INTERNATIONAL JOURNAL OF MODERN EDUCATION STUDIES

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Dr. Marko Turk
University of Tyumen, School of Advanced Studies, Russian Federation
turk.marko1983@gmail.com https://orcid.org/0000-0001-9067-6757

Dr. Sevie Paida
Hellenic Open University, Greece
paida.sevasti@ac.eap.gr https://orcid.org/0000-0001-7181-072X

Dr. Lames Abdul Hadi
Zayed University, British University in Dubai, United Arab Emirates
lames.abdulhadi@gmail.com https://orcid.org/0000-0001-6328-0896

PhD Candidate Kirsten Michael Letofsky
New Mexico State University, United States
letofsky@nmsu.edu https://orcid.org/0000-0002-6465-5351

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Research

Determination of high school students' cognitive structures related to the atmosphere and climate

Baştürk Kaya[1] **Caner Aladağ**[2]

Abstract:

The aim of this study was to determine the cognitive structures of high school students related to the atmosphere and climate. The study group consists of 70 students in the 10th grade of a state high school affiliated to Konya Provincial Ministry of National Education. In this study, a survey model, which allowed us to determine the current situation, was used. Data were collected using the word association test (WAT). The key concepts related to the subject were climate, atmosphere, temperature, pressure, wind, humidity, and precipitation. A frequency calculation, a descriptive analysis technique, was used to analyze the data. The obtained data were subjected to evaluation, and a frequency table was prepared. Among the key concepts, the most response words were related to climate (n=20). The others were the atmosphere (n=14), temperature (n=14), humidity (n=11), precipitation (n=11), pressure (n=10) and wind (n=8). The answer word rain (n=49) was written for the key concept of precipitation and had the highest frequency value. The answer words for the key concepts were analyzed in detail, and concept networks were created using the cut-off point technique. Thus, it was attempted to reveal the cognitive structures of the students regarding the subject. In addition, sentence examples were analyzed and classified according to their characteristics and a scientific content table was created.

Keywords: Geography, atmosphere, climate, word association test, cognitive structure

[1]Assoc. Prof., Necmettin Erbakan University, Ahmet Keleşoğlu Faculty of Education, Konya, Türkiye. basturkbhk@gmail.com, https://orcid.org/0000-0002-4801-4386

[2]Assoc. Prof., Necmettin Erbakan University, Ahmet Keleşoğlu Faculty of Education, Konya, Türkiye. caner5101@gmail.com, https://orcid.org/0000-0001-5392-2760

INTRODUCTION

The atmosphere comprises various layers of gases surrounding the earth. Its most important feature is that it is a natural environment where weather events occur. While this environment enables life, it also prevents the earth from overheating and cooling by retaining some of its sunlight. The atmosphere, which is a mixture of many different gases, contains life-giving gases such as oxygen for humans and animals and carbon dioxide for plants. Climate is a branch of science that establishes connections between humans, the environment, and meteorological events. In other words, a close relationship between the climate of a region and its natural environmental characteristics. The climate has a shaping effect on the society living in a region, its landforms, natural vegetation, and human activities. Therefore, it is important to understand the atmosphere, which is a natural environment, and the climatic characteristics that reflect the average character of atmospheric events. Only by achieving this can society become sensitive to the environment. Thus, it can be understood that there is a mutual relationship between different components, such as the atmosphere, climate, society, and environment, landforms, and vegetation, and the importance of this being sustainable. In achieving this, geography has a very important duty and responsibility.

Geography is a field that analyses the human-space relationship and the distribution of natural and human events within the framework of causality (Ünlü, 2014). Geography is a science that reveals the characteristics of the places on earth and investigates and explains the causes of these characteristics and the similarities and differences between various places and the laws governing them. Geomorphology (landform science), climate, and vegetation play the most important roles in the formation of these features, similarities and differences (Erinç, 1977).

Climate is the most important environmental factor affecting the life of organisms in terrestrial ecosystems. The average character of atmospheric events that occur over any area on earth for a long time is called climate. Climate is formed as a result of the Sun's rays not reaching Earth under the same angle. Temperature, precipitation, wind, air humidity, pressure, and its changes during the day and year are the factors that affect the formation of climate in a region. Among these, precipitation and temperature are the two most determining elements of climate (Gökmen, 2007). Climate encompasses all elements such as temperature, precipitation, humidity, wind, and pressure (Efe, 2010). The weather and climate are two separate concepts that are often confused with each other. The weather is the atmospheric conditions over a short time interval in any place. Instantaneous, hourly, daily. Weather events are meteorological events. Climate, on the other hand, is the average expression of weather events and characteristics measured and observed at certain intervals over long periods of time anywhere in the world (Şahin, 2006). Climate is the most important physical geography feature in the world. Physical

features such as underground and surface waters, plants, animals, landforms, soils, and many other social and economic activities such as settlement, agriculture, tourism, trade, energy, transport, construction, and health, as well as the physical, psychological, and sociological characteristics of people and even all living things are under the influence and control of climate (Şahin, 2006). Climate is defined as all of the limit and average values of weather conditions in a region over a long period. Therefore, changes in conditions over time are not attributed to climate changes. However, the climate of a region also changes over thousands of years or longer periods (Aydeniz, 1985). The atmosphere is an important region where weather events occur. In this respect, it is important to understand the relationship of climate elements with the atmosphere, their properties, how they are formed and their effects. In this respect, it is useful to briefly explain the key concepts (climate, atmosphere, pressure, humidity, temperature, wind, precipitation) selected in relation to the subject.

The atmosphere is the gas mass that surrounds the earth with the effect of gravity. In ancient Greek, the term translates as atmos = breath, sphere = globe. The atmosphere refers to the breath or air sphere (Karaoğlu, 2013). The gas molecules that make up the atmosphere have a certain weight, like all other substances. Therefore, these molecules exert force on each other to the extent of their weight under the influence of gravity. This force or weight is called the atmospheric pressure (Yazıcı, 2020). The wind is the movement of an air mass consisting of different pressures and changing horizontal displacements (Akman, 1990). Temperature is also an important climatic element. Because temperature also affects other climate elements to a great extent. The total amount of (potential) energy in the mass of an object is called heat, and the effect of this energy on the environment as electromagnetic waves, is called temperature. The main source of heat on earth is the sun. Solar energy is the main factor influencing both the life of living things and the occurrence of atmospheric events (Gökçe, 2010). The earth, which is heated by energy from the Sun, gives back most of the energy it receives to the atmosphere. Thus, the atmosphere surrounding the Earth has reached a certain temperature. The temperature of the atmosphere is expressed as air temperature or temperature in both meteorology and climatology (Şahin, 2006). The amount of water vapor in air is called humidity (Yazıcı, 2020). Very small water grains with a diameter of 0.001 to 0.040 mm, which form fog and clouds, combine or become larger with the new condensation added to them, reaching a size larger than 0.5 mm and becoming heavier. Thus, because this weight can overcome the vertical air movements present in clouds, it starts to fall toward the ground. These grains falling to the ground by following a short or long path in the atmosphere are called precipitation. The precipitated grains can be solid or liquid (Erol, 2010). Although these concepts are abstract, they constitute the basis of related subjects. Correct and meaningful learning of these concepts is important for understanding the subject. To realize conceptual learning, concept teaching strategies should be employed. Abstract concepts should be as concrete as possible and given examples. Otherwise, it may be difficult and time-

consuming to understand and learn the concepts in our minds.

Concepts consist of directly or indirectly observed properties of objects and events. Directly observed properties are the physical properties of the object or event. Indirectly observed properties are its meanings. In other words, observable properties are concrete, whereas indirectly observed properties are abstract. In this regard, concepts are divided into two parts: concrete and abstract. The concepts perceived by sense organs are concrete concepts, whereas those that cannot be perceived are abstract concepts. People learn concrete concepts, which are formed by observing the physical environment from birth by making generalizations at first. Learning abstract concepts is much more difficult and requires a complex process (Yılmaz & Çolak, 2011). Concepts are formed according to people's experiences and change over time. Regardless of how concepts are acquired, they gain meaning only through people's experiences. Concepts that are in the process of continuous redefinition in terms of quantity and quality because of diversity, dynamism, and complexity in experiences have multidimensional features. Some concepts include many interrelated concepts (Yılmaz & Çolak, 2011). Concepts form the foundation of human thought. From this perspective, concepts are the building blocks of thought and knowledge production (Kılıç, 2009). Since concepts are abstract units of thought derived from objects, events, and phenomena, concept teaching should consider students' abstract thinking skills. In modern teaching approaches, the idea that permanent learning should be conceptual rather than procedural is dominant. If an individual can transfer the knowledge to new situations, he/she is considered to have grasped the knowledge learnt (Yılmaz & Çolak, 2011). It can be said that the more important it is for prospective teachers to be equipped in terms of general culture, professional and field knowledge, the more important it is for them to know/learn the concepts of their fields. Especially for the field of social sciences, it can be said that mastery of social sciences disciplines, correct use of concepts belonging to these disciplines, and teaching and learning of concepts are also important (Pınar & Akdağ, 2012).

According to Barth and Demirtaş (1997), one of the most distinctive properties of the science of geography is that it frequently uses concepts to define and explain geographical phenomena and events on earth (cited in Ünlü, 2014). The fact that geography forms conceptual links with different disciplines causes different perceptions and definitions of the concept of geography (Özgen, 2011). As is known, concepts enable us to understand our physical and social worlds. Thanks to concepts and terms, we distinguish events, phenomena, thoughts, and substances from each other. In geography teaching, concepts and terms constitute word groups to be taught to the students both in the transfer of the lesson to the students and during the processing of the lesson; that is, the building blocks of the information, and geographical facts and events can only take place in the minds of the students through concepts and terms (Turan, 2002). Thus, the information learned in geography education gains meaning, and information about any subject is obtained. Issues such as the level of information learned about any subject in

students' minds, for which concepts this information consists of the accuracy of the information they have learned are related to the cognitive structure, and the realization of this can only be achieved through meaningful learning. Students have difficulty attaining high cognitive levels regarding atmosphere and climate. In other words, students have difficulty analysing and evaluating issues such as the structure of the atmosphere, its properties, weather events occurring in the atmosphere, their causes, and their effects. The same applies to climate. A similar situation can be observed in issues such as climate elements, climate factors, air masses, climate types, and the causes and effects. The reasons for this include misunderstanding and thus misinterpretation of scientific concepts on this subject. In addition, their low level of prior knowledge and their attempts to memorize without understanding negatively affected their cognitive structures in this regard. Another reason may be that the participants had difficulty associating the concepts of these subjects with daily life.

The importance of students' cognitive structures should be considered in successful education. When teaching a concept, the teacher should combine it with other related concepts. Meaningful education considers the organization of knowledge and the combination between old experiences and new experiences. It should consider the learner's brain as a database of well-organized and stored items linked together. It should also meet the educational needs of students and define what students need to learn (Abdelhalim, 2019). Cognitive structures play an important role in learners' information-processing abilities because they serve as frames of reference, allowing learners to grasp and work with one or several aspects of a concept (Navaneedhan, & Kamalanabhan, 2017). For this reason, cognitive structure is also called "schema". Cognitive structures or schemas are hierarchical and individualized. In a hierarchical structure, general information can be easily remembered at the upper level and has a fixed character, while there is more specific information at the bottom (Berber & Yıldız, 2019). Cognitive structures are basic mental patterns that people employ to process information (Navaneedhan, & Kamalanabhan, 2017).

Determining the cognitive structure is crucial in geography lessons. An important misconception in geography lessons consists of concepts related to nature. While some of this information was acquired outside school, some of it was acquired in classroom environments due to its abstract nature. Therefore, it is necessary to reveal students' cognitive structure for any subject. One of the techniques used in this study is word association tests. Polat (2013) stated that researchers mostly use the WAT technique to determine the cognitive structures of students before and after teaching and reveal changes in their cognitive structures with teaching.

Word association is a method developed to reveal the relationships established between concepts. Since concepts can be units within subjects, word association can be used to measure how not only concepts but also a discipline, situations, and even people are understood (Atasoy, 2004). In its simplest form, a word association test simply asks

students in an oral or written forum what a series of key words evoke (Aydın & Güngördü, 2016). The basis of this type of test consists of presenting a stimulus word to each participant and asking them to say a predetermined number of words through free association (Graneri et al., 2023). Word association is a method developed to reveal the relationships established between concepts. Since concepts can be units within subjects, word association can be used to measure how not only concepts but also a discipline, situations, and even people are understood (Atasoy, 2004). WAT is a highly effective measurement and evaluation technique for diagnostic purposes in determining cognitive structure and investigating misconceptions (Işıklı et al., 2011). It can be said that WAT is a measurement-evaluation technique that serves the purposes emphasized in the curriculum (MoNE, 2005) as evaluating an interconnected, well-structured knowledge network and meaningful and deeply learned knowledge. This is because students are expected to reveal the words and vocabulary evoked in their minds by the concepts presented with the WAT in any number they want without limitation. In addition, WAT provides the opportunity to obtain visual data as it reveals the relationships and conceptual organization between these concepts, words and vocabulary with concept networks (Taşdere et al., 2014).

In this study, the word association test was used as a data collection tool to determine what students understood from the concepts related to weather and climate, with which concepts they associated it, and what their cognitive structures were on this subject.

Purpose of the Study

In this study, we aimed to determine the cognitive structures of high school students on the subject of "atmosphere and climate" by using independent word association test. It is also aimed at determining the concepts with which high school students explın the subject of "atmosphere and climate" in the 9th grade unit of geography, their thoughts about this subject, their ability to establish relationships between concepts, and whether meaningful learning has taken place in this subject.

METHOD

Research Design

In this study, a descriptive research (screening, survey) model was used to determine the current situation. Descriptive research (screening, survey) describes and explains what has already been experienced and what is experienced. The researcher does not intervene in these phenomena. He/she does not prevent their flow. In other words, he/she does not introduce a new variable into the environment. Analyzes the event as it is and how it works. He/she does not engage in any activities that will ensure its change and development. The phenomenon will continue to exist in the same manner regardless of whether the researcher engages in research activity or not (Sönmez & Alacapınar, 2011). The survey is a research

model that aims to determine a situation that existed in the past or that still exists as it exists. The event, individual, or object that is the subject of the research is tried to be defined in its own conditions and as is. No effort was made to change or influence them in any way. The thing to be known exists and is present. The important thing is to observe and document it appropriately (Karasar, 2016). According to Aslantürk (2008), this method is especially used with test and interview techniques when the number of people to be reached increases. In the survey model, the interaction between events, phenomena, objects, concepts, and situations is tried to be revealed as it is by taking into account their current conditions and characteristics (cited in Yılmaz, 2019). In this study, a descriptive survey model study was preferred because the concepts of high school students' knowledge of the atmosphere and climate and their level of ability to establish relationships between concepts were investigated. According to Karasar (2016), the aims of survey models are usually expressed in question sentences. What were these? What is it? What is it related to? What does it consist of?

Therefore, what are the cognitive structures of the respondents' key concepts regarding the atmosphere and climate? Which answer words were related to the concepts? Trying to find the answers to questions such as this is a screening study. Demographic features were neglected in this study because of the nature of the study. The creation of concept networks is the main theme of this study. It is not possible to display answer words in the concept networks according to demographic characteristics. Because participants with different demographic characteristics can write the same answer phrase, the visuality of concept networks disappears.

Working Group

This study was conducted with 10th grade students in a state high school affiliated with the Ministry of National Education in Konya Province (Türkiye) in the autumn term of the 2023-2024 academic year. The participants consisted of a total of 70 people, 39 of whom were female and 31 of whom were male. However, demographic characteristics were not considered in this study.

Data Collection Tool

The data of this study were obtained using an independent word association test (WAT). In order to conduct the test, 7 key concepts related to the subject of atmosphere and climate in the 9th grade natural systems unit of geography were used as data collection tools. In selecting key concepts, geography textbooks and achievements were examined, and expert opinions were examined. These key concepts were the basic concepts related to the subject and were determined as climate, atmosphere, temperature, pressure, wind, humidity, and precipitation, respectively.

To write the answer words for each key concept, each key concept was written 10 times, one after the other, and a blank space was left. If possible, the answer words were written as a single word in this space quickly. An example of a measurement tool prepared

in this way is given below. Bahar and Özatlı (2003) explained that the reason for writing the key concept is to prevent the risk of chain answers. Thus, it is ensured that students return to the key concept after writing each answer. Otherwise, instead of the key concept, the learner will write the words that the concept brings to mind as an answer.

A sample page of the measurement tool is shown below.

Climate ....

Climate ....

Related sentence: ....

In this study, 1 min (60 seconds) was given for each key concept, and students were asked to write the words that came to mind about the key concept within this time. In Geeslin and Shavelson's (1975) study, it was determined that the participants were given 1 min to write answer words related to the key concept.

At the end of the one-minute period, students were asked to move on to the next key concept. Thus, it was ensured that students made inferences about key concepts using the free-association technique during the period. In addition, in this way, students were given the opportunity to apply each key concept simultaneously.

In addition, the participants were asked to write sentences describing each key concept. These sentences were analyzed one by one during the data analysis phase, and necessary evaluations were made. Işıklı et al. (2011) stated that more meaningful and conceptual information can be obtained through related sentences.

According to Ercan et al. (2010), because a sentence related to a keyword has a more complex and higher-level structure than a one-word answer, it is necessary to consider situations such as whether the sentence is scientific or not and whether it contains misconceptions of different qualities in the evaluation process.

Analyzing Data

A frequency calculation, a descriptive analysis technique, was used to evaluate the data obtained using the word association test. The answer words produced for each key concept were classified and grouped. Thus, a frequency table showing the types of answer words and the number of times these answer words were repeated for which key concepts was formed (Table 1). By evaluating the data in the frequency table, the cut-off point (BP) technique proposed by Bahar et al. (2010) was used, and concept networks were created for each cut-off point level.

In this technique, in the frequency table, 3-5 numbers below the most frequent answer for any key concept in the word association test are used as a cut-off point, and the answers above this answer frequency are written in the first part of the map. Then, the cut-off point is lowered at certain intervals, and this process is continued until all keywords are revealed. A concept map made in this way reveals how students perceive the relationships between

concepts and leads to the discovery of new relationships. Teachers can revise their teaching methods by taking this concept network map into consideration or can orient themselves toward conceptual connections that are missing in the map (Bahar et al., 2010). In this study, the upper level of the cutoff point was determined as 46, and response words with a frequency of 46 and above were included at this level. For example, at this level, the frequency of the answer words "rain" is f = 49 and has a value greater than 46. That is why the answer to the word "rain" is shown at this level. Because the frequency of the answer words for other key concepts was not 46 or above, they were moved to a lower level. This lower level is determined by taking 7 below 46. Thus, response words with frequencies between 40 and 45 were included in this sublevel. Other levels below this level were created using the same approach.

In this regard, frequency tables related to the answers given by the students to the key concepts were prepared. According to the results obtained from the tables formed from the students' answers, concept networks were formed. The cut-off point technique was used in the creation of these concept networks. The cut-off point was colored according to the frequency range of the students' answers to the keywords. 46 and above are shown in black, 40-45 in red, 34-39 in dark blue, 28-33 in orange, 22-27 in pink, 16-21 in green, and 10-15 in blue. For example, the key concepts of precipitation with a cut-off point of 46 and above and the answer word "rain," which ensures precipitation at this level, are shown in black. Key concepts and answer words that appear at the lower level (i.e., between the cut-off points 40 and 45) are shown in red. The key concept of rainfall at the next level, i.e., 46 and above, and the rain answer words are shown at the lower level, preserving their colors. In the others, the same approach was continued, and the color level indicated which key concept and answer words appeared at each level, thus eliminating confusion.

In addition, the dashed lines in the concept networks indicate that a stimulus (response word) is written as a response to another stimulus. Level colors were used to easily understand at which level and in relation to which key concept the response words appeared. In other words, the stimulus words were written with the colors of the level at which they appeared and with capital letters in the boxes. The response words for the key concepts are written in lowercase letters with the colors of the level at which they occur. In this study, the answer words appearing at any level are shown with the color of the level at which the key concept occurred. Sometimes the same answer may be used for different key concepts at different levels. In this case, a straight line is established between the two key concepts; however, the answer words are shown with the colors of the level at which they appear. For example, the answer word "rain" was written for the key concept of rain and appeared at levels 46 and above and was shown in black. Again, the answer word "rain" was written in humidity, and the cut-off point appeared in the range of 22-27. Pink color is used in this range, a connection is established with a straight line, and the key concepts of humidity and precipitation are associated with the color pink. If key concepts are written as answer words for each other, they are shown as a dashed line. For example, the cut-off point

for temperature in the range of 28-33 is written as humidity, and temperature is the answer word within the key concept of humidity. Thus, key concepts are associated with each other and are shown as a dashed line and orange because they are both at the same level.

In this study, a scientific content table was created to present the sentences related to key concepts. Additionally, sentence examples for each key concept were analyzed, and sentence examples containing scientific, non-scientific, or superficial information were included. Again, when creating concept networks, a dashed line was used between two key concepts if one of the key concepts was written as an answer to the other.

Ensuring Validity and Reliability

The main purpose (and claim) of scientific research is to find the right (convincing) answer to the questions or problems that the researcher seeks to answer. For this purpose, two points are given special importance in research: validity and reliability (Altunışık et al., 2002). To ensure the validity of the study, all steps of the study method should be presented in detail. Presenting the sampling, data collection, and analysis stages in detail also contributes to the validity of the study (Özkan, 2023). In this context, data collection, analysis, and how the researcher obtained the results were explained in detail. The results were reported, interpreted, and presented in detail.

To ensure reliability, either different observers should associate events (items) to the same category, or the same observer should associate the same category in the same way at different times (Altunışık et al., 2002). Accordingly, the data obtained were coded, and frequency tables were created separately by two researchers. These codes were compared for the reliability of the research, and consensus was achieved. The reliability of the data analysis was calculated using the formula [Agreement / (Agreement + Disagreement) x 100] (Miles & Huberman, 1994). The average reliability between the coders was calculated as 95%.

Ethical Considerations

Before starting the research, ethical principles were applied to the Necmettin Erbakan University Social and Human Sciences Research and Publication Ethics Committee, and an ethics committee approval certificate numbered (Date: 08/12/2023, No: 2023/586) was obtained.

RESULTS AND INTERPRETATION

For the key concepts related to the subject of atmosphere and climate, a cut-off point was created with the answer words inferred by the students with a repetition number of 10 or more (Table 1). The number of these answer words was calculated as 66. The key word for which the greatest number of answer words were written was climate (n=20), while the others were atmosphere (n=14), temperature (n=14), humidity (n=11), precipitation (n=11), pressure (n=10), and wind (n=8), respectively. The answer word rain (n=49) with the highest

frequency was written for the key concept of precipitation. It is noteworthy that more than half of the students wrote the answer words: high pressure (n=45), low pressure (n=44), snow (n=43), and wind (n=36). The frequencies of other answer words were written by fewer students.

Table 1.

