretmenin istatistik öğretimi yaparken, öğrencilerin merkezi eğilim ölçü birimlerinin

matematik becerilerinde ustalaşmalarının önemli olup olmadığı, istatistiklerin gerçek dünya durumlarıyla ilişkili olup olmadığı ve teknolojinin öğrencilerin öğrenmesine yardımcı olup olmayacağı ile ilgilenir. Öğrencilerin uygun araçları seçmelerine izin vermek önemlidir. Öğrencilerin ve öğretmenlerin matematik eğitimine ilişkin görüşlerinin incelenmesi uzun ve ayrıntılı bir geçmişe sahiptir. Ancak istatistik eğitimi söz konusu olduğunda ve özellikle öğretmenlerin inançlarına odaklanıldığında çalışma sayısı yok denecek kadar azdır (Pierce ve Chick, 2011).

Estrada ve Batanero (2008) tarafından vurgulanan sınıf dışındaki istatistiklerle ilişkiler ise, öğretmenlerin inançlarından etkilendiğini göstermektedir. Bu bağlamda, öğretmenlerin istatistik öğretimine yönelik inançlarının incelenmesinin önemli olduğu düşünülmektedir. Türkiye'de yapılmış önceki çalışmalar, bu çalışmanın aksine genellikle öğretmen adaylarının istatistiğe veya aldıkları istatistik dersine olan tutumları ile ilgidir. Bu çalışmada, matematik öğretmenlerinin istatistik ve istatistik öğretimi hakkındaki inançlarının incelenmesi amaçlanmıştır.

YÖNTEM

Bu çalışma, eğitim ortamlarında yaygın olarak kullanılan temel nitel araştırma yöntemlerini kullanmaktadır. Çalışmada nitel araştırma desenlerinden olgubilim deseni kullanılmıştır. Bu çalışmada da matematik öğretmenlerinin istatistik ve istatistik eğitimine yönelik inanç ve tutumlarının derinlemesine incelenmesi amaçlanmıştır.

Çalışma Grubu

Bu çalışma için, amaçlı örnekleme yöntemi kullanılarak milli eğitim bakanlığında çalışan 11 matematik öğretmeni seçildi. Katılımcıların çalışmada yer alması için Eğitim Fakültesi Matematik bölümlerinden mezun olmaları, İstatistik dersi almış olmaları ve çalışmaya gönüllü olmaları gerekmektedir. 7'si ortaokul ve 4'ü lise düzeyinde olmak üzere toplam 11 öğretmen gönüllü olarak çalışmaya katılmıştır. Çalışmaya katılan öğretmenler Milli Eğitim Bakanlığı bünyesinde çalışan matematik öğretmenleridir. Katılımcıların 5'i erkek, 6'sı kadın ve yaşları 30 ile 40 arasında değişmektedir.

Veri Toplama Aracı

Veri toplama aracı olarak, yarı yapılandırılmış görüşme formu kullanılmıştır. Bu form, konuyla ilgili literatür taraması yapılarak belirlenmiş ve öğretmenlerin istatistik eğitimi ile ilgili inanç ve tutumları arasındaki ilişkiler üzerine odaklanmıştır. 15 sorudan oluşan taslak form pilot çalışma ve uzman iki öğretim üyesinin görüşleri doğrultusunda bazı sorular çıkarılarak 11 sorudan oluşan matematik öğretmenlerinin istatistik ve istatistik eğitimi konusundaki inanç ve tutumlarına yönelik nihai görüşme formu elde edilmiştir. Pilot çalışma, bu çalışmanın katılımcıları olmayan ikisi ortaokul ve ikisi lise düzeyinde olan dört matematik öğretmeni ile yapılmıştır.

Veri Toplama Süreci

Çalışmanın verileri Şubat 2023 tarihinde toplanmıştır. Veri toplama sürecinde, matematik öğretmenleri araştırmanın amacı hakkında bilgilendirilmiş ve birçok öğretmen çalışmanın istatistik ile ilgisinden dolayı katılmayı reddetmiştir. Katılmaya gönüllü olanlarla görüşmeler yapılmıştır.

Görüşmelerin ses kayıtlarının kullanılması, görüşme süresini kısaltarak ve öğretmen adaylarının cevaplarını eksiksiz bir şekilde kaydetmeye yardımcı olması amacıyla tercih edilmiş ve tüm katılımcılar ses kaydı yapılmasını kabul etmiştir. Görüşmeler, katılımcıların kendilerini rahat hissedecekleri uygun ortamlarda birebir şekilde gerçekleştirilmiştir, böylece onların konforu ve güvenliği göz önünde bulundurulmuştur.