Frequency Table of Key Concepts and Response Words Related to the Atmosphere and Climate

Answer Word	Climate	Atmosphere	Temperature	Pressure	Wind	Humidity	Precipitation
Mediterranean	*	*	3	*	*	11	*
Mediterranean climate	25	*	*	*	*	*	*
Low pressure	*	*	2	44	19	1	3
Atmosphere	8	1	2	19	3	4	5
Nitrogen	*	12	*	*	*	*	*
Relative humidity	*	*	*	*	*	23	*
Barometer	*	*	*	10	*	*	*
Pressure difference	*	*	*	4	15	*	1
Pressure force	*	*	*	13	*	*	*
Pressure	2	20	12	*	23	1	2
Flora	17	*	2	*	*	1	5
Steam	*	*	*	*	*	10	1
Evaporation	*	*	5	*	1	10	8
Cloudy	2	6	*	3	2	8	28
Desert	10	*	11	*	2	*	1
Sea	*	*	2	1	*	19	2
Degree	*	*	17	*	*	*	*
Full	*	*	11	*	*	4	27
Equator	11	*	12	2	*	12	3
Gas	*	6	*	10	*	3	*
Sun	4	2	17	*	*	1	1
Incident angle of sun rays	*	*	10	*	*	*	*
Sunlight	11	5	3	*	*	*	*
Weather	5	23	8	16	13	9	1
Weather events	16	17	2	3	4	3	6
Heat	1	*	19	*	*	4	*
Climate	*	3	17	2	1	11	10
Climate types	2	*	11	*	*	*	*
Ionosphere	*	19	*	*	*	*	*
Snow	5	*	3	*	*	4	43
Blacksea climate	14	*	*	*	*	4	11
Continental climate	20	*	*	*	*	*	*
Layers	*	19	1	*	*	*	*
Frost	*	*	1	*	*	4	14
Climatology	15	*	*	*	*	*	*
Convective precipitation	*	*	*	*	*	*	10
Dry	18	*	7	*	2	*	2
Pole	12	*	9	2	*	*	*
Lithosphere	*	10	*	*	*	*	*
Breeze winds	*	*	1	2	16	*	*
Meteor	*	12	*	*	*	*	1
Season	13	*	10	*	1	1	1
Mesosphere	*	28	*	*	*	*	*
Monsoon climate	18	*	*	*	*	1	8
Absolute humidity	*	*	*	*	1	22	1
Moisture	12	4	20	6	2	1	25
Oxygen	*	17	*	*	*	*	*
Ozone	*	10	*	*	*	*	*
Ozon layer	*	20	*	*	*	*	*
Wind	1	4	6	36	*	*	*

Wind speed	*	*	*	2	10	*	*
Hot	11	*	9	7	6	5	2
Heat	20	7	*	17	7	33	13
Cold weather	13	*	16	8	8	1	9
Cold winds	*	*	*	*	12	*	*
Stratosphere	1	22	*	*	*	1	*
This	1	2	3	5	1	2	10
Water vapor	*	4	*	*	*	18	4
Thermometer	1	*	29	*	*	*	*
Thermosphere	*	17	*	*	1	*	*
Tundra	10	*	*	*	*	*	*
Long-years average	16	*	*	*	*	*	*
Precipitation	12	1	3	5	5	19	*
Rain	9	1	2	*	3	23	49
High pressure	*	*	1	45	22	*	*
Height	*	*	*	12	*	1	*

When the sentences produced for the keywords are analyzed, it is seen that the sentences containing the most scientific information were written for the key concepts of atmosphere (n=50) and wind (n=50). This was followed by pressure (n=45), climate (n=44) and precipitation (n=44) (Table 2). The least number of response words was written for humidity (n=36). When the number of sentences containing non- scientific and superficial information is analyzed; temperature (n=23), humidity (n=17) and climate (n=15) appeared as the key concepts with the highest frequency. The number of sentences containing misconceptions was highest for the key concept of pressure (n=11). In addition, the key concepts that did not have many sentences (no answer) were humidity (n=10) and precipitation (n=10).

Table 2.

Scientific Content Table containing Sentences Related to Key Concepts

Key Concept	Number of sentences containing scientific information	Number of sentences containing non-scientific or superficial information	Number of sentences containing misconceptions	No response
Climate	44	15	7	3
Atmosphere	50	9	4	6
Temperature	40	23	1	5
Pressure	45	8	11	5
Humidity	36	17	6	10
Wind	50	10	2	7
Precipitation	44	11	4	10

When the sentences written by the students for the key concepts are analyzed, it is seen that there were more examples of sentences containing scientific information (Table 3). These sentence examples are correct and academic scientific sentences. Some of these sentences for key concepts consist of similar expressions. However, there are also examples of sentences representing very different features of key concepts. In the second place, examples of sentences containing non-scientific or superficial information. It can be seen that a significant number of these sentences are correct, but they do not possess the characteristics of a scientific expression. Again, among the examples of sentences written about key concepts, there are expressions containing misconceptions.

Table 3.

Examples of sentences made by students related to the key concepts of "atmosphere and climate"

Key Concept	Examples of sentences containing scientific information	Examples of sentences containing non-scientific or superficial information	Examples of sentences containing misconceptions
Climate	-Türkiye generally has a Mediterranean climate (P1) -The climate of Konya is dry and hot in summer and mild and cold in winter (P4) -Climate depends on the mathematical position of a region and affects human life significantly (P10) -Ocean currents affect climate (P12) -40-50-year average weather conditions that affect the living conditions of people and the vegetation of the environment are called climate (P32) -Black Sea, Mediterranean and continental climate is observed in our country (P36) -There are various climates in the world and each of them has its own characteristics (P39) -Climate is one of the most important factors affecting settlement (P42) -Climate has been the most important factor determining the settlement of people since the earliest times (P44) -Equatorial and monsoon climates receive a lot of rainfall (P56) -The atmosphere is being damaged day by day due to air pollution (P57)	-People organise their lifestyle according to the climate (P2) -There are many different climates in the world (P4) -Climate is important for tourism (P14) -Türkiye is one of the few countries where four climate types are seen (P21) -Global warming is effective in changing climates (P34) -The climate is changing (P46) -Climates are long term (P49) -Climate is changing day by day (P53) -Climate change has recently become more important (P54) -The climate here is very harsh (P58) -Our atmosphere is polluted every year (P58) -Let's not pollute the air please (P63) -We damage the atmosphere (P64) -Atmosphere too hot (P65)	-The climate of the Aegean region is warmer than other regions (P6) Climate is the result of long-term research (P7) -General weather (P18) -Türkiye is generally under the influence of continental climate (P48) -Climate change damages the atmosphere (P59) -Gases in the atmosphere are proportional (P66) -There is life in our atmosphere (P69)
Atmosphere	Weather events occur in the atmosphere (P1) -Nitrogen is more abundant in the atmosphere than oxygen (P2) -Atmosphere blocks harmful rays coming to the earth (P3) -The atmosphere consists of different layers (P5) -The Earth's atmosphere protects us from various harmful rays and meteorites (P6) -Atmosphere is important for life (P14) -Atmosphere is the eye layer that surrounds the earth (P16) -Because the gases in the atmospheric layer pressurise the earth, open air pressure occurs (P34) -The mesosphere is a layer of the atmosphere (P47) -78% of the atmosphere is nitrogen, 21% is oxygen and 1% is other gases (P52)	-Layers of the sky (P17) -Atmosphere is related to life (P26) -Let's protect our atmosphere (P46)	-Air decreases as the atmosphere gets closer (P22) -The thickness of the atmosphere is decreasing day by day (P53)
Temperature	-Temperature depends on the angle of incidence of the sun's rays, the temperature is higher where it is perpendicular and close to perpendicular (P10)	-Today the temperature was 12 degrees (P4) -The temperature was high today, humidity will increase (P5) -The temperature in Konya will	Temperature is the average temperature (P43)

	-Temperature affects pressure (P2) -If the humidity is high, the temperature felt is high (P8) -Temperature forms the EU and HP fields (P9) -The unit of temperature is Celsius (P12) -Equatorial belt has the highest average temperature (P21) -Temperature and heat are different concepts (P26) -Temperature is the average kinetic energy of the particles that make up the substance (P27) -The temperature decreases as you rise above sea level (P28) -Latitudes are very effective on temperature. The average temperature decreases as you move away from the equator (P39) -Mathematical position and the angle of incidence of the sun's rays affect the temperature (P47) -The hottest regions in the world are deserts (P48) -Southeastern Anatolia is the region with the highest temperature in Türkiye (P52)	drop tomorrow (P6) -Humidity increases as the temperature increases (P7) -Temperature affects agriculture (P14) -There are many factors affecting the temperature (P18) -The temperature increased (P46) -Today the temperature is 36,5° C (P53) -The temperature can drop to minus degrees in winter (P58) -The weather is very cold (P63) -High temperature is uncomfortable (P64) -The temperature increased with climate change (P66)	
Pressure	-Wind blows from high pressure to low pressure (P67) -Pressure is divided into high- and low-pressure areas (P60) -The pressure decreases as you go higher (P58) -Cloudy at low pressure, clear at high pressure (P55) -Wind occurs if there is a pressure difference between two regions (P49) -Descending air movements are observed in high pressure areas (P48) -Wind direction is determined by pressure (P47) -Pressure is the force exerted by gases on a unit surface (P32) -If the temperature increases, the pressure decreases (P23) -Pressure fields are formed due to temperature difference (P19) -The higher the pressure difference between two regions, the higher the wind intensity (P10) -Open air pressure decreases with increasing altitude (P7) -There is a pressure difference between cold and hot regions (P5)	- Pressure change had a bad impact on life (P66) -Pressure difference too high (P65) -Pressure is very important (P63) -Liquids transmit pressure exactly (P22) -Pressures create winds (P14) -We studied solid pressure in physics (P4) -It is the pressure on the surface (P50) -Pressure change is felt in the body (P59)	- The pressure applied to the bottom of the container (P69) -Winds are from low pressure to high pressure (P41) -The place with high pressure is cold (P37) -The ratio of the perpendicular bathtub of a substance to the surface to the area (P30) -The perpendicular force exerted by the mass on the unit surface (P20) -It is the force that compresses natural wastes and turns them into coal (P25) -Force exerted on materials under the influence of moving gas (P15)
Humidity	-Maximum humidity is the maximum amount of moisture that air can carry (P1) -For precipitation to occur, the amount of moisture in the atmosphere must be high (P1) -If the temperature is high in places near the water, humidity is high (P5) -Water vapour in hot air condenses	-The weather was humid today (P4) -Maximum humidity is high in the Black Sea (P11) -Humidity is high in the Mediterranean region (P13) -Humidity makes breathing difficult (P59) -The weather is too humid (P62) -Humidity too high (P64)	-Moisture is evaporated water (P18) -Precipitation is observed in case of excess moisture (P19) -Ratio of water vapour in the sky (P30) -It is formed by evaporation of sea water (P36) -Moisture is measured by

	and forms precipitation (P9) -The higher the humidity in a region, the greater the difference between the actual temperature and the felt temperature (P10) Humidity is used when calculating the sensed temperature (P12) -Equator and its surroundings are the most humid regions (P14) -Water vapour in the atmosphere is called moisture (P16) -The ratio of absolute humidity to maximum humidity is called relative humidity (P44) -Humidity is one of the factors determining climate (P57)	-Humidity makes breathing difficult (P66) -The weather will be very humid next week (P67) -The weather in the Mediterranean is very humid (P68) -High humidity (P69)	alluvometer (P47)
Wind	-Winds carry the temperature of the region they come from to the place they reach (P1) -The winds blowing from the poles are cold (P11) -Wind can erode (P12) -Breeze winds are the winds with the least effect (P13) -Wind is a horizontal air movement from high pressure to low pressure (P15) -Winds are formed due to pressure difference (P19) -The region with the strongest winds in Türkiye is the Central Anatolia Region (P21) -Pressure difference and wind speed are directly proportional (P26) -Barchans are forms of wind accumulation (P37) -Witness rock is formed by erosion of winds (P52)	-The winds blew strongly (P4) -The wind was so strong, it almost blew us away (P6) -Winds affect the climate (P14) -The name of the wind changes according to the regions (P43) -Windy weather dries our skin (P51) -The weather is very windy (P58) -The wind got stronger and stronger (P62) -The wind blows hard (P64) - It's windy (P65)	-Winds carry heat (P3) -Heated air rises (P22)
Precipitation	-Precipitation is higher at the equator (P2) -In Türkiye, precipitation is high in the Black Sea (P3) -Precipitation is weather events (P9) -Can comment on the amount of precipitation by looking at the climate characteristics of a region (P10) -Precipitation occurs when the relative humidity is 100% (P11) -The Indian peninsula has the highest rainfall in the world (P12) -Precipitation is formed by condensation of water vapour in the atmosphere (P16) -Rain and hail are types of precipitation (P18) -Precipitation is regular at the equator (P34) -Where humidity is high, precipitation is high (P39) -Monsoon precipitation is a type of precipitation (P47)	-It rained for a long time today (P4) -We can understand that rain may come from the clouds (P21) -Today there is a lot of rain (P22) -Precipitation occurs as a result of the water cycle (P23) -Grey indicates that clouds will bring rainfall (P37) -Rain is expected today (P51) -Increased precipitation (P62) -It is raining today (P64) -Very little rainfall (P66) -Increased rainfall (P66) -It is raining in Konya today (P67) -No precipitation for a long time (P69)	-Elevation precipitation is observed on mountain slopes (P1) -Precipitation types are elevation, slope and convectional (P8) -Water vapour accumulated in the clouds cools down and descends to the earth (P17) -Clouds must collide for rain to fall (P36)

Concept networks are an important technique for revealing the organization of knowledge in students' minds on any subject. In other words, it is possible to determine

the level of a student's cognitive structure on a subject using this technique. With this technique, what the student knows about the subject, what concepts he or she has structured in her mind, the nature of these concepts, and his or her ability to establish relationships between concepts can be determined. Frequency of answer words for key concepts are very important when creating a benchmark. Because the frequencies of answer words written for key concepts indicate the level at which the key concept appears. The fact that all of the key concepts emerged at high levels and with high-frequency answer words reveals that the students' cognitive structures on that subject were sufficient. If a significant part of the key concepts is revealed with low-frequency response words at levels below the cut-off point, this indicates that the cognitive structure is not at a sufficient level. In addition, the concept networks created at each level of the cutoff point are visuals that allow students to see their knowledge about a subject more clearly. These maps reveal the concepts that students' cognitive structures consist of and their level of establishing relationships between concepts. The greater the relationships (connections) between concepts at the upper levels of the cut-off point, the more meaningful learning occurs. In line with these explanations, the following evaluations were made for this study.

Between cut-off point 46 and above; the first key concept that emerged in this range was identified as precipitation. The participants associated the word precipitation with the word rain. At this level, the number of repetitions of the answer phrase "rain," which emerged in connection with the key concept of precipitation, was calculated as n=49. In this range, a single key concept appeared in relation to a single answer word (Figure 1). At this level, no word associated with other key concepts was produced. Therefore, it can be concluded that students' cognitive structures regarding weather and climate are not sufficient for this level. Because the frequency of answer words for the emergence of other key concepts at this level is not sufficient and there are no related answer words. It is important that the key concept of precipitation, one of the climate elements, first emerged at this level in relation to rain. Among the climatic elements, precipitation is the most important, and it is also an important form of precipitation.
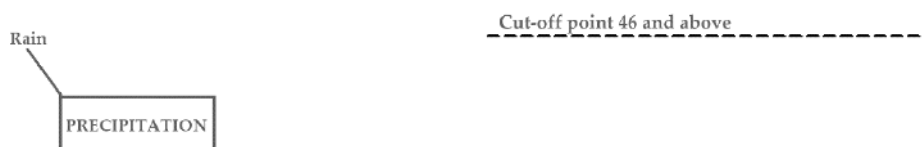
Figure 1. Concept network constructed according to key concepts (cut-off point 46 and above)

Between cut-off point 40 and 45; The key concept of pressure emerged from the key concepts given as stimulus in the range of cut-off point 40-45. The key concept of pressure was associated with the answer words low pressure (n=44) and high pressure (n=45) (Figure 2). The number of repetitions of these two answer words was equal and both answer words

were written by approximately the same students. The key concept of pressure given as a stimulus caused more than half of the students to associate low and high pressure as answers. At this level, the answer to the term "snow," which is one type of precipitation, also emerged in relation to the key concept of precipitation. At this level, the number of answer words for these two key concepts is not sufficient to represent the students' cognitive structure. At the same time, it can be seen that these two answer words emerged independently of each other. However, the answer words "snow," which the students wrote for precipitation, and the answer words "low pressure" and "high pressure," which they wrote for pressure, are the basic concepts of the atmosphere and climate subject, and it is important that they appear at this level.

Figure 2. Concept network constructed according to key concepts (Between cut-off point 40 and 45)

Between cut-off point 34 and 39; this level of the cut-off point shows characteristics similar to those of the cut-off point at the upper level. At this level, it can be seen that the answer word "wind" was written in relation to the key concept of pressure. The number of students who associated the answer word wind with the concept of pressure was found to be n=36 (Figure 3). However, at this level, both key concepts are independent of each other. In other words, common answer words that represented the two key concepts at this level did not emerge. According to this result, students could not establish relationships between concepts at this level.
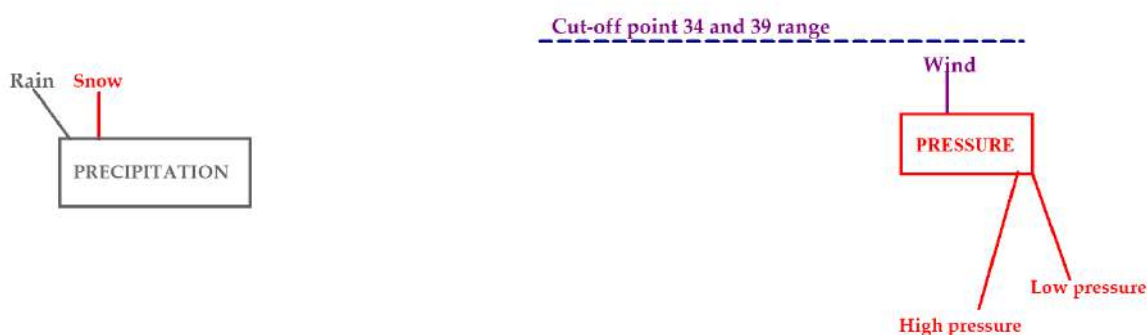
Figure 3. Concept network constructed according to key concepts (Between cut-off point 34 and 39)

Between cut-off point 28 and 33; 5 key concepts emerged in this interval. The key concepts of temperature, humidity, and atmosphere were included in the key concepts that emerged at previous levels. The key concept of temperature was associated with

thermometer (n=29). For the key concept of atmosphere, students wrote the answer phrase mesosphere (n=28), which is one of the layers of the atmosphere (Figure 4). In addition, the key concept in which one stimulus is written as an answer to the other stimulus is also observed at this level. In other words, for the key concept of humidity, the key concept of temperature was written as the answer word, leading to the establishment of a relationship between humidity and temperature.

There are no words associated with the key concepts of atmosphere, pressure, and precipitation at this level. Although 5 key concepts emerged at this level, it can be seen that the concepts are independent from each other because the relationship between the concepts has not yet been established. Because most of the answer words were not common to the key concepts, and each of them is specific to a single key concept. At this level, a relationship could have been established between temperature and pressure, pressure and atmosphere, and temperature and precipitation. However, it can be seen that this did not happen. In short, although 5 key concepts emerged in this range, the cognitive structures of the students were not fully revealed.
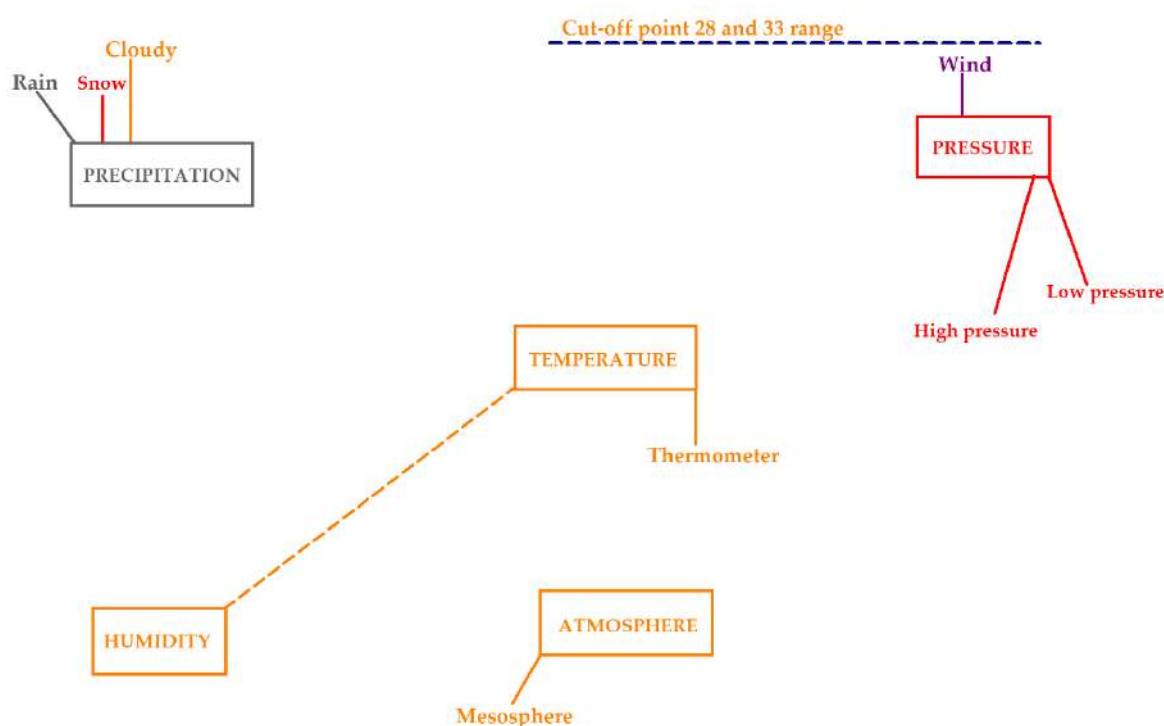
Figure 4: Concept network constructed according to key concepts (Between cut-off point 28-33)

Between cut-off point 22 and 27; in this range of the key concepts emerged in this range of cut-off point. The concepts of wind and climate were added to the key concepts at the previous level. At this level, the concept of pressure (n=23) was written as the answer word for the key concept of wind; thus, the two concepts were related to each other. In addition, the answer phrase "high pressure (n=22) written for the key concept of wind caused a relationship to be established between the key concepts of pressure and wind at this level. Again, at this level, the answer word rain (n=23) appeared for the key concept of humidity,

which led to the establishment of a relationship with the key concept of precipitation. For the stimulus word precipitation, the stimulus word humidity (n=25) was written as an answer term and appeared at this level. Hail (n=27) for the key concept of precipitation, Mediterranean climate (n=25) for climate, relative humidity (n=23) for humidity, air (n=23) and stratosphere (n=22) for atmosphere were produced as answer words (Figure 5). These answer words are basic concepts that represent key concepts. At this level, common answer words enable the establishment of relationships between the key concepts of precipitation, humidity, pressure, and wind. This result is important in terms of revealing the level of students' cognitive structures related to the subject. Because the number of answer words increased and the network of relationships between key concepts began to form. However, the key concepts of the atmosphere and climate still form islands at this level and exist independently.
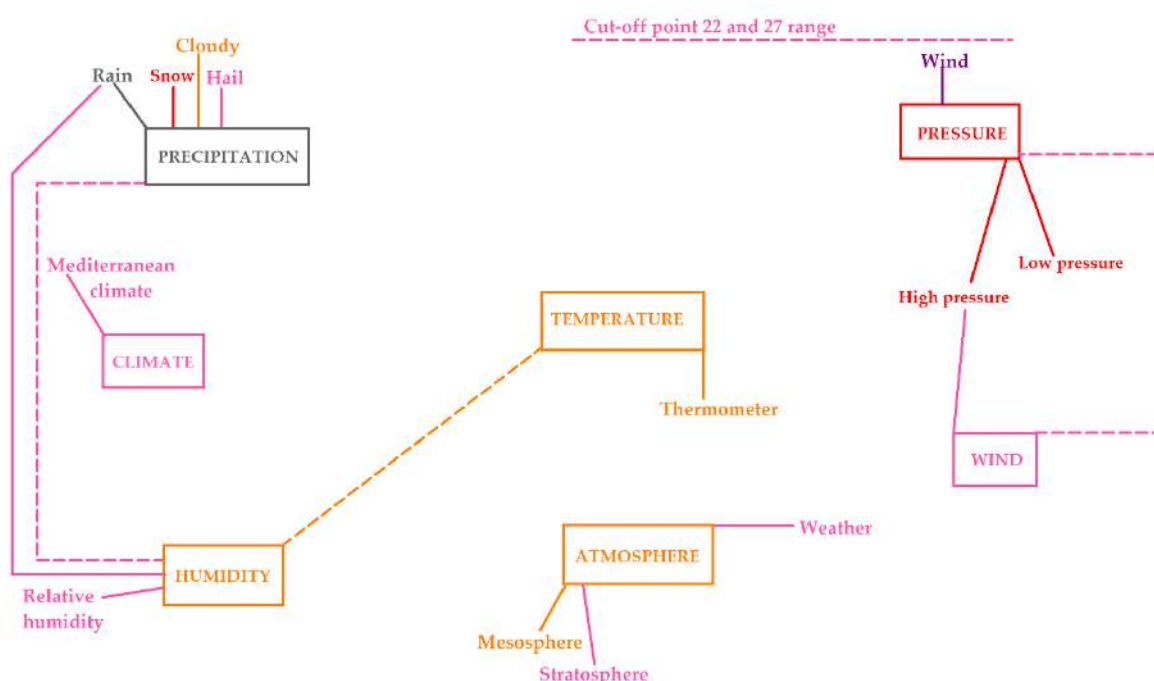
Figure 5. Concept network constructed according to key concepts (Between cut-off point 22-27)

Between cut-off point 16 and 21; the number of answer words written for key concepts, which were fully revealed at the upper level, increased in this range. However, the frequency of these answer words remained low. However, there was also an increase in the number of answer words that associate key concepts with each other. It can be seen that there are common answer words for all the key concepts. We can consider this a level at which students' cognitive structures begin to emerge more clearly. Because there is an increase in the number of answer words, there is also an increase in the number of relationships established between the key concepts. Although there are independent concepts, the answer word weather (n=16) for the key concept of pressure led to the establishment of a relationship with the key concept of atmosphere. In addition, the concept of atmosphere was written as an answer to the key concept of pressure, and a meaningful relationship was

established between the two concepts. Weather events were written n=16 times for the key concept of atmosphere and n=17 times for the key concept of climate, thus establishing a connection between the two concepts. Again, the key concepts of precipitation for humidity (n=19), climate for temperature (n=17), humidity for temperature (n=20), and temperature for pressure (n=17) emerged as answer words. At this level, all the key concepts were linked with different answer words. At the same time, there was an increase in the number of independently written answer words for key concepts. While there were no independent answer words for the key concepts of precipitation and pressure, for the key concepts of atmosphere, ozone layer (n=20), oxygen (n=17), and thermosphere (n=17); for the key concepts of climate, terrestrial climate (n=20), long-term average (n=16), and vegetation (n=16); degrees (n=17), heat (n=17) for temperature; relative humidity (n=23), absolute humidity (n=22), water vapor (n=18) for humidity; and breeze winds (n=16) for wind key concept (Figure 6).
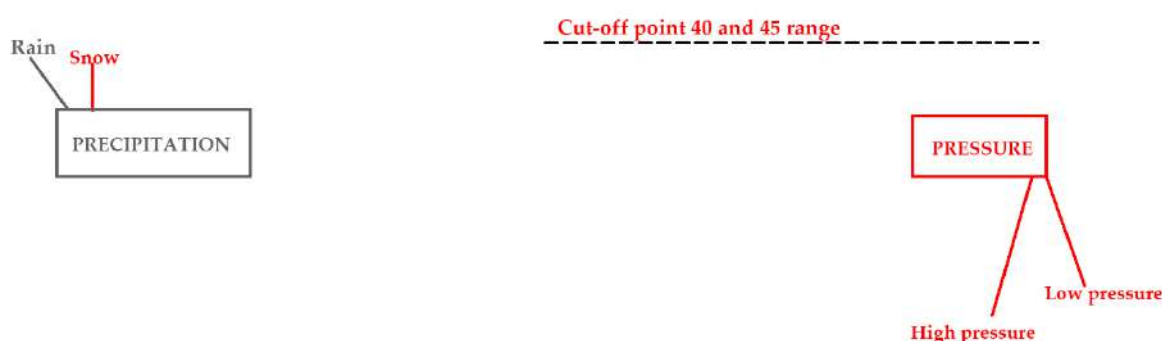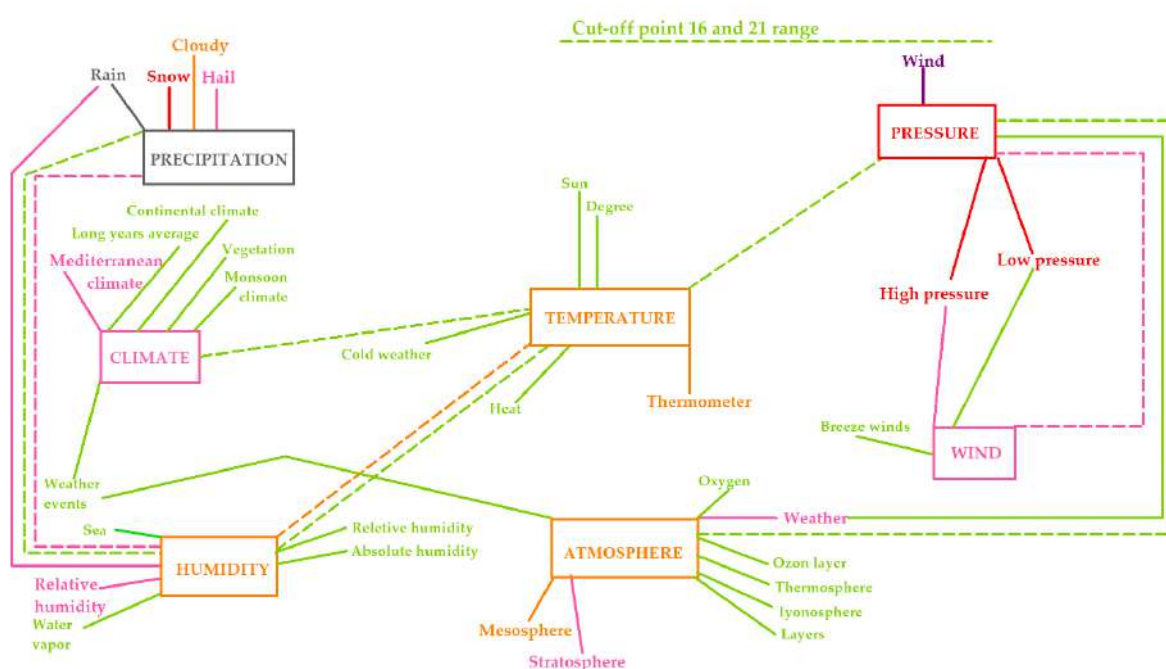

Figure 6. Concept network constructed according to key concepts (Between cut-off point 22-27)

Between cut-off point 10 and 15; in this range, the connections and relationships between key concepts and answer words increased slightly. The concept network showing these relationships started to become sufficiently clear. In other words, although more words were produced at this level, fewer students wrote these words. In this interval, there was an increase in the number of answer words that associated the key concepts of precipitation, temperature, climate, and humidity with each other, resulting in the formation of a concept network. A more complex structure emerged compared with the other intervals. It can be seen that the answer words for the key concepts of pressure, wind, and atmosphere are independent answers specific to these concepts. For the key concepts of pressure, pressure force (n=13), height (n=12), barometer (n=10), and gas (n=10); for the key concepts of wind,

cold winds (n=12), pressure difference (n=15), and wind speed (n=10); for the key concepts of atmosphere, nitrogen (n=12), ozone (n=10), and lithosphere (n=10) were written as answer words. The students believed that the answer words for these key concepts were independent of each other. Many answer words that did not appear at higher levels were expressed by the students at this level, although their frequencies were low. Although a direct relationship was established between the concepts of temperature and precipitation, a similar situation was observed between the concepts of climate and humidity. In other words, temperature (n=13) for the key concepts of precipitation, humidity (n=12) for climate, and climate (n=11) for humidity were written as answer words, and the key concepts were associated with each other. In addition, the answer word desert was written n=10 times for the key concept of climate and n=11 times for the key concept of temperature at this level, thus establishing a connection between the two concepts. The answer word equator generated a triple relationship between the key concepts of climate, humidity, and temperature. In addition, the answer word air (n=13) appeared at this level for the key concept of wind, and a connection was established between the key concepts of atmosphere and pressure (Figure 7). In summary, it can be seen that there is an increase in the number of common words associated with key concepts at this level. Although the connections between the key concepts and the answers given to them increased, their frequencies remained low. For this issue, it can be said that conceptual learning is not sufficient and cognitive structures are disconnected from each other; that is, meaningful learning has not fully occurred. Because important answer words that count the connection between key concepts were not produced at higher levels, most of the answer words that emerged had low frequencies and were not common to the key concepts. Thus, a connection could not be established with the previously revealed key concepts, and each concept was considered independent from the other. However, at this level, new answer words were produced for each key concept.
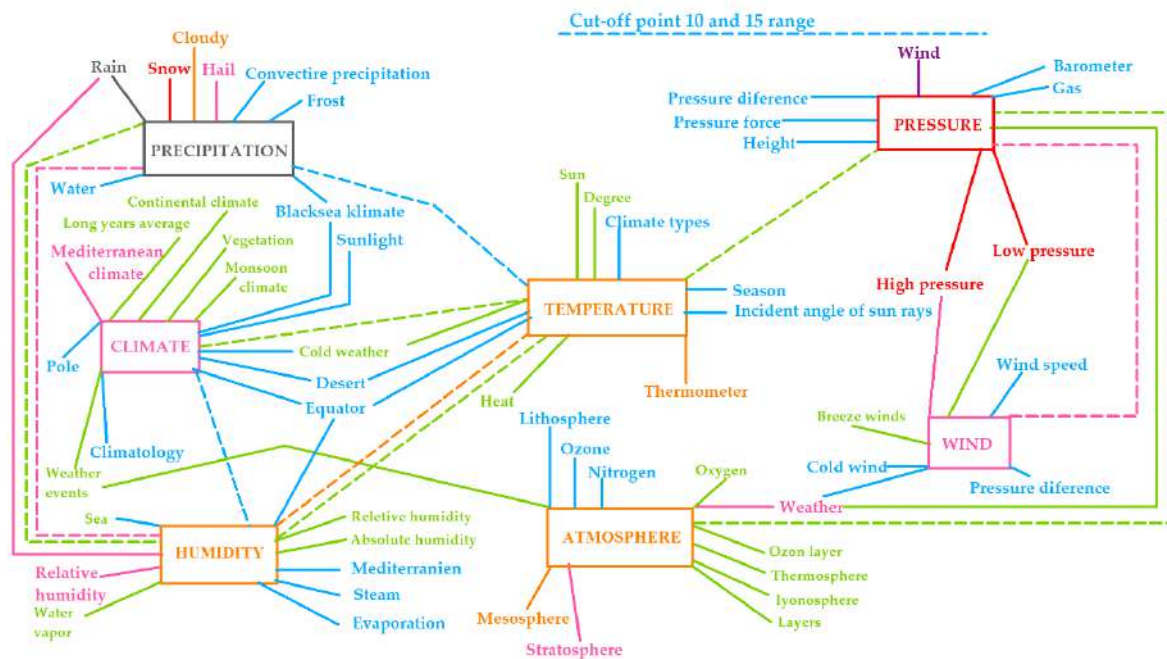
Figure 7. Concept network constructed according to key concepts (Between cut-off point 10-15)

CONCLUSION AND DISCUSSION

This study aimed to reveal basic concepts related to the atmosphere and climate subject in the 9th grade natural systems unit of the geography curriculum and the relationship between these concepts. For climate, atmosphere, temperature, pressure, wind, humidity, and precipitation, which were selected as key concepts, concept networks were created by evaluating the answer words inferred by the participants. Thus, it was attempted to determine which concepts came to the fore in the minds of the students in relation to the subject, how many students wrote these concepts, and at what level was the answer word related to which key concept emerged. When the obtained data were analyzed, the students were observed to produce a large number of answer words related to the key concepts. However, not all the answer words were included in the concept networks. Some of these concepts were written by a few students, and their frequencies were low. Therefore, it is not possible to create a cut-off point and construct a concept network with all answer words. Therefore, the lower level of the cut-off point was formed from answers that were repeated 10 times.

The upper cut-off point level was determined as 46 and above. In this range, n=49 students wrote the answer phrase "rain," and the key concept of precipitation emerged for the first time. Thus, only one key concept emerged at this level. According to this result, it is seen that students cannot produce enough answer words at this level in the subject of weather and climate, and it can be said that their cognitive structures are not at the desired level. According to Aydın and Güngördü (2016), teachers can check whether concepts can be understood by observing the number of answers given to the key concepts in memory (it is assumed that the meaning increases as the words given as answers increase) and word type (is it related to the key concept or not?).

The answer word "rain" constitutes the most important liquid form of precipitation among the forms of precipitation. Therefore, the fact that this answer was given by more than

half of the participants reveals that the key concept was understood correctly. In their study, Dere and Aktaşlı (2022) stated that students intensively associate the key concepts of precipitation with the words rain, snow, and hail.

The low-pressure (n=44) and high-pressure (n=45) expressions written in response to the pressure stimulus words in the range of 40 and 45 caused this concept to emerge. These answer words were written by almost the same students. The relationship between these answer words and the key concepts was not yet established at this level. In addition, the answer word snow (n=43) for the key concept of precipitation also emerged at this level. These two key concepts are among the most important topics in climatology, so they must occur at this level. Although no relationship was established between precipitation and pressure systems, the fact that most students had written them is suggestive in terms of revealing which concepts their cognitive structures consist of. In short, at this level, students still consider many of the words they produce as independent of each other. This indicates that students do not have sufficient knowledge of the subject and have difficulty in remembering some concepts.

Between cut-off point 34 and 39, only the answer term wind (n=36) was associated with the concept of pressure. However, the fact that there are no answer words to establish a relationship between both key concepts and that the key concepts are independent and disconnected from each other indicates that the cognitive structures of the students in this subject are not yet at the desired level.

At cut-off point 28 and 33, 3 more key concepts emerged in addition to the two previously mentioned concepts. These are the key concepts of temperature, humidity, and atmosphere. Students wrote the answer words thermometer (n=29) for the key concepts of temperature and mesosphere (n=28) for the key concept of atmosphere. In addition, temperature was written as the answer word for the key concept of humidity, and a direct relationship was established between humidity and temperature. In other words, two stimulus words were associated with each other, and a connection was established between key concepts for the first time at this level. Although it is seen that 5 key concepts emerged at this level, it is noteworthy that not enough answer words were written for these concepts. According to Atasoy (2004), the more answers to the keyword, the better the comprehension is.

All the key concepts emerged between cut-off point 22 and 27. The concepts of wind and climate were included in the 5 key concepts at the upper level. Although there is a partial increase in the number of answer words, there is also an increase in the relationship established between the concepts. At this level, basic concepts related to the atmosphere and climate began to emerge. These answer words represent not only the key concepts but also the characteristics of words to be written in common for the key concepts. In addition, at this level, a relationship was established between the key concepts of precipitation, humidity, pressure, and wind, and a relationship network started to form. However, common answer words were not used for the key concepts of atmosphere and climate at this level. The frequencies of the response words written for the stimulus concepts are low and the relationships established for the key concepts are not sufficient.

There was a remarkable increase in the number of answer words between cut-off point 16 and 21. However, the frequency of these answer words also decreased gradually. Although very few students wrote the answer words, there is an increase in the diversity of

the answer words. We can say that students' cognitive structures begin to be clearly observed at this level. In this range, many common answer words were written for the key concepts, and relationships were established between them. The number of answer words specific to each key concept.

Cut-off point 10 and 15 constitute the lower cut-off point level. In this interval, key concepts increased compared to the upper level. The relationship between concepts emerged more clearly in this interval. More answer words were produced, but these were written by fewer students. In other words, these low-frequency answer words caused the key concepts of precipitation, temperature, climate, and humidity to be associated with each other and to form a concept network. This range shows a more complex characteristic. At this level, it can be seen that the answer words for the key concepts of pressure, wind, and atmosphere are independent answers specific to these concepts. In short, at this level, many new answer words were produced for the key concepts, and the cognitive structure was revealed more clearly.

When the sentence examples written by the students for the key concepts are analyzed, it is seen that the sentence examples containing scientific knowledge were in the majority. Among the sentence examples written for all key concepts, the number of sentences containing scientific knowledge was 309, the number of sentences containing non-scientific or superficial knowledge was 93, and the number of sentences containing misconceptions was 35. The total number of students who did not write answers to the key concepts was 46. The key concept for which most sentences containing scientific knowledge were written (n=50) was wind. The highest number of sentences containing non- scientific or superficial information was written for the key concept of temperature (n=23). Pressure was the key concept with the highest number of misconceptions was pressure (n=11). Even if some statements about pressure were correct as a subject of a physics course, they were considered as misconceptions because they were not directly related to the atmosphere.

These results reveal that students learn geography subjects mostly theoretically and, as a result, acquire knowledge through rote learning. Therefore, geography lessons should be supported with visual materials, and active learning methods and techniques should be applied in learning by doing and experiencing environments. According to Turan (2002), learning through rote memorization is far from providing complete learning and is contrary to the aims and principles of Turkish National Education. For this reason, while teaching concepts and terms in geography, it is imperative to avoid methods that will lead students to memorize as much as possible and to create a set of methods that will lead them to understand.

Examples of sentences containing a few misconceptions within the key concepts were written. These examples are mostly related to the key concepts of pressure, climate, and humidity. Most subjects related to the atmosphere and atmospheric pressure are especially abstract. This situation makes it difficult for students to make sense of the subject in their minds. Some students wrote answer words related to physics subjects for this key concept. In addition, it was observed that students mostly wrote sentences such as defining and explaining the meaning of key concepts. In other words, we can say that students have few examples of sentences at the level of analysis, synthesis, and evaluation. The reasons for all this should be revealed. First, if common topics and concepts between disciplines, it is very important for geography teaching to determine the level and framework of the relationship

between them and to handle them within the scope of the principle of holism. In short, in teaching abstract geography subjects, it is necessary to determine how students construct the basic concepts specific to the subject in their minds, what they understand, how they express them, with which examples they explain them, and whether they have misconceptions about the subject. For example, Kılınç and Tuna (2013) revealed how students described atmospheric pressure using a descriptive map. In the description map, basically 6 types of description ways were identified. These ways are defining it as the pressure in the atmosphere, explaining it as various properties in the atmosphere, its association with the effect on living things and humans, defining it as the force on the earth and beings, explaining it as the weight of the air, and defining it as one of the elements of weather and climate. According to Demirkaya and Tokcan (2007), before teaching concepts related to the immediate environment to their students, teachers should take into account that their students may have incorrect knowledge about the concepts to be learned. While teaching geography-related information to students in primary, secondary, and university education, experience-based teaching should be applied.

According to Görgülü Arı and Aslan (2020), to create awareness about climate and climate changes in individuals, to provide individuals with the necessary awareness, and, most importantly, to provide an effective climate-oriented environmental education, it is necessary to reveal the deficiencies of students regarding climate and climate literacy. Thus, in line with the deficiencies determined by individuals, the education that can be provided can be shaped, and the most accurate education path can be created. In this way, it is possible to shape individual-specific environmental education and transfer it to the most appropriate method.

In this context, the cut-off point can be used as a technique to determine the characteristics of the concepts in the subject, which concepts the subject consists of, and how the concepts are understood by the students. In this way, the type and frequency of the students' answer to the key concepts, what they understood about the subject and briefly their cognitive structures can be revealed. In successful education, it is necessary to determine the cognitive structures of students in relation to any subject. According to Abdelhalim (2019), students' cognitive structures should be considered when teaching languages. This helps teachers know how to present educational material, how to make lesson plans, and how to assess students' learning level.

In conclusion, the air and atmosphere are important components of natural systems. The fact that this subject is closely related to both academic life and contemporary life further increases its importance. In addition, this subject is rich in basic concepts. Most of these concepts are abstract, it is difficult to construct in the mind. Despite this property, the results show that students' knowledge of this subject is correct but not at the desired level. Because the frequency of most of the words that the students made associations was low and they appeared at lower levels. The connection words between the key concepts were mostly concentrated at lower levels and in answer words with low frequency. There was also an increase in the number of answer words specific to key concepts at these lower levels. When the concept networks are examined, it is noted that most of the answer words for the key concepts were independent. In other words, each answer word is specific to a certain key concept and is not associated with other key concepts. The fact that common answer words for key concepts appeared mostly at lower levels reveals that students lacked aptitude for

atmosphere and climate.

RECOMMENDATIONS

The subjects belonging to the units in the geography curriculum have a rich variety of scientific concepts. In teaching these concepts, concept teaching techniques should be employed, and relationships between concepts related to the subject should be established; thus, conceptual learning should be ensured.

Misconceptions, if any, should be identified with appropriate techniques. Their reasons should be revealed, students should be made aware of their misconceptions and efforts should be made to eliminate these misconceptions. Only in this way can the correct structuring of knowledge in the mind be ensured, and mental contradictions can be reduced.

If common topics and concepts belong to other disciplines, they should be emphasized in the lessons; interdisciplinary relations should be revealed by giving examples; the meanings of the concepts in the discipline should be explained; similar and dissimilar examples should be given especially for the concepts; and the relationship of the related concepts and topics with geography should be explained.

With this technique, similar studies can be conducted by determining the basic concepts of ecosystem characteristics, global environmental problems, disasters, the structure of the world and the issues related to its formation process (internal forces and external forces).

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Biographical notes:

Baştürk Kaya 1[3]: He works as an Associate Professor at Necmettin Erbakan University. Fields of study: geography education, environmental education and physical geography.

Scopus Author Identifier Number: 16233328700

Web of Science Researcher ID: CZE-1461-2022

Google Scholar Researcher ID:
https://scholar.google.com.tr/citations?user=RHehOtEAAAAJ&hl=tr

*Caner Aladağ 2***:** He works as an Associate Professor at Necmettin Erbakan University. Fields of study: geography education, environmental education and urban geography.

Scopus Author Identifier Number: 56955113500

Web of Science Researcher ID: G-6746-2017

Google Scholar Researcher ID:
https://scholar.google.com.tr/citations?user=SiUj7MUAAAAJ&hl=tr

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[3] Corresponding Author

Research

Do School Administrators' Perception Management Skills Improve School Agility?[1]

Seval KOÇAK[2]   **Şirin YÖRÜK**[3]

Abstract:

The purpose of this research is to determine the role of school administrators' perception management skills on school agility in line with teachers' views. This research begins by recognizing the vital importance of addressing school agility. Perception management is widely regarded as a critical managerial skill for fostering positive organizational behaviors. In this context, the relationships between variables were examined and the level of prediction of perception management on school agility was determined. The research was designed in relational survey model and conducted with 346 teachers working in Uşak. Quantitative techniques were used to analyze the data collected from the participants. The findings of the study showed that the level of school administrators' perception management skills and school agility were at high levels. Additionally, it has been determined that there are positively significant relationships between school administrators' perception management skills and school agility; perception management is identified as a meaningful predictor of school agility. Recommendations based on the research findings have been provided.

Keywords: Perception, perception management, agile school, organizational agility, speed, technology, organizational flexibility.

INTRODUCTION

Education systems are one of the most sensitive social systems to social, political and economic developments. This is because it is a necessity for schools to train manpower in accordance with the changing conditions and needs of all other social systems. The ability of schools to respond to changing conditions is only possible if they are equally agile in developing appropriate moves. Moreover, it is of great importance for schools to design their organizational structures with the flexibility to maneuver effectively in case of all kinds of predictable or unpredictable change. Important roles are addressed to school leaders to play in establishing these structures.

The speed at which information is shared has gained great momentum due to globalization and rapid change in technology, and the speed at which schools can adapt this information to their education and training processes, human and material resources has become an important criterion in their preference. Although schools in Turkey are trying to renew themselves, the centralized structure of the Turkish National Education System and some legal restrictions may restrict school's activities at the local level (Çelikten, Ayyıldız & Çelikten, 2019). However, the slow flow of bureaucratic work in schools, paperwork and bureaucratic obstacles that increase the workload impose restrictions on the mobility of school leaders. (Keman, 2019). Along with these problems, the fact that schools still maintain the characteristics of the classical managerial tradition of the industrial revolution also has a retarding effect on their agility (Cummings & Worley, 2008). On the other hand, the survival of schools in the ecosystem is closely linked to their competitiveness (Koçak, 2021). Today, the competitiveness of schools is determined by their ability to continually update themselves in the face of changing conditions, to maneuver quickly and wisely thanks to their flexible structure, and to use technology effectively (Kaya & Özdemir, 2022). An agile school is an educational institution that prioritizes flexibility and adaptability. An agile school can respond to rapidly changing conditions and teachers and student needs. As Atmaca (2021) stated in her study, school agility was found to be a significant predictor of school effectiveness. According to Osoli (2007), agile organizations possess a profound comprehension and readiness to adjust to cahnges that extend beyond fleeting opportunities. Their innovative approaches and specialized knowledge enable them to secure a steadfast position." In this context, agile organizational characteristics that can change human and material resources at the same speed and use them wisely in the face of rapidly changing conditions have become very critical. Otherwise, it does not seem possible for school organizations to keep their existence effectively.