Verilerin Analizi

Öncelikle kaydedilen görüşmelerin çözümlemesi yapılmıştır. Çalışmanın güvenirliğini sağlamak amacıyla, veriler iki ayrı kişi tarafından, biri araştırmacı diğeri ise nitel veri analizi konusunda deneyimli bir öğretim üyesi olmak üzere, analizler yapılmıştır. Veri analizi için "kesme ve sınıflandırma (cutting and sorting)" tekniği kullanılmıştır (Lincoln ve Guba, 1985).

BULGULAR

Araştırmaya katılmaya gönüllü olan öğretmenlerin istatistik ile ilgili inançlarının ve tutumlarının yapılan görüşmelerin başlangıcında ilk ifade ve tepkilerine göre olumsuz olduğu gözlemlenmiştir.

Öğretmenlerin istatistik eğitimi hakkındaki görüşleriyle ilgili bulgular

Öğretmenlerin istatistik eğitimi hakkındaki görüşlerini özetleyecek olursak şu şekilde sunabiliriz:

İstatistik eğitimi gerekliliği konusunda öğretmenlerin genel bir mutabakatı vardır. İstatistik eğitiminin, sorgulayan bireyler yetiştirmek ve verileri yorumlamak için gerekliliği vurgulanmıştır.
İstatistik eğitiminin hangi düzeyde olması gerektiği konusunda öğretmenler, temel düzeyden başlayarak ilerlemesi gerektiği ve seviyeye uygun bir şekilde sunulması gerektiğini savunmaktadır. Temel kavramların öğrencilere anlatılması ve istatistiksel düşünme becerilerinin kazandırılması önerilmiştir.
İstatistik eğitiminde kullanılması gereken yöntem konusunda öğretmenler arasında farklı görüşler bulunmaktadır. Genel olarak uygulamalı ve örnek olaylara dayalı bir yaklaşım önerilmiştir, ancak bazı katılımcılar geleneksel yöntemleri ve teorik bilgiyi vurgulamıştır.

Olasılık ve istatistik arasındaki ilişki konusunda öğretmenler arasında farklı görüşler vardır. Bazıları bu iki disiplinin ayrı ayrı ele alınması gerektiğini savunurken, diğerleri bu iki disiplinin birbirini tamamladığını düşünmektedir.

İstatistik ve olasılık derslerinin hangi öğrenim düzeylerinde verilmesi gerektiği konusunda farklı bakış açıları bulunmaktadır. Bir grup öğretmen, bu konuların ilkokul veya okul öncesi seviyelerde tanıtılması gerektiğini savunurken, diğerleri bu derslerin ortaokul veya lise düzeylerinde daha kapsamlı bir şekilde işlenmesini önermektedir.

Genel olarak, öğretmenler arasında istatistik eğitimi ile ilgili farklı perspektifler ve görüşler bulunmaktadır. Bu farklılıklar, öğrenci düzeyi, öğrenim düzeyi, öğretim yaklaşımı ve deneyim gibi faktörlere dayanmaktadır.

Öğretmenlerin istatistik eğitimi konusunda inanç ve tutumlarıyla ilgili bulgular

Öğretmenlerin istatistik eğitimi, inançları ve tutumları hakkında elde edilen bilgileri özetleyecek olursak şu şekilde sunabiliriz:

İstatistik hakkında;

İstatistik, verilerin toplanması ve yorumlanması yoluyla anlam çıkarma süreci olarak görülüyor.

Genellikle geleceğe yönelik tahminler yapmak veya geçmişteki olayları anlamak için kullanılıyor.

İstatistik, matematiksel metotlarla çalışan bir bilim dalı olarak kabul ediliyor.

İstatistikçiler hakkında;

Günlük hayatın bir parçası olarak kabul ediliyor ve karar verme süreçlerinde yardımcı oluyor.

İstatistikçiler, veri toplama, analiz etme ve yorumlama süreçlerini kullanarak gelecekteki olayları tahmin etmeye çalışan uzmanlar olarak görülüyor.

İstatistikçiler sonuçları anlamlandırma ve karar verme süreçlerine katkı sağlıyorlar.

Kendi yeterlilikleri hakkında;

Bazı öğretmenler, istatistik alanında daha fazla öğrenmeye ihtiyaç duyduklarını ve gelişmeleri gerektiğini vurguluyorlar.

Bazıları, çalıştıkları okul seviyelerinde (ortaokul, lise) verilen istatistik derslerini öğretmekte yeterli olduklarını, ancak daha üst seviyelerde zorlanabileceklerini ifade ediyorlar.

Genel olarak, öğretmenler istatistiği veri analizi ve tahmin yapma yeteneği olarak görüyorlar. Ancak bazıları, istatistik eğitimlerinin yetersiz olduğunu düşünerek daha fazla öğrenme ve gelişme ihtiyacı olduğunu belirtiyorlar. Ayrıca, özellikle üst düzey istatistik konularında öğretmenlerin kendilerini yetersiz hissettiği görülüyor. Bu durum, öğretmenlerin istatistik öğretimi konusundaki inanç ve tutumlarını etkileyebilir.