A limited number of studies related to school agility were found in the literature, and in one of these studies, school agility was found to be a significant predictor of school effectiveness. (Atmaca, 2021). In a study conducted at the higher education level, the organizational agility perceptions of academic and administrative staff were described (Gözcü, 2020; Öksüz-Gül, 2020). In another study, a school agility scale was developed

(Kaya & Özdemir, 2022). Apart from these studies, there is no empirical study on educational organizations. It is thought that organizational agility is a very important feature for schools trying to exist in a continuous and rapid change, and therefore, studies related to school agility should be increased.

Empirical studies on businesses other than educational organizations point to the importance of organizational agility in all social systems and show that it is an organizational characteristic that can be developed through leadership styles. For example, in one of the studies conducted on businesses, it was revealed that organizational agility increases organizational commitment and has a negative relationship with intend to quit job (Tarakçı, 2021). The related research shows that organizational agility provides positive consequences to the organization. However, there are also studies showing that leadership styles and the perception of the leader as a leader play an important role in organizational agility (Güneş, 2021; Özeroğlu, 2019). Ateşoğlu (2023) concluded in his study that positive leadership behaviors improve organizational agility through increasing intrapreneurship, while negative leadership behaviors have a negative effect. In another study, it was concluded that employee empowerment, which is one of the important leadership behaviors, contributes significantly to organizational agility (Seyrani-Aktan, 2023). These results indicate that organizational agility can be improved through leadership practices.

The starting point of this research is the necessity of addressing school agility, which is of great importance for school organizations to compete and, more importantly, to achieve the desired outcomes in the national and international arena. In addition, it was thought that the study could provide a new perspective on how school agility can be improved through leadership practices and give school administrators an idea on this issue. Considering that it is important to be able to influence the ideas, thoughts, attitudes and behaviors of employees in the development of school agility, it is predicted that the perception management skills expected from today's school leaders can play an important role in school agility. As a matter of fact, according to Çoban (2019), perception management is seen as a very important managerial skill in terms of creating positive organizational behaviors. Moreover, there is no study examining the relationship between perception management and school agility.

In this context, the aim of this study is to determine what role school administrators' perception management skills play on school agility in line with teachers' views. Within the framework of this purpose, answers were sought to the following research questions:

- What is the relationship between level of school administrators' perception management skills and school agility?

- Is there a significant relationship between school administrators' perception management skills and school agility?

- Are school administrators' perception management skills a significant predictor of school agility?

Within the framework of the related purpose, the relationships between the variables were examined and the level of prediction of perception management on school agility was determined.

Conceptual Framework

Organizational Agility and Agile Schools

Due to the rapid and unpredictable changes in social, economic and political life, the survival of organizations has become dependent on their ability to maneuver in the face of these changes. One of the requirements of organizational effectiveness has been the ability to adapt rapidly to changing conditions and to use material and human resources in this direction. In this regard, Kumkale (2016) stated that the survival and sustainability of today's organizations depends on their ability to quickly grasp the change and implement it faster than their competitors. The term "agility" was first mentioned in 1982 in a business context as "the capacity to accomplish something." Brown and Agnew (1982) described agility as "the ability to quickly respond to rapidly changing conditions. This concept, referred to as *organizational agility*, is associated by Maskell (2001) with the capacity to have flexible structure and human resources to respond to rapidly changing conditions and unforeseen requirements in the most effective way and to integrate change rapidly into organizational processes. In another definition, *organizational agility* is explained as being agile; being flexible in a way that makes adaptation easier, following a standardized process of learning from possible error situations, being open to new ideas and different opinions, and easily adapting to innovations (Çapan, 2019). Chonko and Jones (2005) explained the indicators of organizational agility with flexibility in organizational structure, employee skills, use of technology, openness to innovation and knowledge management processes.

It is also seen in the literature that organizational agility is associated with evaluating change as an opportunity and using it for organizational development (Dahmardeh & Banihashemi, 2010) and having comprehensive methods to implement and benefit from change (Maskell, 2001). However, considering that environmental changes will not always occur with fixed categories, it is stated that agile organizations have an organizational and managerial structure that can adapt itself to each new situation again and again (Segal, 1974). In this context, it is emphasized that organizational agility can be achieved through the coordinated work of three resources consisting of human resources, technology use and management/organizational structure of the organization (Nagel & Dove, 1991).

The concept of organizational agility generally focuses on three main areas: flexibility, speed and technology. (Kaya & Özdemir, 2022). Among these characteristics, flexibility is

explained as the ability to adapt to environmental changes and to adapt the organizational structure to these conditions (İleri & Soylu, 2010). In addition, abilities such as having and using alternative resources, finding solutions to problems in different ways, being open to different views and ways of doing business, and being able to develop and change the organization's routine practices and methods are also associated with flexibility (Akkaya & Tabak, 2020). In this context, it is possible to say that it is possible to give up traditional methods, to choose functional ways that are suitable for the conditions of the day and to solve the problems, with a flexible structure instead of rigid rules and hierarchical structure. Indeed, (Denning, 2015) states that offering new experiences to stakeholders and meeting current needs is not possible with a hierarchical bureaucracy. Another important factor for organizations is *speed*. It is a concept related to the response time of organizations to change and demands. Sharifi and Zhang (2000) defined speed as one of the most important elements of agility and defined it as the ability of organizations to perform their tasks and operations in the shortest possible time. In this context, they emphasized that organizations should provide the desired service or product quickly, deliver it to stakeholders in a short time, and that high quality products or services should generally go through a fast transaction process. The last concept that can be emphasized as components of organizational agility *is technology*. The fact that their organizations have high-level information technologies and the capabilities to use these technologies provides them with agility and contributes significantly to their competitiveness. In this regard, Yeganegi and Azar (2012) stated that organizations can facilitate their work, accelerate data and information sharing, improve organizational learning, provide fast and easy communication with stakeholders, and briefly improve their organizational agility by using flexible software and programs thanks to information technologies. As a matter of fact, Chen and Siau (2012) state that it is not possible to respond quickly to change demands without information technology infrastructure and that information technologies are of great importance in order to create an agile organization. When all these characteristics are considered as a whole, it can be said that managers of organisations have important roles in increasing the agility of the organization and should show motivating leadership behaviors in this regard. The ability of individual organizational employees to show agile behaviors within the framework of their duties, to be open to change, to change the methods they use, to use technology effectively and to update service quality in line with stakeholder demands seems to be related to how leaders influence them in this regard.

Based on the concept of organizational agility, agile schools are open to innovative ideas, make learning a passion with inclusive and democratic leaders, focus on professional development, and create a shared vision. In agile schools, communication is strong, it is a passion to inspire and bring about change in the school. Leaders in agile schools are aware of the needs of all stakeholders and respect those with different perspectives (Cooper, 2012). As a matter of fact, in the current rapid change process, it seems possible for schools to

develop with agile leaders who support the strengthening of organizational agility (Breakspear, 2016).

Perception Management

Perception is defined as a process in which information coming from the environment through the senses is selected, brought together, organized, interpreted and made meaningful in itself. (Eren, 2008). Perception management is seen as a kind of information warfare; it is defined as influencing the feelings, thoughts and behaviors of the target group (Spaiser 2008). It is defined also as the ability to turn the process in favor of the organization by meeting the needs of people and ensuring their motivation and job satisfaction in their profession or the work to be done (Uğurlu, 2008). In this context, perception management aims to regulate the way employees understand and interpret the external world in a way that contributes to the achievement of organizational goals. In this way, it is ensured that the ideas and behaviors of employees are developed in a way that contributes to organizational effectiveness (Özdağ, 2018). Moreover, with perception management, undesirable organizational behaviors can be prevented (Korkmazyürek ve Hazır, 2014). In order to achieve these goals and create positive perceptions, it is important to use motivational resources (Atalay, 2016). In addition, school administrators are expected to be effective in *emotional management*, which is related to perception management, in order to develop positive organizational behaviors. (Argon, 2015).

Perception management carried out in line with organizational goals and on the basis of ethical principles provides significant benefits to the organization. As a matter of fact, Otara (2011) states that organizational climate and effectiveness are largely shaped by the perceptions of employees, so perception management should be taken into account by managers. In this regard, Akıllı (2022) emphasizes that positive perceptions positively affect organizational processes, while negative perceptions negatively affect the organizational climate. Moreover, it is pointed out that perception management is important for the competitiveness and effectiveness of organizations (Bakan ve Kefe, 2012; Yörük ve Summak, 2016). For this reason, it is very important for school leaders to realize effective perception management skills in order to increase teacher performance and voluntary participation in educational and management processes in the school. In the study conducted by Konan and Çavuşoğlu (2018), they stated that the formation and continuity of general positive perceptions within the school is largely dependent on the school leader and that teacher performance can be improved through positive perceptions of both the school leader and the school. Botha (2013) emphasized that perception management in schools is a necessary leadership skill; only leaders with this skill can have an impact on school stakeholders.

In the process of perception management, there are certain processes that leaders should follow and tools that can carry out these processes. In their scale development study, Uylas and Argon (2020) addressed perception management processes with the stages of "determining the current perception", "creating and influencing impressions" and "creating

and directing perception". In this context, clearly identifying the current ideas and thoughts of employees, motivating individuals by creating a positive impression, and creating a positive perception by presenting reasonable evidence, persuading and convincing are considered as important steps of the perception management process. However, Eren (2008) mentioned some points to be considered about perception while conducting this process. One of them is that the perception process is influenced by the individual characteristics of the perceiver. Therefore, it is important for managers to operate perception management processes in accordance with individual differences. The other is that the characteristics of the perceived thing (person, event, phenomenon, etc.) and the environment in which the perception process takes place are effective in shaping this process. Based on this, it can be said that the characteristics of the teachers, what the perceived thing means to the teacher and the school environment (school climate and culture, school leader's management style and perception management skills, etc.) where the perception process takes place are very important for the formation of positive perceptions at school.

METHOD

This study, which examined the relationships between school administrators' perception management skills and school agility, was designed in the relational survey model. The relational survey model is used to reveal the relationship or effect between two different quantitative variables (Fraenkel et al., 2012). Quantitative techniques were used to analyze the data collected from the participants. Descriptive statistics such as mean and standard deviation were used to determine teachers' and school administrators' perceptions of perception management skills and school agility. Pearson correlation coefficients were calculated to identify the relationships between variables. Multiple regression analysis was conducted to determine the predictiveness of perception management on school agility.

The Study Group

This research, which examines the relationships between perception management and school agility, was conducted with teachers working in primary and secondary schools in Uşak province. In this study, the focus was on the relationships between variables. There is no intention of generalizing to the population. Therefore, a specific study group was determined for the research. In this framework, the study group consisted of 346 teachers. Table 1 provides descriptive information about the study group.

Table 1. Descriptive statistics of the study group

			f	*%*
Gender	Female		182	52.6
	Male		164	47.4
School Level	Primary/	Sec.	217	62.7
	High School		129	37.3

Senority	1-15 years	149	43.1
	16 years and over	197	56.9
Level of Education	Bachelor's Degree	258	74.6
	Master's Degree	88	25.4
Number of	1-20 teachers	90	26.0
Teachers in School	21 teachers and	256	74.0
Toplam	346		

As seen in Table 1, 46.4% of the 407 teachers who constitute the study group of the research are female and 53.6% are male. Among these teachers, 298 of them work in primary education and 109 of them work in secondary education institutions. Of the participant teachers, 203 had 1-10 years of seniority and 204 had 11 years or more.

Data Collection Tools

In this study, "Perception Management Scale" developed by Uylas and Argon (2020) was used to determine teachers' views on school administrators' perception management skills. In determining the agility levels of schools, the "Agile School Scale" developed by Kaya and Özdemir (2022) was utilized. The psychometric properties of the instruments are presented below.

Perception Management Scale (PMS): The scale used to reveal the perception management skills of school administrators consists of 16 items and three dimensions. The three dimensions of the five-point Likert-type scale are named as "*determining current perception, creating and influencing impression, creating perception and directing perception*". As a result of the exploratory factor (EFA) analysis conducted during the development of the scale, it was concluded that the three-dimensional structure explained 55.99% of the variance. Confirmatory factor analysis (CFA) results were [$\chi2/df$ =2.89 (p>05); CFI= .96; IFI=.96; RMSEA=0.08]. The Cronbach Alpha coefficients calculated for the reliability of the scale were .88 for the "*determining the current perception*" dimension, .75 for the "c*reating and influencing impressions*" dimension, .73 for the "*creating and directing perception*" dimension and .88 for the whole scale. Considering the values, it was concluded that the scale is a valid and reliable instrument (Uylas & Argon, 2020). In this study, the validity and reliability analyses of the scale were performed and the results of the CFA were [$\chi2/df$ =2.81 (p>05); CFI= .99; IFI=.99; RMSEA=0.07]; the reliability coefficient was calculated as .92 for the dimension of "*determining the current perception*", .89 for the dimension of "*creating and influencing impressions*", .88 for the dimension of "*creating and directing perception*" and .95 for the whole scale. The related values showed that the scale is a valid and reliable instrument that can be used in this study (Kline, 2011).

Agile School Scale (ASS): The Agile School Scale, which is used to determine the agility levels of schools, is a 21-item, three-dimensional scale labeled as *"flexibility, technology and speed"*. As a result of the EFA conducted during the development of the scale, it was determined that the variance explained by the three-dimensional structure was 64%. The

CFA values for the validation of the construct were reported as [χ2/df =2.33 (p>05); CFI= .99; IFI=.97; RMSEA=0.08]. The reliability coefficient of the scale was calculated as .95 (Kaya & Özdemir, 2022). The results of the CFA conducted to determine whether the scale is a valid and reliable instrument in this study were calculated as [χ2/df =3.25 (p>05); CFI= .98; IFI=.98; RMSEA=0.08]. The Cronbach Alpha coefficients of the scale were. 89 for the "flexibility" dimension, .90 for the "*technology*" dimension, .86 for the "*speed*" dimension and .95 for the whole scale.

Data Collection and Analysis

This research was conducted with 346 teachers working in primary and secondary education institutions in Uşak province and data were collected on a voluntary basis. Necessary permissions were obtained from Uşak Provincial Directorate of National Education for data collection. In order to prepare the data for analysis, missing data controls and extreme value analyses were performed. Confirmatory factor analyses were performed to determine whether the scales were valid and reliable for this study, and Cronbach Alpha coefficients were calculated. To determine whether the data were normally distributed, kurtosis and skewness coefficients were evaluated and normal distribution curves were analyzed. Since the kurtosis and skewness coefficients were between -1 and +1, it was decided that the data showed a normal distribution. In line with the purpose of the study, arithmetic mean and standard deviation values of the variables were first calculated. Pearson correlation coefficients were used to determine the relationships between school administrators' perception management skills and school agility; regression analysis was used to determine the role of school administrators' perception management skills on school agility. In the first step of the regression analysis, control variables coded as dummy variables were added and in the next step, perception management was included in the analysis. In the interpretation of arithmetic averages, score ranges of 1.00- 1.79 (*very low*); 1.80-2.59 (*low*); 2.60-3.39 *(medium)*; 3.40-4.19 (*high*); 4.20- 5.00 (very high) were used.

FINDINGS

Depending on the first research question, arithmetic mean and standard deviation values of school administrators' perception management skills and school agility variables were calculated. Related values are presented in Table 2.

Table 2. Arithmetic mean and standard deviation values of variables

	(X)	Ss
Perception Management Total	**3.58**	**.81093**
Determination of current perception	3.62	.94123
Creating and influencing impressions	3.59	.88071
Creating and directing perception	3.54	.81830
School Agility Total	**3.90**	**.57695**
Flexibility	3.91	.60733

Technology	3.97	.62449
Speed	3.83	.65558

As seen in Table 2, teachers' opinions show that the total mean value of school administrators' perception management skills is $\overline{X}$=3.58, and the mean values of the dimensions vary between 3.54 and 3.62. The averages of school agility show that the total mean value is $\overline{X}$=3.90 and the averages of the dimensions vary between 3.83 and 3.97.

Secondly, the relationships between school administrators' perception management skills and school agility were determined. Table 3 presents the correlation coefficients between the related variables and their dimensions.

Table 3. Correlation coefficients for the relationships between perception management and agile school

	School Agility	*Flexibility*	*Technology*	*Speed*
School Agility Total	,667**	,642**	,568**	,621**
Determination of current perception	,647**	,634**	,559**	,577**
Creating and influencing	,593**	,574**	,507**	,545**
Creating and directing perception	,611**	,574**	,510**	,597**

N=346, **p* < .01

As seen in Table 3, the correlation coefficients indicate that there is a positive, medium-level significant relationship between perception management and school agility. In this context, it is seen that the highest relationship between the dimensions of school agility and general perception management belongs to the "flexibility" dimension (rayt x e = .642; p < .01), followed by "speed" (rayt x h = .621; p < .01) and "technology" (rayt x t = .568; p < .01) dimensions respectively.

Based on the last research question of the study, the results of the regression analysis conducted to determine the role of perception management on school agility are presented in Table 4.

Table 4. Regression analysis results for the prediction of school agility

	β	t	R^2	ΔR^2
			,026	-
Gender	,122	2,196*		
Seniority	,054	,952		
Level of Education	-,047	-,849		
School Level	-,073	-1,253		
Number of	,004	,075*		
			R^2	ΔR^2
			,468	,442
Perception Man.	,676	16,774*		

*p<.05

As seen in Table 4, in the first step of the regression analysis, control variables coded as dummy variables (gender, seniority, education level, school level and number of teachers in the school) were included in the analysis. Among these variables, gender explained 2.6% of the variability in agile schools (*F= 1.787, p<0.05*). Accordingly, it was found that male teachers' perceptions of agile schools tended to be high. In the second step of the analysis, perception management was included in the analysis and it was determined that this variable was a significant predictor of the perception of agile school. In this context, it was determined that perception management alone explained 44.2% of the variance on agile school ($\Delta R2$= .442, p<0.05). In general, it was determined that control variables and perception management together explained 46.8% of the variance in agile school (*F= 49.613, p<0.05*).

Ethical considerations

In the course of this research, we paid scrupulous attention to ethical guidelines, ensuring that the integrity and reliability of the study were never compromised.

In alignment with the overarching commitment to ethics, this study stringently adhered to all provisions delineated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive." It is imperative to note that there were zero instances of activities which might infringe upon the clauses stated under the "Actions Against Scientific Research and Publication Ethics."

Ethical Review Board: Uşak University Social Sciences and Humanities, Scientific Research and Publication Ethics Committee

Date of Ethics Review Decision: 09.05.2024

Ethics Assessment Document Issue Number: 2024-113

DISCUSSION

In this study, the role of school administrators' perception management skills on school agility was determined. In this context, firstly, school administrators' perception management skills and school agility levels were determined and then the relationships between variables were examined.

Based on the first research question of the study, descriptive statistics of the variables were determined. The total mean of school administrators' perception management skills was found to be in the "always" range. As a matter of fact, in other studies conducted on the use of perception management by school principals according to teachers' views, it was observed that the general average of perception management was in the same range as this study (Atalay, 2016; Çoban, 2019; Uylas, 2017). In this context, it indicates that school administrators are successful in perception management, but on the other hand, there are some points that need to be improved.

Another remarkable finding regarding perception management is the ranking of dimension averages. As a result of the analyses, it was observed that the averages of the sub-dimensions were, from largest to smallest, *determining the current perception, creating and influencing impressions, creating perception and directing perception*. In other studies in which teachers' views were determined, it was observed that school administrators had higher averages in the skills for determining the current perception compared to other dimensions (Çoban, 2019; Uylas, 2017). In this context, it can be said that school administrators are more effective in determining the perception in the first step of the perception management process than in influencing and perception formation steps. However, it is emphasized that the perception management process is -strategically- shaping perceptions for the benefit of the organization (Spaiser 2008; Özdağ, 2018). Therefore, it is possible to say that it is necessary but not sufficient to effectively identify existing perceptions in the perception management process. In this regard, Elsbach (2003) underlines that in order to understand the nature of organizational perception management, it is necessary to know all the elements of the whole organization, that organizational perception management is different from individual perception management, and that knowing the conditions is only one of the components of organizational perception management. For this reason, the achievement of the objectives of perception management seems to depend on the success in all the steps of determining the current perception, creating and influencing impressions, creating perception and directing perception within the scope of perception management (Uylas & Argon, 2020). The overall average of school agility, which is the dependent variable of the study, was found to be high. In a study conducted by Atmaca (2021), teachers' views on the level of school agility are similar to the findings of this study. In addition, similar results were found in university-level research on organizational agility (Gözcü, 2020; Öksüz – Gül, 2021). These results generally indicate that educational institutions have a certain level of

awareness about organizational agility. Moreover, in today's world, where it is imperative to adapt to changes in an unpredictable life process, it is possible to say that it has already become a necessity for organizations to show agile characteristics.

Breakspear (2016) sees agile school characteristics as an important need for improving teaching-learning processes in the complex structures of today's schools. Dahmardeh and Banihashemin (2010) state that it is important for social systems to have flexible, fast and lean production structures that can cater to the changing and rapidly demanding business world in terms of their competitiveness and continuity. Therefore, the continuity of today's educational institutions seems to depend on keeping themselves up to date in terms of managerial, human and material resources as well as all educational processes. For this reason, it is actually expected that educational institutions show agile organization characteristics at a high level. However, the fact that the averages are in the high level range shows that there are points that need to be improved in school agility. It is thought that it is very important for educational institutions to carry the characteristics of agile organizations at the highest level due to their duty to train qualified manpower for other social systems and their important role in the socio-economic development of countries.

Another remarkable finding obtained as a result of the analysis on school agility is the averages of the dimensions of organizational agility. It was determined that these averages were ranked as technology, *flexibility* and *speed* from large to small. In this context, it has been observed that schools have lower perceptions of organizational speed than other agility dimensions and that the speed dimension is lower than the general average of organizational agility. In other words, schools think that they have organizational speed characteristics at a lower level than other agility characteristics. This can be explained by the bureaucratic structure of the Turkish National Education System. As a matter of fact, there is a hierarchical correspondence system for all kinds of work and transactions carried out in schools, such as applications, requesting information, giving information or receiving information. According to Çelikten, Ayyıldız, and Çelikten (2019), this centralized structure, some legal limitations within the structure, or the limited authority of school leaders can slow down their activities at the local level. The slow progress of bureaucratic works, bureaucratic obstacles encountered in some practices, and more importantly, the heavy paperwork required by the bureaucratic structure can limit leaders (Keman, 2019). All of these reasons may be hindering the speed of the organization's employees in particular and the organization as a whole in general, and may create various problems in reacting quickly.

Based on the second and third research question of the study, the relationships between variables were examined. In this context, it was observed that there were significant positive relationships between school administrators' perception management skills and schools' use of technology, flexible behaviors and organizational agility. The results of the regression analysis also showed that school administrators' perception management skills were a significant predictor of school agility. In this context, flexible behaviors, speed and tendencies of organizational employees towards the use of technology seem to depend on

the success of school leaders in perception management. As a matter of fact, it is stated that school administrators who can perform effective perception management can have an impact on all stakeholders of the school (Botha, 2013). In addition, it is stated that through successful perception management at school, teachers may become willing to spend more effort for school goals; thus, the effectiveness and efficiency of the school may increase (Konan & Çavuşoğlu, 2018). In other studies conducted on the basis of different businesses, it is also emphasized that successful perception management is a very important managerial skill in organizational effectiveness, quality of organizational functioning, and gaining the interest and satisfaction of other stakeholders (Hargis & Watt, 2010; Stupak, 2001; Johanson & Xiong, 2003). The fact that perception management is a significant predictor of school agility in this study can be interpreted as perception management is an effective tool in motivating teachers to use the skills required for agile schools. In other words, it is possible to say that school leaders can motivate teachers to show qualified and fast reactions, to be flexible towards different, current and new practices, and to use technology effectively through effective perception management.

The fact that school administrators' perception management skills predict agile school characteristics indicates the importance of perception management on teacher performance. However, an important element draws attention here. Effective perception management is possible only if school administrators know the direction of teachers' perceptions, accept that teachers' perceptions are different from each other and implement perception management that takes individual differences into account. Only in this way will teachers be motivated in the desired direction. In this regard, Otara (2011) states that in the process of perception management, managers should accept that individuals have different perceptions and use stimuli that respond to individual needs. Uğurlu (2008), on the other hand, emphasizes that if individuals are to work in line with organizational goals through perception management, the unique needs of employees should be considered and met. Based on these statements, it can be said that a school administrator who wants to create an agile school should take into account the individual needs and feelings of teachers in a perception management process. Argon (2015) studied "management of emotions" in schools, which is closely related to perception management, and determined whether school administrators take teachers' emotions into consideration or not. As a result of the research, it was emphasized that school administrators have deficiencies in taking teachers' emotions into consideration. However, it has been observed that teachers whose feelings are not taken into consideration tend to exhibit negative behaviors; behaviors such as "unhappiness, feeling worthless, slowing down the work, distrusting the administrator and the institution, decreasing school success and being confrontational" have emerged. In this context, taking emotions into account, understanding them and transforming them into positive emotions and perceptions in the desired direction is of great importance in terms of increasing teacher performance. More specifically, improving teacher performance in schools in a way to create

agile schools and ensuring that teachers are flexible, open to innovations, fast and qualified in their work seems to depend on the perception management skills of leaders.

CONCLUSION

In this study, the relationships between school administrators' perception management skills and agile school characteristics were examined, and the general conclusion was reached that perception management plays an enhancing role on school agility. More specifically, successful perception management has been found to improve organizational agility, one of the most important capabilities for schools in today's rapidly changing world. Accordingly, with a successful perception management conducted by the school administrator, teachers become more willing to exhibit the skills of agile school dimensions. In this context, teachers' willingness to use their skills related to using technology, being flexible in the face of innovations and changes, and responding quickly to stimuli depends on the perception management skills of school administrators.

Based on the related results, it is recommended that school administrators improve their perception management skills. In this context, school administrators should act in accordance with individual differences in the processes of determining the current perceptions of teachers, creating a positive impression, shaping the desired perception and directing the perception. For this reason, school administrators can be provided with trainings on this subject. In addition, technological infrastructure can be provided to support the development of agile school characteristics and schools can be equipped in this respect. Similarly, it is very important but insufficient for teachers to create a positive perception of their use of technology. For this reason, need-oriented trainings can be provided to improve teachers' skills in this area.

In this study, the perception management variable, which is thought to play an important role in the development of agile school characteristics, was studied. In future studies, research can be conducted on the issues related to which other managerial and physical conditions can improve agile school characteristics. Similarly, qualitative methods like interviews, focus groups and case studies can be conducted to reveal the important factors in the development of agile school characteristics and they can provide a profound insights into the details of perception management practices and their effects on school agility. Looking at how different cultures handle perception management and how schoold adapt to change can give a wider understanding. By studying these topics across cultures, it can be effective to find specific problems that schools faces and the most effective ways to address them. In this study, no comparison was made between school levels; the aim was to reveal the general appearance of public schools. In this context, future researches can be designed to uncover differences at the school level would contribute to the field.

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Data Availability Declaration

Data Availability Upon Formal Request:

While the primary datasets utilized in this study are not publicly accessible due to certain constraints, they are available to researchers upon a formal request. The authors have emphasized maintaining the integrity of the data and its analytical rigor. To access the datasets or seek further clarifications, kindly reach out to the corresponding author. Our aim is to foster collaborative academic efforts while upholding the highest standards of research integrity.

Author Contributions

All authors, Koçak and Yörük contributed equally to this work. They collaboratively handled the conceptualization, methodology design, data acquisition, and analysis. Each author played a significant role in drafting and revising the manuscript, ensuring its intellectual depth and coherence. All authors have thoroughly reviewed, provided critical feedback, and approved the final version of the manuscript. They jointly take responsibility for the accuracy and integrity of the research.

Biographical notes:

Seval Koçak 1[4]: She received her master's degree in 2012 and his PhD degree in 2016 from Hacettepe University. Between 2016 and 2019, she worked as a research assistant at Usak University; she worked as an assistant professor in 2019. Dr. Koçak continues to work as an associate professor at Usak University.

SC Scopus Author Identifier Number: 56585607300

Web of Science Researcher ID: JHH-0559-2023

Şirin YÖRÜK 2: She graduated from English Language Teaching Department at Marmara University and received her master's degree from Uşak University in 2021. She is currently working as an English teacher at Uşak Provincial Directorate of National Education and she is also a PhD student in the Management of Education Programme at Pamukkale University."

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[4] Corresponding Author

Research

Examining the Relationship Between Social Media Addiction Level, Emotional State, and Mental Well-being among Early Childhood Teacher Candidates

Özge PINARCIK SAKARYALI [1] Nur Banu YİĞİT [2]

Abstract:

This study explores the relationship between social media addiction, mental well-being, and emotional states among Early Childhood Education (ECE) candidates. Utilizing a sample of 330 ECE students from Düzce University and Alanya Alaaddin Keykubat University, the research employed the Social Media Addiction Scale-Adult Form, Positive and Negative Affect Schedule (PANAS), and the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) to gather data. Findings revealed that ECE candidates exhibited moderate levels of social media addiction, with age and daily internet usage time being significant predictors, while gender was not a significant factor. Despite moderate addiction levels, participants reported above-average mental well-being, potentially attributed to positive digital engagement. The study also found significant correlations between social media addiction and negative affect, as well as a negative relationship with mental well-being and positive affect. These findings highlight the need for targeted interventions that focus on healthy digital engagement and emotional resilience, particularly for younger candidates and those heavily engaged online. The study's implications underscore the critical role of ECE candidates in modeling balanced digital behaviors to future generations, emphasizing the integration of digital literacy and emotional intelligence into educational curricula.

Keywords: Early childhood teacher candidates' social media addiction levels, emotional states, and mental well-being

[1] Assoc. Prof. Dr., Alanya Alaaddin Keykubat University, Alanya, Türkiye. o_pinarcik@hotmail.com,
iD Orcid ID: 0000-0001-9652-2089

[2] Res. Asst., Düzce University, Türkiye. nurbanubasihos@duzce.edu.tr,
iD Orcid ID: 0000-0002-2078-0185

INTRODUCTION

Social media has rapidly transformed how individuals interact, communicate, and engage with the surrounding environment over the last decade. Defined as "websites which facilitate profile creation and the visibility of connections between users" (Sims et al., 2017), it has become a predominant leisure activity for many individuals, including teachers and student candidates. Presently, nearly half of the global population (49%; 3.80 billion people) are active social media users, and this number continues to grow daily (Kemp, 2020). People engage with social media for various purposes, including maintaining relationships, accessing information, and entertainment (Boyd & Ellison, 2007; Lin & Lu, 2011), making it an integral part of daily life for many. For ECE candidates, who are often young adults themselves, social media serves as a crucial platform not only for personal interaction and professional development. They use social media to connect with peers, share educational resources, discuss teaching methodologies, and participate in professional communities. Moreover, teachers use social media to engage with parents and students, enhancing communication and support outside the classroom (Carpenter & Krutka, 2014). Despite the numerous advantages and opportunities offered by social media, concerns about its overuse have been mounting worldwide (Baccarella et al., 2018).

Excessive or addictive social media use is defined as "a behavioral addiction characterized by a preoccupation with social media, driven by an uncontrollable urge to engage with it, and dedicating so much time and effort to social media that it interferes with other important aspects of life" (Hilliard, 2024). The duration of social media use showed a significant but weak correlation with depressive symptoms. In contrast, social media addiction is a much stronger predictor of adverse mental health effects (Cunningham et al., 2021). Therefore, social media addiction, characterized by maladaptive usage patterns, poses a greater threat to mental health than the frequency of social media engagement (Thomas et al., 2022).

More specifically, social media addiction is notably linked to higher levels of depressive symptoms, anxiety, and stress in young adults (Jiang, 2021; Sampasa-Kanying & Lewis, 2015; Shannon et al., 2022). Various factors may contribute to this association. Using social media as a stress reliever can be a coping strategy to mask or reduce depression and anxiety symptoms (Wolfers & Schneider, 2021). Some young individuals spend considerable time passively scrolling or observing others' lives without direct interaction (Thorisdottir et al., 2019), leading to heightened social comparison and subsequent feelings of depression and low self-esteem (Keles et al., 2020; Verduyn et al., 2020). Moreover, the constant pressure to respond to notifications can increase anxiety, especially when people feel they might miss important updates (Karim et al., 2020).

Understanding the relationship between social media addiction, mental well-being, and emotional state is particularly important for ECE candidates because their emotional and mental well-being is crucial for their personal health and their effectiveness as

educators. Research indicates that social media addiction can lead to emotional dysregulation, manifested as increased irritability, mood swings, and heightened emotional sensitivity (Beyens et al., 2020). These emotional disturbances can impede their ability to provide a supportive and nurturing environment for young children, ultimately affecting the developmental outcomes of those in their care. Hence, this study examined the relationship between social media addiction levels, emotional states, and mental well-being among ECE candidates, providing insights that could inform the development of supportive measures and interventions in educational settings. To address this, the study formulated specific research questions and sought answers to them.

Q1. What is the social media addiction level of ECE candidates?

Q2) What is the level of mental well-being of ECE candidates?

Q3) What are the positive and negative affect levels of ECE candidates?

Q4) Do the social media addiction levels of ECE candidates differ significantly according to age, gender, and daily Internet usage time?

Q5) Do the mental well-being levels of ECE candidates differ significantly according to age, gender, and daily Internet usage time?

Q6) Do the positive and negative affect levels of ECE candidates differ significantly according to age, gender, and daily Internet usage time?

Q7) Is there a statistically significant relationship between the level of ECE candidates' social media addiction, mental well-being, and positive and negative affectivity?

Q8) To what extent can demographic variables (age, gender, daily Internet usage time) predict the level of social media addiction among ECE candidates?

Q9) To what extent does the level of social media addiction predict the mental well-being of ECE candidates?

Q10) To what extent do the levels of positive and negative affect predict the mental well-being of ECE candidates?

METHOD

Study Design

In this study, a correlational research design, which is a type of quantitative research method, was employed. As noted by Creswell (2005), this design assesses the extent of the relationship between two or more variables, allowing for the examination of their interconnections. Additionally, correlational research does not establish cause-and-effect

relationship established between the variables, and researchers cannot manipulate variables (Fraenkel & Wallen, 2006).

Participants

The study involved ECE teacher candidates enrolled in the ECE Program at Düzce University and the department of Child Development at Alanya Alaaddin Keykubat University. A total of 330 teacher candidates completed the online surveys. Detailed participant information collected via a personal information form is presented in Table 1.

Table 1

Personal Information About Participants

Personal Information	Options	n	%
Age	"18"	19	5.8
	"19"	66	20.0
	"20"	74	22.4
	"21"	71	21.5
	"22 and over"	100	30.3
Gender	"Female"	285	86.4
	"Male"	45	13.6
Daily Internet Usage Time	"1-3 hours"	93	28.2
	"4-7 hours"	207	62.7
	"8 hours and over"	30	9.1
Total		330	100%

Instruments

Four instruments were used for data collection. These included the "Personal Information Form," the "Social Media Addiction Scale-Adult Form" (Şahin & Yağcı, 2017), the "Positive and Negative Affect Schedule (PANAS)" (Gençöz, 2000), and the "Warwick-Edinburgh Mental Well-Being Scale (WEMWBS)" (Keldal, 2015). These tools provided comprehensive data on various aspects relevant to the research objectives.

The Personal Information Form collected basic demographic information, namely, age, gender, and daily Internet usage time of the participants.

Table 2

Scale Reliability Analysis Results

	α
Social Media Addiction Scale-Adult Form	
Virtual Tolerance	0,82
Virtual Communication	0,76
Total	0,86
The Warwick-Edinburgh Mental Well-Being Scale (WEMWBS)	0,92
Positive and Negative Affect Schedule (PANAS)	
Positive Affect	0,89
Negative Affect	0,86

Şahin and Yağcı (2017) developed the 'Social Media Addiction Scale-Adult Form' to assess social media addiction in adults aged 18-60. This 5-point Likert scale comprises 20 items divided into two subdimensions: "Virtual Tolerance" and "Virtual Communication." The overall reliability coefficient (Cronbach's Alpha) is 0.94, with subdimension reliability coefficients of 0.92 for Virtual Tolerance and 0.91 for Virtual Communication. In this study, reliability analysis yielded a Cronbach's Alpha of 0.86 for internal consistency, with subdimension coefficients of 0.82 and 0.76 for virtual tolerance and virtual communication, respectively (Table 2).

Tennant et al. (2007) developed the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) to assess individuals' mental well-being. Keldal (2015) conducted the Turkish adaptation, confirming a single-factor structure with a Cronbach's alpha coefficient of 0.89. In this study, the Cronbach's Alpha coefficient was 0.92 (Table 2). The scale comprises 14 items rated on a 5-point Likert scale, with scores ranging from 14 to 70. There were no reverse-scored items, and higher scores indicated higher levels of mental well-being.

Watson et al. (1988) developed PANAS to assess the emotional states of individuals during the previous week. The scale includes 10 positive and 10 negative affect items, each rated on a 5-point Likert scale from 1 (very slightly or not at all) to 5 (extremely). Scores for each affect dimension ranged from 10 to 50. The correlations of positive and negative affect levels with the Beck Depression Inventory are 0.35 and 0.56, respectively, and with the State-Trait Anxiety Inventory's state anxiety score are 0.35 and 0.51. The Turkish validity and reliability study was conducted by Gençöz (2000), with internal consistency coefficients of 0.83 for

positive affect and 0.86 for negative affect. Test-retest values ranged from 0.40 to 0.54. Factor analysis confirmed that items were grouped under positive and negative affect factors, as in the original scale. In this study, for PANAS, the reliability analysis yielded a Cronbach's Alpha of 0.89 for Positive Affect and 0.86 for Negative Affect.

Table 3 presents examples of questions from the Personal Information Form and items from the Social Media Addiction Scale-Adult Form, WEMWBS, and PANAS, which were utilized for data collection.

Table 3

Sample Questions and Items in the instrument

Instrument	Sample Questions and Items
Personal Information Form	How old are you?
	What is your gender?
Social Media Addiction Scale-Adult Form	"I see social media as an escape from the real world."
	"I spend more time on social media than I originally planned."
	"Being on social media comforts me when I feel unhappy."
Positive and Negative Affect Schedule (PANAS)	"Interested"
	"Distressed"
	"Excited"
Warwick-Edinburgh Mental Well-Being Scale (WEMWBS)	"I am optimistic about the future."
	"I feel useful."
	"I feel relaxed."

Data collection and analysis

Prior to data collection, ethical approval for the study was obtained from the ethics committee of Düzce University. The data collection instruments were digitized and made accessible online. These digital surveys were distributed to the ECE teacher candidates. The data collected from the participants in the online setting were imported into SPSS 26.0 statistical software for the analyses.

Prior to data analysis, skewness and kurtosis values were evaluated to verify the normality of the data distribution obtained from the scales. The results indicated that the

skewness and kurtosis values ranged from +1.5 to 1.5, confirming that the data followed a normal distribution (Tabachnick & Fidell, 2013). Therefore, parametric tests were applied during the analysis due to the data normality.

Descriptive statistics were utilized to determine values such as the mean, minimum, and maximum scores and the standard deviation from the scores obtained by ECE teacher candidates on the Social Media Addiction Scale-Adult Form, PANAS, and WEMWB. The Independent Samples t-Test was used to examine differences in scale scores by gender, while a one-way analysis of variance (ANOVA) was utilized to assess scale scores based on age and daily Internet usage time. The "Pearson Product-Moment Correlation Coefficient" was calculated to identify significant relationships between social media addiction levels and positive/negative affect, as well as mental well-being. The significance level was set at 0.05. If the ANOVA results were significant, the LSD test was used to identify the source of the differences.

The assumptions for the regression analysis were examined, and the tolerance index was found to be 0.996 for age, 0.998 for gender, and 0.998 for daily Internet-usage time. The variance inflation factor (VIF) was found to be 1.004 for age, 1.002 for gender, and 1.002 for daily Internet-usage time. These results indicate that there is no multicollinearity among the variables. A multiple regression analysis was conducted to examine the impact of participants' gender, age, and daily Internet usage time on their social media addiction levels; the impact of participants' positive and negative affect on their mental well-being; and a regression analysis was conducted to determine the extent to which social media addiction influences mental well-being.

Ethical Considerations

Ethical Review Board: Scientific Research and Publication Ethics Committee of Düzce University

Date of Ethics Review Decision: 21.03.2024

Ethics Assessment Document Issue Number: 2024/90

FINDINGS

In this section, the findings from the analysis that respond to the research questions are discussed.

Levels of social media addiction, mental well-being, and positive and negative affectivity among Ece candidates

Table 4

Descriptive Analysis Results of the Score Averages

	N	Min.	Max.	$\bar{x}$	S

Social Media Addiction					
Virtual Tolerance	330	1,18	5,00	2,96	0,70
Virtual Communication	330	1,00	4,44	2,31	0,62
Total	330	1,10	4,75	2,67	0,60
WEMWBS	330	1,00	5,00	3,44	0,77
PANAS					
Positive Affect	330	1,00	5,00	3,00	0,81
Negative Affect	330	1,00	5,00	2,44	0,81

According to Table 4, the sample group's mean score on the Virtual Tolerance subscale of the Social Media Addiction Scale was 2.96, while the mean score on the Virtual Communication subscale was 2.31, with an overall mean score of 2.67. Considering the minimum and maximum possible scores on the scale, it can be concluded that the social media addiction levels of the sample group were slightly above average.

The sample group's mean score on WEMWBS is 3.44, indicating that their mental well-being is above average.

The Positive Affect subscale of the PANAS had a mean score of 3.00, while the Negative Affect subscale had a mean score of 2.44. These scores indicate that the sample group had positive affect levels above average and negative affect levels below average.

Differences in the social media addiction level of Ece candidates according to personal characteristics

Table 5

Differences in the Social Media Addiction Level of Participants According to Gender

Social Media Addiction	Gender	N	$\bar{x}$	S	t	p
Virtual Tolerance	Woman	285	**32,98**	7,68	2,087	**0,038***
	Man	45	30,40	7,9961		
Virtual Communication	Woman	285	20,76	5,52	-0,842	0,400
	Man	45	21,53	6,48		
Total	Woman	285	53,75	11,78	0,945	0,345
	Man	45	51,93	13,37		

*p<0,05

According to Table 5, there was a significant difference in the Virtual Tolerance subscale scores of the Social Media Addiction Scale between genders (p<0.05). The mean score for females ($\bar{x}$=32.98) is significantly higher than that for males ($\bar{x}$=30.40). However, the Virtual Communication subscale and the total scores did not show a significant gender difference.

Table 6

Differences in the Social Media Addiction Level of Participants According to Age

Social Media Addiction	Age	N	x̄	S		Sum of Squares	df	Mean Squares	F	p
Virtual Tolerance	18	19	31,15	7,57	Between groups	618,472	4	154,618	2,615	**0,035***
	19	66	33,95	7,55	Within groups	19214,161	325	59,120	Difference: 19 > 22 and	
	20	74	34,44	7,77	Total	19832,633	329		above,	
	21	71	31,54	8,07						
	22	100	31,47	7,45					20 > 21, 22 and over	
Virtual Com.	18	19	20,47	5,25	Between groups	292,299	4	73,075	2,316	0,057
	19	66	21,42	4,59	Within groups	10254,356	325	31,552		
	20	74	22,33	6,17	Total	10546,655	329			
	21	71	20,02	5,44						
	22	100	20,10	5,96						
Total	18	19	51,63	11,39	Between groups	1732,162	4	433,041	3,079	**0,016***
	19	66	55,37	10,63	Within groups	45706,326	325	140,635	19 > 22 and above,	
	20	74	56,78	12,17	Total	47438,488	329			
	21	71	51,57	12,62					20 > 21, 22 and over	
	22	100	51,57	11,90						

*p<0,05

According to Table 6, there was a significant difference between the participants' ages and their scores on the Virtual Tolerance subscale and the overall Social Media Addiction Scale scores (p<0.05). The LSD test, used to identify the source of this difference through multiple comparisons, indicates that participants aged 19 have a significantly higher Virtual Tolerance subscale score (x̄=33.95) and total scale score (x̄=55.37) compared to those aged 22 and above. Similarly, participants aged 20 and older had significantly higher scores (x̄=34.44 for the subscale; x̄=56.78 for the total scale) than those aged 21 and 22 and above. However, the Virtual Communication subscale scores did not vary significantly with age. Overall, it is

noteworthy that participants aged 19 and 20 had higher social media addiction scores than the other participants.

Table 7

Differences in Social Media Addiction Level according to Daily Internet Usage Time

Social Media Addiction	Daily Int. Usage Time	N	$\bar{x}$	S		Sum of Squares	df	Mean Squares	F	p
Virtual Tolerance	1-3 hrs	93	27,45	7,28	Between groups	3733,551	2	1866,775	37,917	**0,000***
	4-7 hrs	207	34,27	6,80	Within groups	16099,082	327	49,233	Difference: 8 hours and over
	8 hours or more	30	37,40	7,59	Total	19832,633	329		> 4-7 hrs > 1-3 hrs
Virtual Com.	1-3 hrs	93	18,65	5,57	Between groups	726,960	2	363,480	12,104	**0,000***
	4-7 hrs	207	21,50	5,13	Within groups	9819,695	327	30,030	Difference: 8 hours and over
	8 hours or more	30	23,36	7,25	Total	10546,655	329		> 4-7 hrs > 1-3 hrs
Total	1-3 hrs	93	46,10	11,48	Between groups	7740,419	2	3870,209	31,880	**0,000***
	4-7 hrs	207	55,77	10,42	Within groups	39698,069	327	121,401	Difference: 8 hours and over
	8 hours or more	30	60,76	13,34	Total	47438,488	329		> 4-7 hrs > 1-3 hrs

*p<0,05

According to Table 7, there was a significant difference between the participants' daily Internet usage time and their scores on the Virtual Tolerance and Virtual Communication subscales, as well as the overall Social Media Addiction Scale scores (p<0.05). The LSD test, used to determine the source of this difference through multiple comparisons, shows that the scores for those who spend 8 hours or more on the Internet ($\bar{x}$=37.40 for the Virtual Tolerance subscale; $\bar{x}$=23.36 for the Virtual Communication subscale; $\bar{x}$=60.76 for the total scale) are significantly higher than the scores for those who spend 4-7 hours ($\bar{x}$=34.27; $\bar{x}$=21.50; $\bar{x}$=10.42) and 1-3 hours ($\bar{x}$=27.45; $\bar{x}$=18.65; $\bar{x}$=11.48) on the Internet. Overall, it is

noteworthy that as daily Internet usage time increases, the participants' social media addiction scores also increase.

Differences in the level of mental well-being of Ece candidates according to personal characteristics

Table 8

Differences in WEMWBS Score among Participants According to Gender

	Gender	N	$\bar{x}$	S	t	p
WEMWBS	Woman	285	48,66	10,62	2,056	**0,041***
	Man	45	45,11	11,68		

*p<0,05

According to Table 8, there was a significant difference between the participants' gender and WEMWBS scores (p<0.05). The scores for women ($\bar{x}$=48.66) are significantly higher than those for men ($\bar{x}$=45.11).

There is no significant differences between the participants' age, daily Internet usage time, and WEMWBS scores (p>0.05).

Differences in the positive and negative affect levels of Ece candidates according to personal characteristics

There was no significant difference between the participants' gender and their scores on the subscales of the PANAS (p>0.05).