Matematik Öğretmenlerinin İstatistik Alan Bilgisi ile İlgili Bulgular

Öğretmenlerin temel istatistik kavramlarına yönelik bilgi düzeylerinin eksik olduğu görülmektedir. Evren ve örneklemin tanımı konusunda genel bir anlayışın olduğu, ancak detaylar konusunda eksiklikler bulunduğu görülmüştür. Ayrıca, örneklemin nasıl seçileceği konusunda da katılımcıların yetersiz bilgi sahibi olduğu anlaşılmaktadır.

Merkezi eğilim ve dağılım ölçüleri konusunda ise katılımcıların genel bir anlayışa sahip oldukları ancak ayrıntılarda farklılıklar olduğu gözlemlenmiştir. Merkezi eğilim ölçüleri olarak aritmetik ortalama, medyan ve mod gibi ölçüleri içeren cevaplar sıkça karşılaşılan yanıtlar arasındadır. Dağılım ölçüleri konusunda da benzer bir durum söz konusudur. Standart sapma ve varyans gibi ölçüleri içeren yanıtlar yaygın olarak verilmiştir.

Normal dağılım konusunda ise katılımcılar arasında farklı anlayışlar bulunmaktadır. Bu dağılımın genel bir istatistiksel terim olduğu, belirli bir şekil veya çana benzeyen bir eğriyi ifade ettiği ve Gauss dağılımı olarak da bilindiği gibi farklı açıklamalar yapılmıştır. Bazı katılımcılar ise normal dağılımın, aritmetik ortalama, medyan ve mod'un eşit olduğu bir özellik olduğunu vurgulamışlardır.

Sonuç olarak, öğretmenlerin istatistik alanındaki temel kavramlara ve terimlere yönelik bilgi düzeyleri eksik olduğu için bu konularda daha fazla eğitim ve bilgiye ihtiyaçları olduğu görülmektedir. Bu

eksiklikler öğrencilere doğru ve etkili bir istatistik eğitimi verme konusunda zorluklara neden olabilir. Bu nedenle öğretmenlerin istatistik eğitimlerinin güçlendirilmesi ve bu konuda daha fazla destek almaları önemlidir.

SONUÇLAR

İstatistiğin öğretilmesinde, öğretmenin istatistik ve istatistik öğretimine yönelik inanç ve tutumları önemli bir yere sahiptir çünkü inançlar, insanların davranışlarını etkiler (Estrada, Batanero ve Lancaster, 2011). Bu çalışmada da, matematik öğretmenlerinin istatistik ve istatistik öğretimi ile ilgili tutum ve inançlarını belirlemek amaçlanmıştır.

Öğretmenlere istatistik hakkında konuşmak istendiği söylendiğinde verdikleri ilk tepki geçmiş tecrübelerinden kaynaklı olumsuzdu. Bu durumun Begg ve Edwards (1999)'ın çalışmasında belirtildiği gibi öğretmenlerin lisans eğitimi aldıkları dönemdeki inançlarının devam etmesinden kaynaklanmaktadır. Ayrıca öğretmenlerin genelinde istatistik hakkında geleceğe yön verme ve/veya geleceğe yönelik doğru tahminler yapabilme inanışı kendini göstermiştir.

Öğretmenlerle yapılan görüşmelerde istatistik eğitiminin, öğrencilerin günlük yaşamlarında daha iyi kararlar vermelerine yardımcı olabileceği ve analitik düşünme becerilerini geliştirebileceği konusunda fikir birliğine varıldığı görülmüştür. Ayrıca, istatistik eğitiminin, öğrencilerin verileri anlamalarını, yorumlamalarını ve istatistiksel olarak düşünmelerini sağlayacağı genel bir görüş olarak ortaya çıkmıştır. Öğretmenlerin istatistik eğitiminin hangi yöntemlerle uygulanması gerektiği konusundaki görüşlerine göre ortaya çıkan farklı yaklaşımlar görülmüştür. Bunlardan ilki Uygulamalı istatistik eğitimidir. Bu yaklaşım, Öğrencilerin istatistiksel kavramları ve becerileri günlük hayattan örneklerle anlamalarını sağlayacak uygulamalı örneklerle desteklenen bir yöntem önerilmiştir. Bu sayede öğrencilerin, istatistiğin soyut kavramlarını daha iyi anlayabileceği belirtilmiştir. Burada, uygulamaların yaşa uygun olması, teknoloji kullanarak desteklenmesi ve saha çalışmalarıyla desteklenmesi özellikle vurgulanmaktadır. İkinci yaklaşım sarmal öğrenme yaklaşımıdır. Bu yaklaşımda da, istatistik eğitimi, temel düzeyden başlayarak daha ileri seviyelere doğru giderek tekrarlayan bir sarmal öğrenme şeklinde düzenlenebilir. Öğrencilere farklı zaman dilimlerinde aynı konuların dozu arttırılarak tekrarlanması yoluyla daha kalıcı öğrenmenin sağlanabileceği belirtilmiştir. Öğretmenler her iki yaklaşımda da İstatistik eğitiminin teorik seviyede kalmaması gerektiğini, teorik bilginin mutlaka pratik uygulamalarla birleştirilmesinin gerektiğini vurgulanmıştır.