Table 9

Differences in the PANAS Scores of Participants According to Age

PANAS						Sum of Squares	df	Mean Squares	F	p
	Age	N	$\bar{x}$	S						
Positive Affect	18	19	27,21	7,61	Between groups	223,556	4	55,889	0,849	0,495
	19	66	30,60	7,41	Within groups	21386,335	325	65,804		
	20	74	30,10	7,86	Total	21609,891	329			
	21	71	29,42	8,06						
	22	100	30,52	8,81						
Negative Affect	18	19	20,31	8,20	Between groups	1057,856	4	264,464	4,101	**0,003***
	19	66	23,72	7,44	Within groups	20959,307	325	64,490		

20	74	27,24	8,32	Total	22017,164 329	Difference: 20 >
21	71	24,76	7,64			18, 19, 22 and
22	100	23,38	8,40			over, 21 > 18

*p<0,05

According to Table 9, there was a significant difference in the PANAS Negative Affect subscale scores among participants of different ages (p<0.05). The LSD test, used to identify the source of this difference through multiple comparisons, indicates that the scores for participants aged 20 ($\bar{x}$=27.24) are significantly higher than the scores for those aged 18 ($\bar{x}$=20.31), 19 ($\bar{x}$=23.72), 22, and older ($\bar{x}$=23.28), and the scores for those aged 21 ($\bar{x}$=24.76) are significantly higher than the scores for those aged 28 ($\bar{x}$=20.31). Overall, it is noteworthy that participants aged 20 exhibit the highest levels of negative affect.

There is no significant differences between the participants' daily Internet usage times and their PANAS scores (p>0.05).

Relationship between the levels of social media addiction, mental well-being, and positive and negative affectivity among Ece candidates

Table 10

Relationship Between the Levels of Social Media Addiction, WEMWBS, and the PANAS Score of Participants

		Virtual Tolerance	Virtual Com.	Total Social Media Addiction	WEMWBS	Positive Affect	Negative Affect
Virtual Tolerance	r	1	0,590**	0,925**	**-0,144****	**-0,167****	**0,327****
	p		0,000	0,000	**0,009**	**0,002**	**0,000**
Virtual Com.	r	0,590**	1	0,853**	**-0,185****	**-0,111***	**0,331****
	p	0,000		0,000	**0,001**	**0,044**	**0,000**
Total Social Media Addiction	r	0,925**	0,853**	1	**-0,180****	**-0,160****	**0,367****
	p	0,000	0,000		**0,001**	**0,004**	**0,000**
WEMWBS	r	-0,144**	-0,185**	-0,180**	1	**0,663****	**-0,432****
	p	0,009	0,001	0,001		**0,000**	**0,000**
Positive Affect	r	-0,167**	-0,111*	-0,160**	0,663**	1	**-0,376****
	p	0,002	0,044	0,004	0,000		**0,000**

Negative Affect	r	,327**	,331**	,367**	-,432**	-,376**	1
	p	,000	,000	,000	,000	,000	

There was a low negative correlation between participants' scores on the Virtual Tolerance (r=-0.144, p=0.009) and Virtual Communication subscales (r=-0.185, p=0.001), as well as the total scores of the Social Media Addiction Scale (r=-0.180, p=0.001), and their WEMWBS scores. This indicates that as the participants' levels of social media addiction increase, their mental well-being decreases, or conversely, as their social media addiction levels decrease, their mental well-being improves.

Additionally, there was a low negative correlation between the Virtual Tolerance, Virtual Communication subscales, total Social Media Addiction Scale scores, and the Positive Affect subscale scores of the PANAS (r=-0.167, p=0.002; r=-0.111, p=0.044; r=-0.186, p=0.004). There was also a moderate positive correlation with the Negative Affect subscale scores (r=0.327, p=0.000; r=0.331, p=0.000; r=0.367, p=0.000). This indicates that as the participants' social media addiction levels increase, their positive and negative emotions decrease. Conversely, as their social media addiction levels decrease, their positive and negative emotions decrease.

Finally, there was a moderate positive correlation between WEMWBS scores and the PANAS Positive Affect subscale scores (r=0.663, p=0.000) and a moderate negative correlation with the PANAS Negative Affect subscale scores (r=-0.432, p=0.000). This indicates that as the participants' mental well-being improves, their positive and negative emotions also increase and decrease, respectively. Conversely, as mental well-being decreases, positive emotions decrease, and negative emotions increase.

Prediction of Ece candidates' social media addiction based on personal characteristics

The assumptions for the regression analysis were examined, and the tolerance index was found to be 0.996 for age, 0.998 for gender, and 0.998 for daily Internet-usage time. The variance inflation factor (VIF) was found to be 1.004 for age, 1.002 for gender, and 1.002 for daily Internet-usage time. These results indicate that there is no multicollinearity among the variables.

A multiple regression analysis was conducted to examine the impact of gender, age, and daily Internet usage time on social media addiction levels. In this analysis, being female was set as the independent variable for gender, age 20 as the independent variable for age, and 8 hours or more as the independent variable for daily Internet usage time, with other variables being assigned as dummy variables. The results of the multiple regression analysis are presented in Table 11.

Table 11

Regression Analysis of Participants' Social Media addictions Based on Personal Characteristics

Variables	B	Standard Error	β	t	p	r	rp	Tolerance Index	VIF
Constant	48,001	1,629		29,465	0,000	-	-	-	-
Age	3,648	1,396	0,141	2,613	0,009	0,132	0,143	0,996	1,004
Gender	0,540	1,695	0,017	0,319	0,750	0,012	0,018	0,998	1,002
Daily Internet Usage Time	7,289	2,024	0,194	3,602	0,000	0,188	0,196	0,998	1,002
R=0,235		*R²*=0,055							
$F_{(3-326)}$=6,357		p= 0,000							

In Table 11, examining the zero-order and partial correlations between participants' demographic variables and the predicted level of social media addiction revealed a significant relationship between these demographic variables and participants' social media addiction (R=0.235, R²=0.055, F (3, 326) =6.357, p=0.000). The demographic variables explained 5.5% of the variance in the participants' social media addictions levels.

A weak positive correlation is observed between age and social media addiction (r=0.132, p=0.009), as well as between daily Internet usage time and social media addiction (r=0.188, p=0.000). The gender variable does not have a significant relationship with participants' social media addictions.

According to the standardized regression coefficients, the relative impact of the predictor variables on the dependent variable is in the following order: daily Internet usage time (8 hours or more) (β=0.194), age (20 years) (β=0.141), and gender (β=0.017). In other words, a one-unit increase in daily Internet usage time resulted in approximately a 0.19-unit increase in the participants' social media addiction level, whereas a one-unit increase in the age variable resulted in a 0.14-unit increase in the social media addiction level. Based on the significance tests of the regression coefficients, the mathematical model for predicting participants' social media addiction can be expressed as follows: *age = 3.648, gender = 0.540, daily internet usage time = 7.289.*

Prediction of Ece candidates' mental well-being based on social media addictions

To examine the effect of participants' social media addiction levels on their mental well-being, a simple regression analysis was conducted. The results of the simple regression analysis are presented in Table 12.

Table 12

Regression Analysis of Mental well-beings Based on Social Media Addiction

Variable	B	Standard Error	β	t	p
Constant	59,469	2,752		21,613	0,000
Social Media Addiction Scale	-0,226	0,054	-0,226	-4,198	0,000
R= 0,226		*R*²=0,051			
$F_{(1-328)}$= 17,624		p=0,000			

In Table 12, the correlation between participants' social media addiction levels and their mental well-being indicates a significant relationship (R=0.226, R²=0.051, F(1-328)=17.624, p=0.000). This relationship is negative and of weak magnitude.

Participants' levels of social media addiction explained 5.1% of the variance in their mental well-being. A one-unit increase in social media addiction levels resulted in an approximately 0.23-unit decrease in participants' mental well-being levels.

Prediction of Ece candidates' mental well-being based on social media addictions

The results of the multiple regression analysis examining the effects of participants' positive and negative affect on their mental well-being are presented in Table 13.

Table 13

Regression Analysis for Predicting Participants' Mental well-beings Based on Affect (Positive and Negative)

Variables	B	Standard Error	β	t	p	r	rp	Tolerance Index	VIF
Constant	31,705	2,631		12,050	0,000	-	-	-	-
Positive Affect	0,778	0,058	0,583	13,526	0,000	0,599	0,540	0,858	1,165
Negative Affect	-0,282	0,057	-0,213	-4,948	0,000	-0,264	-0,198	0,858	1,165
R=0,692		*R*²=0,479							
$F_{(2-327)}$=150,138		p=0,000							

In Table 13, examining the zero-order and partial correlations between participants' affect (positive and negative) and their mental well-being showed a significant relationship (R=0.692, R²=0.479, F (2-327) =150.138, p=0.000). Affect explains approximately 48% of the variance in participants' mental well-being.

There was a moderate positive correlation between positive affect and mental well-being (r=0.599, p=0.000) and a weak negative correlation between negative affect and mental well-being (r=-0.264, p=0.000). According to the standardized regression coefficients, the relative impact of the predictor variables on the dependent variable is positive affect (β=0.583) and negative affect (β=-0.213). In other words, a one-unit increase in positive affect resulted in a 0.54-unit increase in mental well-being, whereas a one-unit increase in negative affect resulted in an approximately 0.20-unit decrease in mental well-being. Based on the significance tests of the regression coefficients, the mathematical model for predicting participants' mental well-being based on affect can be expressed as follows: *Positive Affect = 0.778, negative affect = 0.282.*

DISCUSSION

The findings reveal several important insights into the relationship between social media addiction, mental well-being, and emotional states among ECE candidates. The ECE candidates displayed a moderate level of social media addiction, which is consistent with existing research indicating that young adults and university students are increasingly engaged with social media, reflecting broader societal trends (Kuss & Griffiths, 2011; Andreassen et al., 2012). Such behaviors can be understood in the context of the ubiquitous presence of social media in everyday life, serving as a primary medium for social interaction, information dissemination, and entertainment (Perrin & Anderson, 2019).

Interestingly, despite concerns often associated with social media use, the participants reported above-average mental well-being. Previous studies have highlighted the detrimental effects of extensive social media use, linking it to increased rates of anxiety, depression, and lower life satisfaction (Twenge & Campbell, 2018; Kross et al., 2013). However, the nature of social media usage among the ECE candidates may explain this discrepancy. For instance, active engagement—such as creating content and participating in meaningful online interactions—has been associated with positive outcomes, such as enhanced social connectedness and emotional support (Reinecke & Trepte, 2014). This positive engagement might mitigate some of the adverse effects typically associated with social media use.

Affective states measured by the PANAS indicated higher levels of positive affect and lower levels of negative affect among the participants, potentially contributing to their higher mental well-being. The relationship between social media use and affective states is complex and can vary significantly based on the content consumed and the individual's purpose for using social media. For instance, studies have found that while passive consumption of social media content can lead to feelings of envy and dissatisfaction, active

engagement can foster a sense of community and belonging (Verduyn et al., 2017; Ellison et al., 2007).

Moreover, the findings indicated that female participants scored significantly higher on the Virtual Tolerance subscale compared to male participants. This aligns with previous research indicating that women tend to use social media more intensively for communication and social interaction (Haferkamp et al., 2012). Women's higher Virtual Tolerance scores may reflect a greater tendency to engage in activities that involve sustained social media use, such as maintaining social connections and seeking social validation (Tifferet & Vilnai-Yavetz, 2014). However, it is notable that there were no significant gender differences in the Virtual Communication subscale and total scores, which suggests that although women might have a higher tolerance for social media use, this does not necessarily translate into higher overall social media addiction levels. Additionally, the higher mental well-being scores among female ECE candidates might be due to their generally stronger social networks and greater tendency to seek emotional support, which are critical factors in enhancing mental well-being (Taylor et al., 2000; Matud, 2004).

Age-related differences were evident, with younger participants, particularly those aged 19 and 20, showing higher levels of social media addiction. This finding is consistent with literature indicating that younger individuals are more likely to experience higher levels of social media addiction (Andreassen et al., 2016). This age group, often referred to as "digital natives," has grown up with social media as an integral part of their social and informational landscape, potentially making them more susceptible to its addictive qualities (Przybylski et al., 2013). On the other hand, the absence of significant differences in mental well-being scores based on age indicates that these factors may not have a uniform impact on the well-being of ECE candidates. This finding contrasts with some studies that have found age-related differences in well-being, often showing that younger individuals experience higher levels of stress and lower well-being compared to older adults, possibly due to life transitions and uncertainties (Arnett, 2000).

Related to daily Internet usage time, the results also show a clear and significant correlation with social media addiction levels. Participants who spend 8 hours or more on the internet daily exhibit the highest levels of social media addiction. This finding supports the notion that extensive social media exposure can increase the risk of addiction (Andreassen et al., 2016). Several factors can explain the relationship between internet usage time and addiction levels. First, the more time individuals spend online, the more opportunities they have to engage with addictive features of social-media platforms, such as continuous newsreels, notifications, and social validation mechanisms (Griffiths et al., 2014). Second, prolonged internet use may lead to the displacement of other activities, such as physical exercise and face-to-face interactions, which can further exacerbate feelings of loneliness and dependence on social media for social fulfillment (Twenge & Campbell, 2019). However, the lack of significant differences in mental well-being and affective states according to internet usage time indicates that the nature and context of internet use are

crucial. ECE candidates use the internet mainly for academic purposes or maintaining positive social connections, this might mitigate potential negative effects on their well-being and emotional state (Berryman et al., 2018).

Finally, the study's correlations highlight a significant relationship between social media addiction, mental well-being, and emotional states. Higher levels of social media addiction were associated with lower levels of mental well-being, positive affectivity, and increased negative affectivity, which are consistent with findings from existing literature (Kross et al., 2013; Twenge & Campbell, 2018). This negative correlation between social media addiction and mental well-being underscores the detrimental impact that excessive social media use can have on an individual's overall mental health, highlighting the importance of promoting balanced and mindful social media usage among ECE candidates. The study also identified a moderate positive correlation between social media addiction and negative affectivity, indicating that as addiction levels increase, so do negative emotions. This indicates that interventions aimed at reducing social media addiction should also address the emotional aspects, such as managing the negative feelings associated with social media use.

Last but not least, the regression analyses provided further insights, revealing that age and daily internet usage time are significant predictors of social media addiction levels, whereas gender does not play a notable role. Specifically, ECE candidates around the age of 20 and those who spend 8 hours or more online daily show higher levels of social media addiction. This finding emphasizes the need for targeted interventions for younger individuals who are more vulnerable to developing addictive behaviors related to digital media due to their extensive engagement with online platforms (Andreassen et al., 2016). The analysis also demonstrated a clear negative relationship between social media addiction and mental well-being, explaining a small but significant portion of the variance in well-being scores among ECE candidates. This indicates that reducing social media addiction can potentially improve mental well-being among future educators.

Moreover, positive and negative affect were found to be significant predictors of mental well-being, with positive affect having a stronger positive impact than negative affect. This indicates that fostering positive emotional experiences could be particularly beneficial for enhancing the mental well-being of ECE candidates who may face unique stressors related to their training and future roles in early childhood education. The strong association between positive affect and well-being supports the broadening-and-build theory, which proposes that positive emotions expand individuals' thought-action repertoires and build enduring personal resources (Fredrickson, 2001).

These findings collectively emphasize the need for comprehensive strategies that promote healthy digital engagement and emotional resilience among ECE candidates. As future educators, they will need to model and teach balanced digital behaviors and emotional regulation to shape the next generation's relationship with digital media and

overall well-being. By understanding the specific challenges and behaviors of ECE candidates, educational institutions can better support them in developing positive digital and emotional practices that they can, in turn, model for young children.

LIMITATIONS AND RECOMMENDATIONS

The study's sample size, though adequate for exploratory analysis, may limit the generalizability of the findings. The participants were exclusively ECE candidates from specific universities, which may not fully represent the broader population of ECE candidates or students from other disciplines. Future research should include a larger and more diverse sample of participants from various academic disciplines and geographical regions. Moreover, it should employ a cross-sectional design that captures data at a single point in time. This approach limits the ability of researchers to draw causal inferences about the relationships between social media addiction, mental health, and emotional states. Longitudinal studies are needed to establish temporal relationships and causality. The reliance on self-reported measures for assessing social media addiction, mental well-being, and affective states introduces potential biases, such as social desirability bias and inaccurate self-assessment. Incorporating qualitative methods, such as interviews or focus groups, could provide deeper insights into the nuances of social media addiction and its impact on mental well-being. Lastly, given these findings, there is a need for intervention studies that explore strategies to reduce social media addiction and promote healthy digital engagement. Such interventions could focus on digital literacy, emotional regulation and time management skills, specifically tailored for ECE candidates and other student groups.

CONCLUSION

This study underscores the critical need to address the unique challenges faced by ECE candidates in the digital age, particularly social media addiction and its impact on mental well-being and emotional states. The findings highlight that ECE candidates exhibit moderate levels of social media addiction, with younger individuals, especially those aged around 20, and those who spend extensive hours online more susceptible to developing addictive behaviors. This demographic's vulnerability emphasizes the importance of targeted interventions aimed at promoting balanced and mindful social media usage, which is crucial not only for their well-being but also for their future roles as educators.

The significant correlations between social media addiction and mental well-being, including positive and negative affectivity, further illuminate the complex relationship between digital media use and psychological health. While social media can foster social connectedness and emotional support, excessive use, particularly passive consumption, can lead to negative psychological outcomes such as increased anxiety, depression, and reduced life satisfaction. This dichotomy indicates that educational institutions should focus on fostering positive digital engagement strategies that enhance emotional resilience among ECE candidates.

Moreover, the gender differences observed in the study, with female candidates scoring higher on the Virtual Tolerance subscale, indicate that although women may engage more intensively with social media for social interaction, this does not necessarily equate to higher overall addiction levels. This nuance highlights the importance of understanding the different ways in which male and female candidates interact with social media to tailor interventions that cater to the specific needs of each group.

In light of these findings, educational programs must integrate training that promotes digital literacy, emotional intelligence, and mental well-being. As future educators, ECE candidates will play a pivotal role in modeling and teaching balanced digital behaviors to young children, making it imperative that they are equipped with the skills necessary to navigate the digital landscape healthily. By focusing on these areas, educational institutions can help ECE candidates develop the necessary resilience and digital competencies to support their well-being and that of their future students, thereby fostering a healthier, more balanced approach to digital media use in the next generation.

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Data Availability Declaration

Data Availability Upon Formal Request:

While the primary datasets utilized in this study are not publicly accessible due to certain constraints, they are available to researchers upon a formal request. The authors have emphasized maintaining the integrity of the data and its analytical rigor. To access the datasets or seek further clarifications, kindly reach out to the corresponding author. Our aim is to foster collaborative academic efforts while upholding the highest standards of research integrity.

Author Contributions

All authors, Özge PINARCIK SAKARYALI, Nur Banu YİĞİT contributed equally to this work. The team collaboratively handled the conceptualization, methodology design, data acquisition, and analysis. Each author played a significant role in drafting and revising the manuscript, ensuring its intellectual depth and consistency. All authors have thoroughly reviewed and provided critical feedback and approved the final version of the manuscript. They jointly take responsibility for the accuracy and integrity of the research.

Biographical notes:

Özge PINARCIK SAKARYALI: She completed her bachelor's degree in the department of Classroom Education at Selçuk University, began her career as a teacher, and then became a research assistant in the Early Childhood Education Department at Selçuk University. In 2013, she earned a doctoral degree from Selçuk University's Child Development and Education Program and continued as an Assistant Professor in the Early Childhood Education Department of Duzce University's Faculty of Education in 2014. She received her associate professorship in the field of Child Development in 2019

and has been working as Deputy Dean at the Alanya Alaaddin Keykubat University Faculty of Health Sciences in the Department of Child Development since 2021. The areas of expertise include child development and education, early childhood education, psycho-social development, social skills, psychology, child psychology, child mental health, adaptation and behavioral problems, emotional intelligence, children's rights, and values education.

Web of Science Researcher ID: GWM-5739-2022

Google Scholar Researcher ID:

https://scholar.google.com.tr/citations?user=H7r-8REAAAAJ&hl=tr

Nur Banu YİĞİT: She completed her bachelor's degree in the department of Early Childhood Education at Middle East Technical University in 2019 and began her master's degree at the same university within the same year. She completed her master's degree in 2022 and began her doctoral education at the same university within the same year. Doctoral education is ongoing. Additionally, in 2020, she began working as a research assistant at Düzce University's Early Childhood Education Department. She continues to work at this university. The subjects she works on are; social and emotional development, early literacy, behavioral problems, and teacher education.

Web of Science Researcher ID: KFB-6221-2024

Google Scholar Researcher ID:

https://scholar.google.com.tr/citations?user=4bLzLAwAAAAJ&hl=tR

Research Article

Examination of Types of Mathematical Connections that Pre-service Mathematics Teachers Use in Instructions

Muhammet Şahal[1]   Mustafa Doğan[2]   Ahmet Şükrü Özdemir [3]

Abstract:

This study aims to examine the types of mathematical connections that pre-service mathematics teachers use in their instructions and their opinions on the mathematical connection. For this purpose, a total of 60 pre-service mathematics teachers made lesson plans related to a learning objective from the Turkish middle school mathematics curriculum. The case study design, which is one of the qualitative research methods, was adopted in the study. Video recordings, field notes and an opinion form were used as data collection tools. The data were analyzed using content analysis method. Results of the study show that almost all of the pre-service teachers have an understanding of mathematical connections. It was determined that the types of connections between concepts, between different representations and connections with real life were prominent, while the type of association with different disciplines was less common during the instructions. Connections were mainly made by giving examples through verbal expressions. These results provide an important perspective on the mathematical connection skills of pre-service primary mathematics teachers. Suggestions for improving pre-service teachers' mathematical association skills were presented acording to the results of the study.

Keywords: Mathematical connection, pre-service mathematics teachers, case study

[1] Assist. Prof. Dr., Istanbul 29 Mayis University, Education Faculty, Istanbul, Turkiye. msahal@29mayis.edu.tr,
 https://0000-0003-3625-2456
[2] Prof. Dr., Selçuk University, Education Faculty, Konya, Turkiye. mustafa.dogan@selcuk.edu.tr,
 https://0000-0002-7380-9869
[3] Prof. Dr., Marmara University, Ataturk Education Faculty, Istanbul, Turkiye. ahmet.ozdemir@marmara.edu.tr,
 https://0000-0002-0597-3093

INTRODUCTION

In mathematics, operations, concepts, systems, and structures are interrelated. Mathematics is seen as a sequential and cumulative discipline, as it has a structure in which concepts builds on each other in that previous knowledge and concepts form the basis of subsequent concepts and systems. (Bingölbali & Coşkun, 2016). These interactions between different mathematical concepts and systems emphasize mathematical connections. The mathematical connections help learners to see mathematics as a holistic disipline, rather than as a collection of independent and discrete parts (Mwakapenada, 2008). For example, when we consider that every square is also a rectangle and every rectangle is also a parallelogram, there is a relationship between the concepts of square, rectangle, and parallelogram in terms of their common properties. If this relationship is recognized, then these geometric objects are evaluated with a holistic approach rather than separately.

Hiebert and Carpenter (1992) defined the mathematical connection as a part of a network structured like a spider web, where "the junctures, or nodes can be thought of as pieces of represented information, and threads between them as the connections or relationships" (p. 67). Mathematical connections, which are characterized as bridges between mathematical ideas, can also be defined as components of a schema or connected schema groups in a mental network (Eli & Mohr-Schroeder, 2013). Mathematical connection skill, which helps to establish these links, play an important role in mathematics education (National Council of Teachers of Mathematics [NCTM] 2005). Mathematical connection also plays an important role in associating mathematics with different disciplines and daily life (Özgen, 2016). Mathematical connections include both the connections between mathematical concepts and systems and the connections between mathematics in different disciplines and real life. García-García and Dolores-Flores (2018) state that the connections between different subjects of mathematics are considered intra-mathematical connections; if these connections are related to different fields or daily life, they are considered extra-mathematical connections. There are different classifications in the literature for mathematical connection, which has been found to contribute positively to the learning and instructions (NCTM, 2005). In the theoretical framework section, we explain which mathematical connection classification was adopted within the scope of the study.