Olasılık ve istatistik, farklı alanları temsil ediyor gibi görülen ancak birbirleriyle sıkı bir ilişki içinde olan konular olduklarını söylemek mümkündür. Kuramsal olarak bakıldığında olasılığın, istatistiğin temeli olduğunu söylemek yanlış olmaz. Ortaokul öğretmenlerinde de bu görüş ön plana çıkmıştır. Ancak lise öğretmenleri aynı düşüncede değillerdir. Lise öğretmenleri, matematik programında olasılığa yönelik kazanımları sahiplenirken, istatistiğe yönelik kazanımları bir anlamda dışlamışlardır. Sınav odaklı eğitim sistemlerinde doğal olarak öğretenler ve öğrenenler, öğrettikleri ve öğrendikleri konuların sınavda bir karşılığı olmasını beklerler. İstatistik konularının sınava olasılığa ve diğer matematik konularına göre daha az soru malzemesi olmasının böyle bir inanışa neden olmuş

olabileceği düşünülmektedir. Ortaya çıkan bu durumun bir diğer nedeni de öğretmenlerin istatistik alan bilgisi düzeyleriyle de ilgili olabilir.

Öğretmenler, evren, örneklem, merkezi eğilim ölçüleri ve normal dağılım gibi temel istatistik kavramları yeterince hatırlayamamaktadırlar (veya bilinmemektedirler). Bu kavramlar, istatistiksel analizlerin temelini oluşturmaktadır ve bu alanın daha iyi anlaşılması için öncelikle öğretmenlere yönelik daha fazla eğitim ve farkındalık gerektirebilir. Pfannkuch ve Wild (2008), istatistik öğretmenin matematik öğretmekten farklı olduğunu ve istatistiğin bağımsız bir bilişsel yöntemi olduğunu belirtmiştir. Ayrıca öğretmenlerin yeterli alan bilgisine sahip olmadıklarında, öğrencilerinde oluşmasını beklediğimiz istatistiksel düşünme becerisinin yeterince gelişemeyeceğini vurgulamıştır. Pierce ve Chick (2011) öğretmenlerin istatistiği sadece veri toplama ve analizinden ibaret olduğunu düşünmelerinin, öğrencilerine sadece bu konuyu öğretebilecekleri anlamına geldiğini ve bunun da daha geniş bir istatistik anlayışını göz ardı edeceğini belirtmişlerdir. Bu bağlamda, öğretmenler de yapılan görüşmelerde çoğunlukla bilgi eksikliğine sahip olduklarını dile getirmişlerdir. Genel olarak öğretmenlerin istatistikle ilgili daha fazla bilgi edinmeye ve eğitim almaya istekli görünmektedir ve olumlu bir durum olarak değerlendirilmektedir. İstatistik eğitimi ile ilgili literatür, öğretmenlerin istatistik öğretmeye hazır olmalarına ilişkin endişelere işaret etmektedir (Greer & Ritson, 1994) ve bu da onların istatistik alan bilgisi eksikliğiyle bağlantılıdır. Öğretmenlerin bazıları istatistik bilgisinin eksikliğini öğretimleri açısından bir sorun olarak görmedikleri anlaşılmaktadır. Örneğin merkezi eğilim ve dağılım ölçüleri ile ilgili soruya öğretmenler kendilerinden beklenen düzeyde geri dönüş yapmamış olsalar da bunları anlattıklarını yorumlama konusunda eksikliğin öğrencilerden ve/veya sistemden kaynaklandığını belirtmişlerdir.

Sonuç olarak, istatistik eğitimini geliştirirken öğrenci gereksinimlerini ve öğretmenlerin ihtiyaçlarını göz önünde bulundurmak kritik bir öneme sahiptir. Öğretmenlere yönelik istatistikle ilgili temel kavramlar ve bunların öğretimleri konusunda profesyonel eğitimler düzenlenmelidir. Bu sayede öğretmenler, öğrencilerinin istatistiksel düşünme, daha akılcı ve doğru kararlar alabilme becerilerini artırabilecektir.