Theoretical Framework

There is a strong relationship between mathematical connections and mathematical understanding (Cai & Ding, 2017; García-García & Dolores-Flores, 2018; Hiebert & Carpenter, 1992). Mathematical connections make mathematical understanding powerful and deep in the process of constructing knowledge (Skemp, 1989). Mathematical connections can be made not only between mathematical concepts, ideas, or operations, but also with everyday life, prior knowledge, other disciplines, the past, and the future (Begg, 2001; Presmeg, 2006). Mathematical connections strengthen mathematical understanding,

ensure consistent answers, utilize different representations, work inside and outside mathematics, and are influenced by students' belief systems. (Businskas, 2008; Evitts, 2004; García-García & Dolores-Flores, 2018; Özgen, 2013). In this context, Bingölbali and Coşkun (2016) proposed a theoretical framework for systematic classification of mathematical connections to be used more effectively in mathematics education. According to the theoretical framework, mathematical connections are discussed under four categories: the connections between mathematical concepts, the connections between different representations of the concept, the connections with real life, and the connections with different disciplines.

Connections Between Mathematical Concepts

Skemp (1986), pointing out the difficulty of making a precise definition, tried to explain the term "concept" with the process of abstraction that results in a product. "Mathematical concepts consist of mathematical (mental) objects and the relationships among those objects." (Simon, 2017, p. 121). Therefore, in mathematics teaching, it is necessary to establish connections between mathematical concepts to create or improve schemas, which are defined as conceptual structures according to the cognitive approach If the connection occurs between different mathematical concepts or expressions, it should be considered as a connection between concepts (Bingölbali & Coşkun, 2016). Considering that each rectangle is a special form of a parallelogram, the relationship between the concepts of parallelogram and rectangle can be given as an example of connections between concepts.

Connections Between Different Representations of a Concept:

Making connections between different representations of a concept is defined as re-representing the same concept in different forms such as words, graphs, tables, and equations (Prain & Waldrip, 2006). Representing mathematical objects in multiple ways plays an important role in mathematical understanding (Dreher & Kuntze, 2015; Van de Walle, Karp, & Bay-Williams, 2012). Flexibility in transitions between different representations facilitates mathematical learning (Ainsworth, Bibby, & Wood, 1998). In this context, Bingölbali and Coşkun (2016) considered different representations of concepts and the connections between them within the scope of mathematical connections and gave the value table of the dependent and independent variables in the expression whose algebraic representation is $f(x) = x^2$ and the graph on the analytical plane as examples of different representations.

Connections with Real Life

The importance of establishing meaningful relationships between real life and mathematics in mathematics teaching is collectively suggested in the literature (Julie, 2002; Ministry of National Education [MoNE], 2018; NCTM, 2000; Simon & Cox, 2019). This means making use of contexts and examples that students encounter or are likely to encounter in

their daily lives. Bingölbali and Coşkun (2016) evaluated verbal examples given from daily life as well as addressing a concept in context under the type of connections with real life.

Connections with Different Disciplines

Interdisciplinary work is of great importance for the development of 21st-century skills such as questioning, critical thinking, problem-solving, creative and innovative thinking (English, 2016). Nowadays, innovations in medicine, engineering, industry, and many social fields occur through projects that bring together experts from different disciplines. This situation makes it necessary to adopt an interdisciplinary approach both in mathematics teaching and in the teaching of other courses to prepare students for the future. Bingölbali and Coşkun (2016) discussed the situation of using a concept or relationship in a different discipline in teaching a mathematical concept in the category of associating it with different disciplines. According to the theoretical framework, these connections can be made by using the context of a different discipline or by giving a verbal example in another discipline.

Importance, Purpose and Research Questions of the Study

Mathematical connection has been studied with teachers (Mhlolo, Venkat, & Schafer, 2012; Rodríguez-Nieto, Rodríguez-Vásquez, & Font, 2020), pre-service teachers (Eli, Mohr-Schroeder, & Lee, 2013; Özgen, 2019; Rodríguez-Nieto, Rodríguez-Vásquez, & García-García, 2021a; Zengin, 2019) and students at different grade levels (García-García & Dolores-Flores, 2018; 2021). The studies conducted with teachers, pre-service teachers, and students based on making connections between different representations (Mhlolo, Venkat, & Schafer, 2012; Moon, Brenner, Jacob, & Okamoto, 2013), real-life connections (Özgeldi & Osmanoğlu, 2017; Pirasa, 2016), connections between concepts or different disciplines in the context of specific topics (Dolores-Flores, Rivera-Lopez, & Garcia-Garcia, 2019; García-García & Dolores-Flores, 2021; Rodríguez-Nieto, Rodríguez-Vásquez, & García-García, 2021a), and examining participants' views on making associations (Özgeldi & Osmanoğlu, 2017; Özgen, 2013). In these studies, participants' mathematical skills in different contexts were examined. In addition, there are also studies investigating the mathematical connections used by teachers in the subjects they teach in the classroom environment (Jaijan & Lopia, 2012; Rodríguez-Nieto, Rodríguez-Vásquez, & Font, 2020). It is important to determine the mathematical connections made in the lessons and how they are used in teaching (Dolores-Flores, Rivera-Lopez, & Garcia-Garcia, 2019). This situation draws attention to future teachers' undergraduate level. Because the decisions that teachers make in their professional lives cannot be considered independent from the education and training processes during their undergraduate education (Ünlü & Sarpkaya Aktaş, 2017). However, the studies investigating the mathematical connection used in the instructions of pre-service mathematics teachers are limited. Özgen (2019) conducted a study with 19 pre-service mathematics, 11 pre-service physics, and 10 pre-service chemistry teachers and focused on

the participants' ability to connect mathematics with different disciplines in the activities they designed. Özgeldi and Osmanoğlu (2017) examined how pre-service mathematics teachers made connections between real life and mathematics through short videos and reports of the participants. No study in this direction was found in the relevant literature. In this context, the main aim of the study is to determine which types of mathematical connections primary school mathematics pre-service teachers use in the instruction they designed in line with the achievements in the secondary school mathematics curriculum. In addition, it is to examine which methods they used in this process and their views on mathematical connections. For these purposes, the following research questions were tried to be answered:

1. Which types of mathematical connections did primary pre-service mathematics teachers use in the instruction that they designed in line with the achievements of the mathematics curriculum?
2. Which methods did the primary pre-service mathematics teachers use in the mathematical connections they made during the instruction they designed in line with the achievements of the mathematics curriculum?
3. What are the views and opinions of pre-service mathematics teachers on mathematical connections?

METHOD

Research Model

The case study model, which is one of the qualitative research designs, was used in the study. According to Yin (1994), researchers examine a case in-depth in its natural environment and have the opportunity to obtain detailed and holistic knowledge about the case in case studies.

Participants

The participants of the study were determined by purposive sampling method. In purposive sampling, the researcher selects cases that are rich in information regarding the determined research questions and purpose, which will provide the opportunity for detailed investigation (Patton, 2002). The participants of the study consisted of 60 (44 were female (73.33%) and 16 male (26.66%) junior pre-service mathematics teachers who were from a faculty of education in İstanbul. The pre-service teachers were coded as PST1, PST2, ..., PST60. The participants had taken courses related to content knowledge, pedagogical content knowledge, and pedagogical knowledge in the undergraduate curriculum such as general mathematics, abstract mathematics, linear algebra, calculus 1-2-3, analytic geometry, instructional technologies and material design, algebra teaching, mathematics teaching in secondary school, mathematics teaching methods 1, teaching principles and

methods, educational psychology. Participants signed an informed consent form before the implementation.

Data Collection Tools and Implementation

The data were collected within the scope of the Mathematics Teaching Methods 2 course. While the Mathematics Teaching Methods 1 course curriculum in the program is theoretical, the Mathematics Teaching Methods 2 course generally focuses on practical activities. In this context, pre-service teachers were asked to plan a 12-20 minutes teaching activity for an objective from the secondary school mathematics curriculum. Then they acted and thaught as if they were in a real classroom environment. During the instruction, it was stated that the other participants in the class would assume that they are a primary school student and act as it. In this way, we aimed to capture an atmosphere similar to that of a real primary classroom environment in the micro-instruction. The first and second authors took part in the instruction as observers. The implementation lasted for 14 weeks. In the first week, information about the research was presented to the participants, an informed consent form was given to the participants who wanted to be included in the application. In each following week, lecture sections of 4 or 5 participants were included. In order not to disrupt the natural flow, participants were informed that the data would be used within the scope of a research; however, it is not stated that the scope of research is related to mathematical connection.

The data were collected through video recordings, researchers' observation notes, and an open-ended questionnaire. The instruction carried out by the pre-service teachers was videotaped, and short transcriptions of the content were made by labeling the important times in these recordings.

Data Analysis

A total of 920 minutes (15 hours and 20 minutes) of video recordings were analyzed. In addition, comparisons were made with the observation notes that were taken during the teaching sessions. The content analysis method was used to analyze the data through video recordings and open-ended questionnaires. Content analysis is a repetitive and systematic data analysis technique in which data are reduced to certain categories within a certain rule (Weber, 1990). The content analysis method is a technique that can be used not only on texts but also in the analysis of videos (Büyüköztürk et al., 2017). The theoretical frameworks of Bingölbali and Coşkun (2016) and García-García and Dolores-Flores (2018) form the basis for the data analysis. Figure 1 summarizes the implementation and data analysis process.
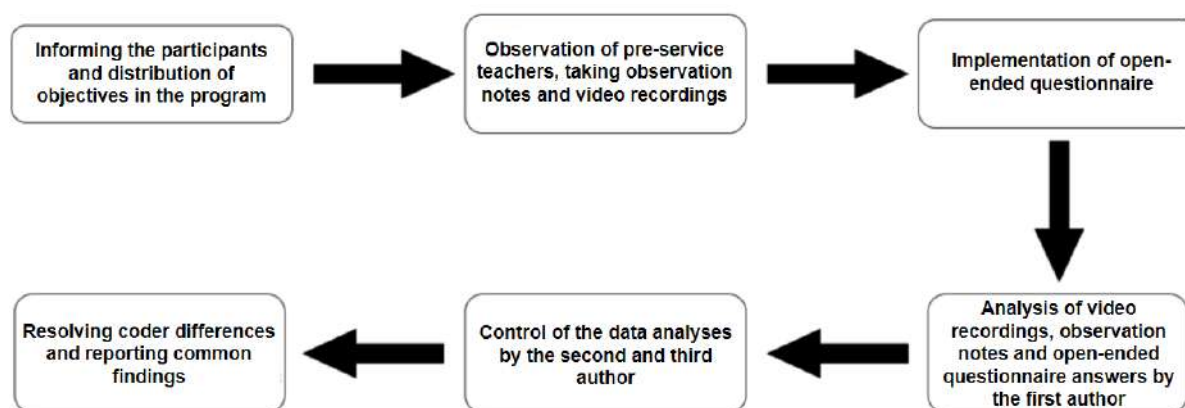
Figure 1. The implementation and data analysis process

Validity and Reliability

To ensure validity and reliability in qualitative research, strategies such as detailed narration, long study process, triangulation, direct quotation, and determination of intercoder agreement should be used (Creswell & Miller, 2000; McMillan & Schumacher, 2014). In this respect, the data obtained from the study were detailed, a long implementation process of 14 weeks was carried out, different data collection tools were used, the participants' statements were conveyed with direct quotations, and intercoder reliability was examined during the data analysis process. According to the intercoder reliability formula of Miles and Hubermann (1994), the agreement between the coders was found to be 87.65%.

Ethical considerations

Since the data were collected in the spring semester of 2019, no ethics committee report was obtained. All data acquired, including the video recordings and participants' consent documents, were securely housed on the first researcher's personal computer, fortified by stringent password protection measures.

RESULTS

Findings Related to the Types of Connections Used by Pre-Service Mathematics Teachers

In this section, the findings related to the types of mathematical connections used by pre-service mathematics teachers in their teaching sections are presented. Most of the participants used one or more types of connections in their instructions. Table 1 summarizes the types of mathematical connections used by pre-service teachers.

Table 1

Mathematical Connections Used by Pre-Service Mathematics Teachers

Intra/extra-mathematical	The type of connection	f	%
Intra-mathematical connections	Connections between concepts	18	30
	Connections between different representations of concept	32	53,33
Extra-mathematical connections	Connections with real life	26	43,33
	Connections with different disciplines	4	6,66
No connection was made		7	11,66

According to the findings, 80% of the pre-service teachers used mathematical connections, while 11.66% of them did not use any type of mathematical connection in their instruction sessions. Among the pre-service teachers who used mathematical connections in their lectures, 30% made connections between concepts, 53.33% made connections between different representations, 43.33% made connections with real life, and 6.66% made connections with different disciplines. In addition, we observed the pre-service teachers who utilized two or three different types of connections in their instructions. While 28.33% of the pre-service teachers utilized two different types of connections, 20% of them utilized three different types of connections in their teaching sessions.

PST11 included connections between concepts, connections between different representations, and connections with real life in the teaching section in which she presented for the achievement of "calculating the area of a circular region and a circular region slice" of Grade 7 in the mathematics curriculum. PST11 referred to the connection between different representations by using circles and circle slices obtained from colored cartons. She also used the connection with real life by projecting visuals such as bagel, money, car tire, cake surface, lifebuoy, and moon on the screen. Nevertheless, PST11 wanted to draw attention to the difference between the concepts of circle and circular region with the projected objects. Lastly, she made the connection between concepts by reaching the area of the circular region by making use of the relationship between the circular region, the slices of the circular region, and the parallelogram consisting of these slices as seen in Figure 2.

Figure 2. A section from the instruction of PST11

In the instruction designed for the objective "determining the basic elements of a right circular cylinder, constructs it and draws its expansion" of 8th grade, PST5 used two different types of connections. PST5 made an introduction to the lesson as follows:

> *"What you see in my hand is a right prism (showing models of prisms). We could define a prism as follows: We call the objects whose base is a polygonal region and whose side faces are rectangular regions right prisms. How did we name them? Whichever polygonal region was their base, that is what we named our prism. What you see in my hand is a square right prism. This is a hexagonal right prism. This is a triangular prism. Now I will ask you a question. We have chosen these bases as polygonal regions. If we had chosen a circular region, what kind of an object would we get?"*

PST5's effort to establish a connection between the circular cylinder and prisms showed that she used the connection between concepts. Besides, her presentation on the expansion of the cylinder with the help of the physical material that she designed from expansion tiles, a rope, and cardboard and dynamic geometry software showed that she used the connection between different representations. Figure 3 shows the carton materials and the reflection dynamic geometry software.
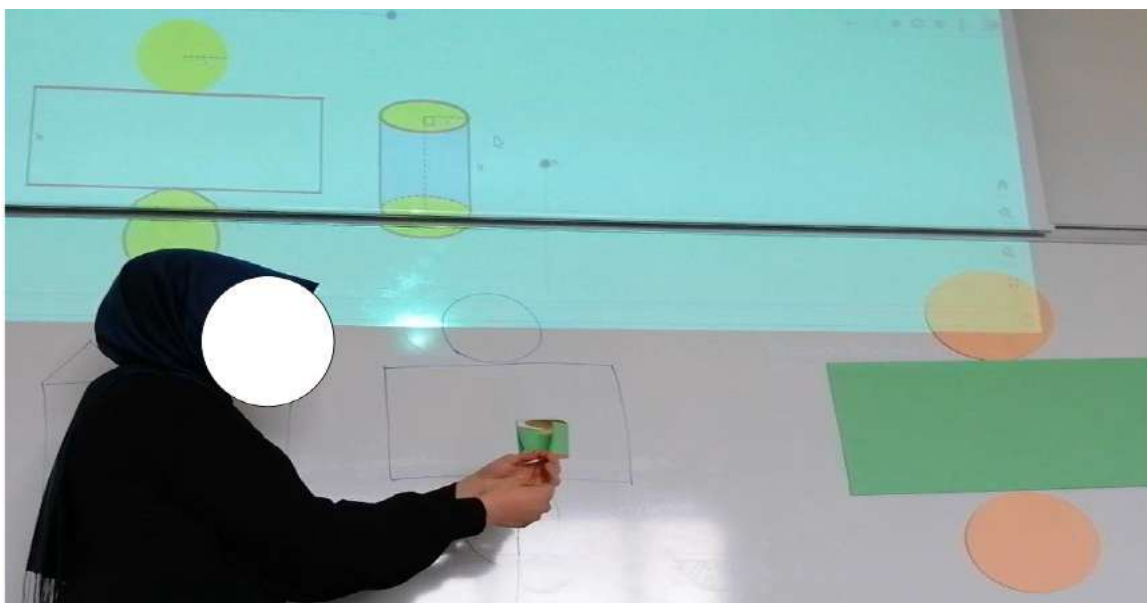
Figure 3. A section from the instruction of PST5

Findings Related to the Methods Used by Pre-Service Mathematics Teachers in Mathematical Connections

In this section, we presented findings related to making connection methods of pre-service mathematics teachers according to the types of mathematical connections.

The connection methods of the pre-service teachers who made connections between concepts were evaluated in the categories of verbal expressions, drawing or representation, and utilizing physical materials. Table 2 shows the preservice teachers' methods of making connections between concepts.

Table 2

The Methods of Connections Between Concepts Used by Pre-Service Mathematics Teachers

The methods of connections between concepts	f
Through verbal expressions	10
Through drawing or demonstrations	6
Through physical materials	2

Table 2 shows that pre-service teachers made connections between concepts mainly with verbal expressions. For example, on the subject of ratio and proportion, PST57 made connections between concepts with verbal expressions by saying that:

"Since our topic was ratio and proportion, do you remember rational numbers? We had a topic called "expansion and simplification" in rational numbers. Therefore, we had a topic called equivalent fractions. What happens when we multiply the numerator and denominator by the same number in these fractions? We were doing the expansion, right?"

In addition, we observed that the preservice teachers made connections by presenting physical materials (PST5), using drawings (PST24, PST43), or projecting visuals related to the concepts (PST32). Figure 4 shows the diagonal drawings made by PST24 to connect the sum of interior angles in polygons with triangles, the drawing of the cube expansion made by PST43 to connect the surface expansion of a rectangular prism with a cube, and the visuals reflected by PST32 about the area connection of a triangle. The pre-service teachers who made connections between concepts through drawing or demonstration and with the help of physical materials also benefited from connections between different representations. However, the representations that pre-service teachers performed were not related to the target concept, but to another concept related to that concept.

Figure 4. Sections from the instruction of PST24 (left), PST43 (middle), and PST32 (right)

Table 3 summarizes methods for the connections between the different representations that pre-service teachers made for the focus objective in the instruction.

Table 3

The Methods of Connections Between Different Representations of Concept Used by Pre-Service Mathematics Teachers

The methods of connections between different representations of concept	f
Through physical materials	28
Through dynamic software or interactive environments	13
Through drawing or demonstrations	9

We observed that the pre-service teachers who made connections between different representations mainly used physical materials. We also observed that the pre-service teachers used carton mockups, algebra tiles, paper clips, compasses, scales, balances, balls, and rods for the focused objective in the teaching sessions. For example, PST33, who carried out an activity using carton cups, chickpeas, and beans related to the GCF (greatest common factor)-LCM (least common multiple) topics in the 8th grade, stated that:

> *"Now I have 9 beans and 6 chickpeas. Now I want to distribute them equally. Logically, if I distribute them to both of them one by one, am I distributing them equally? ... Then can you put 9 cups for 9 beans? 6 cups for 6 chickpeas. One bean and one chickpea in each cup. Now I want you to do the following. I want to distribute them equally, but this time I've added a second condition. I want the number of cups to be the minimum..."*

After the physical materials, we observed that pre-service teachers made connections between different representations with the help of dynamic software or interactive environments. Pre-service teachers mainly made connections related to the target objective with the help of GeoGebra. Figure 5 shows the instruction sections of PST3 showing the angles of prisms and PST49 showing the center of gravity of a triangle.
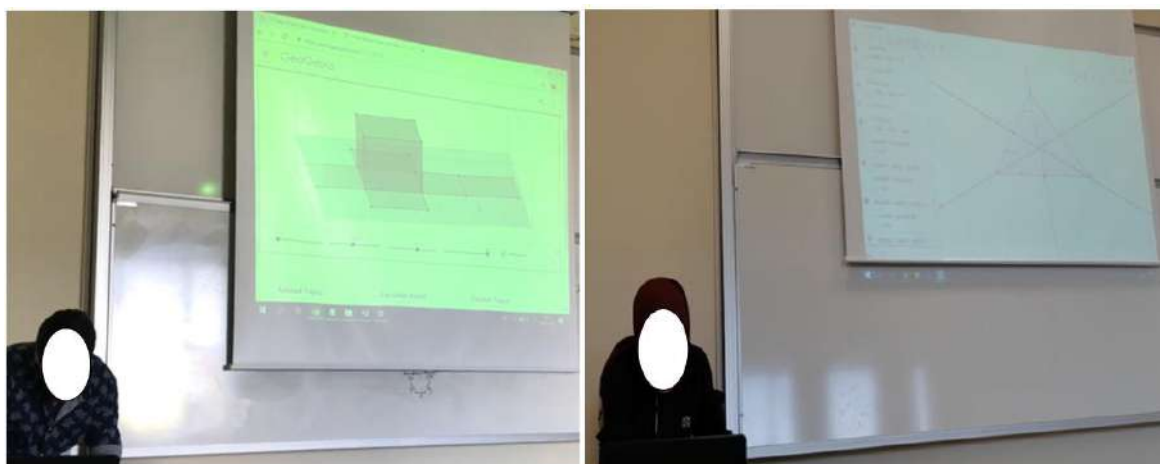
Figure 5. Sections from the instruction of PST3 (left) and PST49 (right)

In the teaching sessions, connections between different representations were also made through drawings or demonstrations. We observed that the pre-service teachers who used this method benefited from making connections by projecting ready-made visuals, watching video recordings, or making drawings by hand. As can be seen in Figure 6, while PST20, who designed instruction on expressing the rule of number patterns of the 7th grade with letters, projected a shape pattern on the board, PST19, who designed instruction on constructing the bisector, bisector and height in a triangle, made drawings on the board with the help of a ruler, protractor and compass.
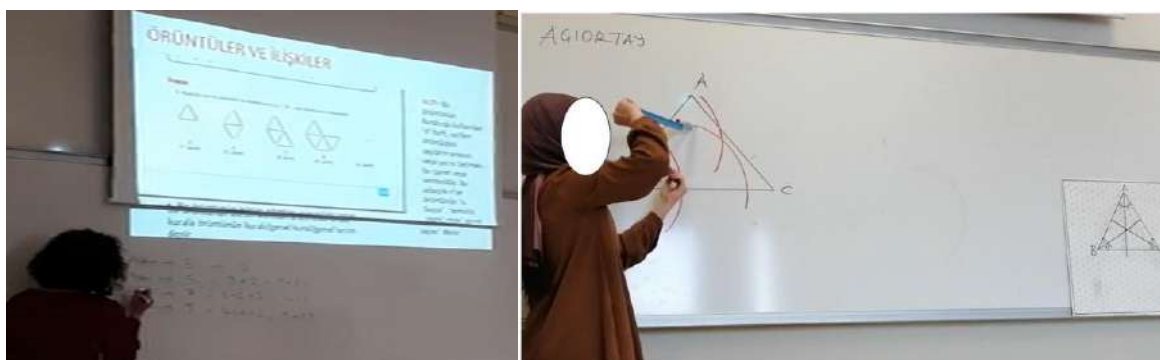
Figure 6. Sections from the instruction of PST20 (left) and PST19 (right)

The pre-service teachers' methods of making connections with real life were categorized as through verbal expressions, history of mathematics, demonstrations, and physical materials. Table 4 presents the methods of making connections with real life.

Table 4

The Methods of Connections with Real Life Used by Pre-Service Mathematics Teachers

The methods of connections with real life	f
Through verbal expressions	13

Through demonstrations	8
Through physical materials	6
Through history of mathematics	1

The pre-service teachers who made connections with real life mainly used verbal expressions, demonstrations, and physical materials. We observed that the pre-service teachers who used verbal expressions or representations presented examples of physical objects, experiences, or experiences from daily life related to the mathematical concepts or situations. In the 6th grade, PST12, who designed instruction related to the attainment related to addition and subtraction of fractions, used the following statements verbally:

"Now, what about addition with fractions in daily life... Can you think of any event? Let's think about it. Maybe when buying fabric, right? For example, I want half of this fabric batch. When I go back later, I say, I want one-fourth of it. I have a certain amount of fabric. I can find out how much the batch of whole I've bought by adding it up."

PST12 connected a shopping context in daily life with addition in fractions by using verbal expressions.

The pre-service teachers also made connections with real life by using demonstrations. They presented visuals or video demonstrations of the related mathematical concepts or objects to the students. As the demonstrations were mostly presented to the students with the help of technology, it was observed that the available relevant visuals were presented physically to the class. Regarding the 6th grade attainment "Drawing a circle and recognizing its center, radius, and diameter", PST16 started the lesson by projecting an image of a Ferris wheel. In 8th grade, in order to make a connection with the topic of reflection in transformation geometry, PST15 presented a photograph of a landscape reflected in water to the class. Figure 7 shows the presentations of the pre-service teachers.
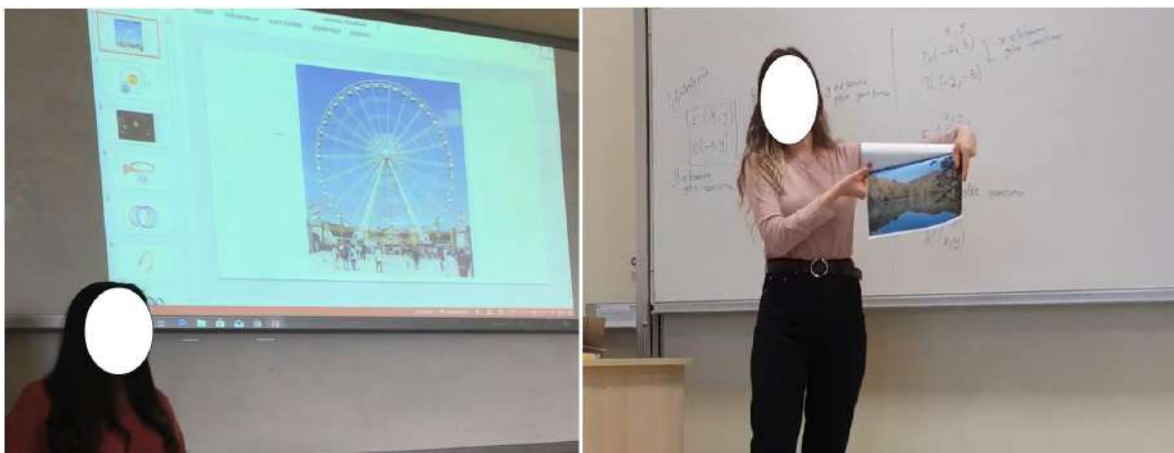
Figure 7. Sections from the instruction of PST16 (left) and PST15 (right)

In the connections with real life, we found that in addition to verbal expressions and demonstrations, the pre-service teachers also made connections through physical materials. We observed that the pre-service teachers who used this method concretized a daily life situation related to the targeted outcome with the help of the tools that they brought to the classroom. In 7th grade, PST26 used a material representing a scale and marbles to display the example of a scale related to the attainment of "Understanding the principle of conservation of equality". Similarly, PST59, who wanted to make connections between positive and negative integers and temperature and coldness related to the attainment of "Comparing and ordering integers" in 6th grade, brought two bottles to the classroom, one with hot (+4) and the other with cold (-5) water. Figure 8 shows the moments of the connections made by the pre-service teachers through physical materials.

Figure 8. Sections from the instruction of PST26 (left) and PST59 (right)

The only pre-service teacher who made a connection with real life by using the history of mathematics was PST10. She used the following expressions by connecting the 8th-grade attainment of "Forming the Pythagorean relation and solving related problems" with land calculations in the ancient Egyptian period:

> *"Pythagoras named this relation after himself. Pythagoras was a Greek mathematician. He lived in 500 BC. This relation was formed as follows: There was a lot of flooding in the Nile River in Egypt. Therefore, the boundaries of the fields and lands were always changing. For this reason, they used the length of the hypotenuse of a right triangle with a known right side length to determine the boundaries. And hypotenuse was the name of Pythagoras' wife."*

The least common type of connection used by pre-service teachers in the teaching sessions was connection with different disciplines. The teaching sessions in which we observed this connection were categorized according to the field of connection. The connections made by pre-service teachers were evaluated in the categories of science, finance, geography, and cryptology. Table 5 presents these disciplines.

Table 5

The Methods of Connections with Connections with Different Disciplines Used by Pre-Service Mathematics Teachers

The methods of connections with different disciplines	f

Science	2
Finance	1
Geography	1
Cryptology	1

The pre-service teachers made connections with different disciplines by using verbal expressions. Examples of mathematical concepts or situations were given from the fields of physics, chemistry, biology in science, interest calculations in finance, and continents in geography, and an activity was carried out by using encryption. In 8th grade, PST7, who connected exponential expressions with both science and finance, used the following statements:

> *"We use exponential numbers to identify the number of bacteria or the rate at which they multiply. We use them to calculate the diameters of planets or measure the distance between two planets. We use them in interest calculations. We use them to express large numbers or, in chemistry, to show the diameter of atoms."*

Similarly, PST21 verbally connected the addition and subtraction of fractions in 5th grade with the topic of continents in geography:

> *"The areas covered by the continents of the world, Africa and Asia, are expressed in fractions. How can we find the total area? The fraction of one-fifth represents Africa, that is, the area it covers. The fraction of three-tenth represents the Asia continent in terms of its area. How can I find the total area of these two continents? By addition. Now in this lesson, we will see how to add these two different fractions."*

Making connections with real life by using physical materials, PST59 also designed an encryption activity that combines the alphabet with the topic of comparing integers. The rules of his activity are as follows:

- Write your own name on a paper,
- Number it from the top in the order of the letters in the name starting from 1,
- Number it from the bottom in the order of the letters in the name starting from -1,
- Compare the numbers above and below the letters,
- Whichever number is larger, move through the alphabet as much as that number and change the corresponding letter.

In her activity, PST59 reversed the idea of comparing the encryption process and the decryption process with integers and applied it in the classroom. Figure 9 shows the password "NVC" obtained for the word "MUZ" and the word "FATMA" obtained as a result of the solution of the password "GCVPE".
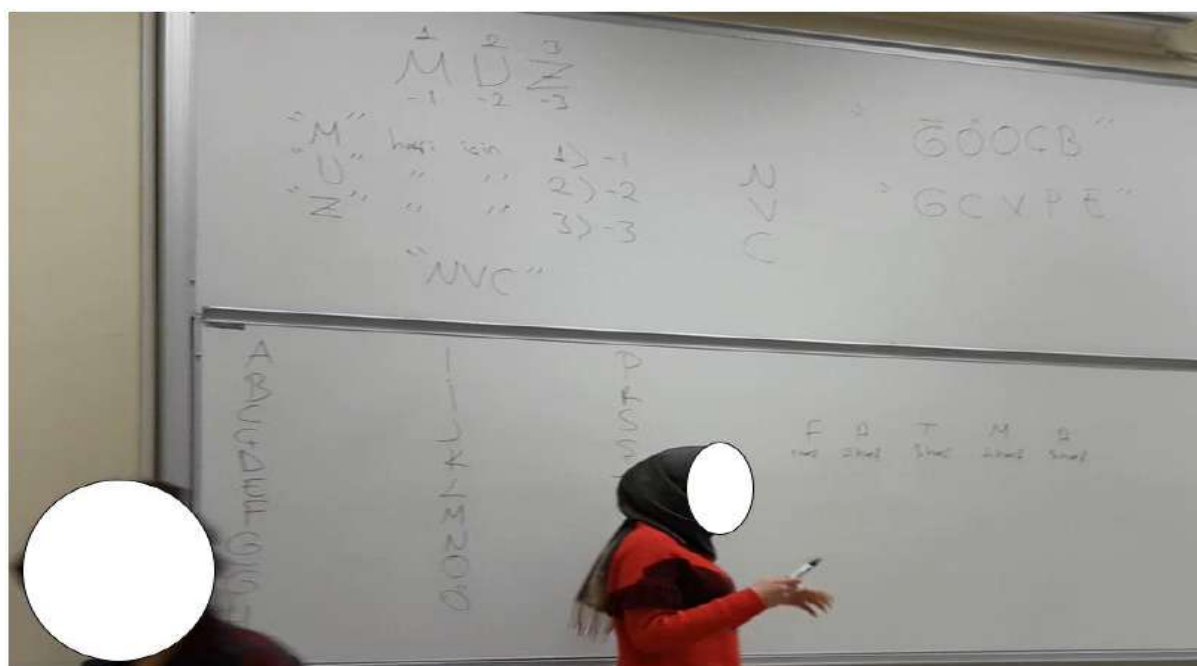
Figure 9. Sections from the instruction of PST59

Findings Related to Views of Pre-service Mathematics Teachers on Mathematical Connections

The findings of the study revealed that almost all of the pre-service teachers considered mathematical connection as one of the basic components of mathematics education. Table 6 summarizes pre-service teachers' views on mathematical connection.

Table 6

Views of Pre-service Mathematics Teachers on Mathematical Connections

Mathematical connection	f
Making connections with daily life	48
Making connections between mathematical concepts or topics	30
Making connections with different disciplines	11
Mathematical symbolism/demonstratiton	2
No idea	1

According to the findings, the majority of the pre-service teachers perceived mathematical connection in the context of making connections with daily life. Besides, the majority of pre-service teachers with this view reflected the idea of making abstract mathematical concepts or topics concrete through objects and experiences in daily life. They

emphasized that students would learn more easily, meaningfully, and permanently in this way. For example, PST22 reported that connecting with daily life would facilitate learning:

> *"We as teachers should concretize mathematics more and transfer it to students. While concretizing, we have to connect mathematics with something. I think that if it is understood that the problems that students face in their daily lives are actually mathematical, it will be easier for the students."*

Similarly, PST30 also reflected the idea of concretization and mentioned the contribution of mathematical connection to meaningful learning:

> *"Mathematical connection is making connections between mathematics and daily life. It is the answer to the question of what these will do for us. When this connection is established, abstract concepts become concrete."*

PST 17 also mentioned the permanence of learning and stated that:

> *"When I think of mathematical connection, the intertwining of daily life and mathematics comes to my mind. When we explain a topic in mathematics and present it with a similar example from daily life, I think its retention increases even more."*

After the connections with daily life, pre-service teachers emphasized the connections between mathematical concepts and subjects for mathematical connection the most. The pre-service teachers who drew attention to this issue referred to the holistic structure of mathematics and the fact that mathematical subjects are the basis of each other. They reported that the connection between concepts would contribute to the interest in the course, the instruction, and the understanding of the subject matter. PST12, who also addressed mathematical connection in the context of making connections with daily life, pointed to the holistic structure of mathematics by stating that:

> *"Mathematics is a cumulative science. The reason for this is the mathematical relationships between the subjects. A teacher should establish these relationships very well so that the student knows that the subjects are not independent of each other and that he/she should know the related subjects."*

PST42 also emphasized that different subjects in mathematics are the basis of each other and reported that:

> *"What is fundamental in mathematical connection is that a subject is also encountered when we move on to other subjects. Almost all mathematics topics are interrelated and it becomes impossible to understand the other topic without knowing one of them."*

Similarly, PST35 referred to the holistic structure of mathematics and mentioned that mathematical connection contributes to the teaching and understanding of the course stating that:

> *"Mathematics is a whole. The subjects in mathematics complement each other. Each of them is related to each other. For example, the topics of percentages, ratio-proportion, and fractions are related to each other. This facilitates both teaching and student understanding."*

Explaining mathematical connection as establishing links between daily life, mathematical subjects, and different disciplines, PST43 reflected his thoughts on interest in the lesson and ease of understanding. In light of these findings, the pre-service teachers who

handled mathematical connections in the context of the connections between concepts are thought to be making consistent explanations. The statements of PST43 are as follows:

"Mathematical connections can be made with daily life or between different subjects. Connections can be made with previous subjects of mathematics or even with the content of a different course. This increases the interest in the course and makes it easier to understand."

Seven of the eleven pre-service teachers who evaluated mathematical connection in the context of making connections with different disciplines also included both making connections with daily life and making connections between mathematical concepts or subjects in mathematical connection. The other four pre-service teachers considered making connections with daily life as well as making connections with different disciplines as part of the mathematical connection. PST13 explained mathematical connection as the relationship established with both daily life and different disciplines and exemplified mathematical connection in the context of culture and art:

"Mathematical connection is the establishment of a relationship between concepts related to mathematics and daily life or other disciplines to make them more concrete. Mathematical connections can also be made with things that are part of humanity, such as culture and civilization. For example, calculating how many kilos of meat each of 7 people gets from a calf slaughtered on the Eid Al Adha is a connection between culture and mathematics. On the other hand, a person drawing a picture calculating perspective is a connection between art and mathematics."

S31 also mentioned all three types of connections stating that:

"Relating mathematical concepts within themselves, with other disciplines and with daily life is called mathematical connection."

It is noteworthy that all of the pre-service teachers who evaluated mathematical connections as making connections with different disciplines also pointed to other types of connections.

Finally, we observed that two pre-service teachers addressed mathematical connections in the context of mathematical symbolism or demonstration. Among these pre-service teachers, PST11 mentioned making connections between mathematical concepts or subjects and different representations in addition to making connections with daily life:

"Mathematical connection is the connection of mathematical concepts with each other. Formulas are also the connection of symbols. For example, showing natural numbers and integers in a set. Making use of ratio and proportion when explaining percentages."

The other pre-service teacher, PST6, evaluated mathematical connection only in the context of symbolism:

"Mathematical connection is the expression of concepts in mathematics with symbols and numbers."

One pre-service teacher did not express an opinion about mathematical connection.

As a result, pre-service teachers have various approaches and evaluations toward mathematical connection. They emphasized the importance of connecting mathematical concepts with daily life and stated that this would facilitate the learning process. At the same

time, pre-service teachers think that mathematical connections could contribute to the understanding of the connections between concepts and support the holistic structure of mathematics. In addition, they also suggested that making connections with different disciplines could enrich students' mathematical understanding.

DISCUSSION

This study aimed to examine which types of mathematical connections pre-service mathematics teachers use in the instruction that they design in line with the attainments of the middle school mathematics curriculum, which methods they use while making mathematical connections, and their views on mathematical connections. The video recordings of teaching sessions of the pre-service teachers were analyzed both simultaneously and after the recording. In this section, the findings of the study are discussed together with the results in the literature.

It was revealed that almost all of the pre-service teachers participating in the study had an understanding of mathematical connections. According to the results, the connection between concepts, between different representations, and with real life was prominent in the teaching sessions of the pre-service teachers, while the type of connections with different disciplines was less common. The pre-service teachers mainly made connections by giving examples through verbal expressions in their instructions. The opinions of the pre-service teachers showed that they had different approaches and evaluations of mathematical connections.

Among the types of mathematical connections used by pre-service teachers in the instructional sessions, connections between different representations came to the fore. This result is similar to the results of Agry et al. (2023), Rodríguez-Nieto, Rodríguez-Vásquez, and García-García (2021a; 2021b). Agry et al. (2023) concluded that pre-service primary school teachers made connections between different representations. Rodríguez-Nieto, Rodríguez-Vásquez, and García-García (2021a; 2021b) found that the type of connection between different representations was the type of connection that pre-service teachers used the most in the derivative subject. It is also noteworthy that pre-service teachers mainly utilized physical materials and technology when making connections between different representations. In addition, the opinions of the pre-service teachers revealed that they had an understanding of the mathematical connection that aimed to concretize the abstract concepts of mathematics. These findings show that pre-service teachers have an awareness of the power of physical materials and technology, and have the skills to use these resources. On the other hand, the findings of the study contradict the studies of Moon, Brenner, Jacob, and Okamoto (2013) and Quilang and Lazaro (2022), who reported that pre-service teachers had difficulty in making connections between different representations. This may be related to the mathematical concept or topic to which the connection is related. While Moon, Brenner, Jacob, and Okamoto (2013) examined different representations of conic curves,

Quilang and Lazaro (2022) examined the types of connections of pre-service teachers about statistics and probability.

Another type of connection that the pre-service teachers used the most in their teaching sessions was the connection with real life. The participants tried to establish the connection of mathematical concepts with daily life mostly through verbal expressions. However, real-life connections were also made using technology and physical materials. In addition to these findings, the theme of making connections with daily life came to the fore in pre-service teachers' views on mathematical connections. In light of this result, it can be said that pre-service teachers reflect their opinions that this type of connection is an effective teaching strategy. The findings of the study on making connections with real-life support the results of Özgeldi and Osmanoğlu (2017) and Özgen (2013). Özgeldi and Osmanoğlu (2017) found that pre-service teachers were able to make explicit connections with real life and that most of them thought that all subjects of mathematics could be connected with real life. Özgen (2013) observed that pre-service teachers mainly addressed mathematical connection in the context of connection with real life. Although pre-service teachers dealt with mathematical connections in the context of making connections with real life, their connection in the teaching sessions remained superficial. We observed that pre-service teachers who made connections with real life mostly gave examples from objects or situations in daily life and did not make in-depth connections. These findings support the results of Pirasa (2016) and Aguirre et al. (2012), who concluded that pre-service teachers made superficial and simple connections between mathematics and real life. The fact that the connections made by pre-service teachers with real life are superficial may be related to the examples of connections in school mathematics and textbooks in their education life. This is because mathematics textbooks tend to give a mathematical definition and then emphasize the connections superficially by giving examples of where they are encountered in real life (Yeniterzi & Işıksal-Bostan, 2015).

After connections between different representations and connections with real life, the pre-service teachers used connections between concepts the most. Pre-service teachers made connections between concepts mainly through verbal expressions. We also observed that mathematical concepts were connected through drawing or demonstration in the teaching sessions. In addition, pre-service teachers' views on mathematical connections revealed that the connections between mathematical concepts or topics are related to the holistic structure of mathematics. They pointed out that all subjects are interdependent, addressing the various mathematical topics based on the curriculum. Agry et al. (2023) emphasized that mathematical concepts become inseparable topics with a holistic understanding through mathematical connection. It can be stated that the findings of the study regarding the connection between concepts support this idea. The results of the study are in line with the results of similar studies in the literature (Agry et al., 2023; Dışbudak Kuru & Işıksal Bostan, 2023: Rodríguez-Nieto, Rodríguez-Vásquez, & Javier García-García, 2021b). Dışbudak Kuru and Işıksal Bostan (2023) found that pre-service teachers tried to make as many connections

as possible between mathematical concepts to appeal to students' thinking in their teaching rehearsals. Similarly, Rodríguez-Nieto, Rodríguez-Vásquez, and Javier García-García (2021b) concluded that inter-conceptual connections were prominent in pre-service teachers' mathematical connections about derivatives.

The least common type of connection in the teaching sessions was connections with different disciplines. We observed that pre-service teachers made connections between concepts, between different representations, and with real life, but they preferred the interdisciplinary connection type less than the others. It can be said that this result supports the results of Dışbudak Kuru and Işıksal Bostan (2023) and Özgen (2013; 2019). Dışbudak Kuru and Işıksal Bostan (2023) concluded that pre-service teachers made connections with daily life, but the connections with different disciplines that they made were limited. Özgen (2013) also revealed that the contexts used by pre-service teachers in making connections with different disciplines were limited. In another study by Özgen (2019), while the use of mathematics in other disciplines was dominant, the use of other disciplines in mathematics education remained narrow. One of the possible reasons for this result might be the fact that making connections is seen as identical to concretization and visualization, as also revealed in the opinions of pre-service teachers. However, it is noteworthy that the pre-service teachers who addressed mathematical connections in the context of connections with different disciplines also emphasized other types of connections. In other words, pre-service teachers who have an idea about making connections with different disciplines are also aware of other types of connections. It can be said that this result indicates that making connections with different disciplines also provides opportunities for other types of connections. In parallel to this opinion, Dışbudak Kuru and Işıksal Bostan (2023) concluded that pre-service teachers who made progress in making connections with different disciplines also made progress in making connections with daily life.

CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

This study, which examines in detail the types of mathematical connections used by pre-service mathematics teachers in their teaching sessions, revealed that connections made between different representations were prominent. While pre-service mathematics teachers frequently preferred connections with real life and connections between concepts, they used connections with different disciplines less frequently. In addition to the examples given superficially with verbal expressions, it is also noteworthy that pre-service teachers used physical materials and technology effectively while making mathematical connections. This study provides an important perspective on the types of mathematical connections used by pre-service mathematics teachers.

In light of the results of the study, we suggest including more practices and rehearsals on the mathematical connection in the undergraduate preperation of pre-service mathematics teachers. In addition, mathematical connections should be used in the courses that pre-service teachers take to strengthen their theoretical and practical background in

mathematical connections. This study is limited to the instructional sessions designed by pre-service teachers for a single outcome they selected in the middle school mathematics curriculum. In this respect, the mathematical connection strategies used by pre-service teachers in their teaching sessions designed for different learning domains and objectives may differ. Nevertheless, we recommend conducting research examining which types of materials are used in mathematical connections and the roles of these materials. Another limitation of the study is related to in-class interactions. In the videotaped teaching sessions, the focus was on the instruction of pre-service teachers rather than student-student interactions. In this respect, research can be conducted to examine in-class interactions and which types of connections can be used in different learning domains and objectives.

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Data Availability Declaration

Data Availability Upon Formal Request:

While the primary datasets utilized in this study are not publicly accessible due to certain constraints, they are available to researchers upon a formal request. The authors have emphasized maintaining the integrity of the data and its analytical rigor. To access the datasets or seek further clarifications, kindly reach out to the corresponding author. Our aim is to foster collaborative academic efforts while upholding the highest standards of research integrity.

Author Contributions

Multiple Authors with Equal Contribution:

Author Contributions:

All authors, [Muhammet ŞAHAL], [Mustafa DOĞAN], and [Ahmet Şükrü ÖZDEMİR] contributed equally to this work. They collaboratively handled the conceptualization, methodology design, data acquisition, and analysis. Each author played a significant role in drafting and revising the manuscript, ensuring its intellectual depth and coherence. All authors have thoroughly reviewed, provided critical feedback, and approved the final version of the manuscript. They jointly take responsibility for the accuracy and integrity of the research.

Biographical notes:

Muhammet Şahal 1[4]: The author is the assistant professor at Istanbul 29 Mayis University, Department of Mathematics and Science Education, in Turkey. He has studies on mathematical modeling, problem posing and the use of technology in mathematics education.

SC Scopus Author Identifier Number: 57207997295

Web of Science Researcher ID: AAZ-5555-2020

Google Scholar Researcher ID:

https://scholar.google.com/citations?user=aF5F9xsAAAAJ&hl=tr&oi=ao

Mustafa Doğan 2: The author is a professor at Selçuk University, Department of Mathematics and Science Education, in Turkey. He has studies on teaching activities of pre-service teachers, textbooks, computer-aided mathematics education as well as dynamic softwares in mathematics education.

SC Scopus Author Identifier Number: 57196589822

Web of Science Researcher ID: AAG-5713-2019

Google Scholar Researcher ID:

https://scholar.google.com/citations?user=rZwxsDoAAAAJ&hl=tr

Ahmet Şükrü Özdemir 3: The author is a professor at Marmara University, Department of Mathematics and Science Education, in Turkey. He has studies on problem posing, mathematical modeling, spatial reasoning, history of mathematics as well as cryptology, and number theory.

SC Scopus Author Identifier Number: 36544416300

Web of Science Researcher ID: AAA-6410-2019

https://scholar.google.com/citations?user=wIBo_vEAAAAJ&hl=tr

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[4] Corresponding Author

Exploring the Impact of Career Steps and Evaluation Systems on Teacher Professional Development: Teachers' Opinions on Career Step Exams

Semra Kıranlı GÜNGÖR[1]   **Güler SHAIKH**[2]

Abstract:

Teachers' professional development and educational policies are two phenomena that significantly affect stakeholders in education. Related research has emphasized that these policies are mostly in striking contrast with long-standing perceptions of the status of the profession, values, beliefs, and norms of teachers. This research aims to evaluate teachers' opinions regarding policies, procedures, criteria, effects on teaching professional ethics, and suggestions regarding "The Career Step Exam" implemented by the Ministry of National Education in Türkiye. In this study, teachers' opinions on these exams were obtained by comparing the type and scope of questions, difficulty levels, entry conditions, and regulations for the exams held in 2006 and 2022. The research data consist of the opinions of teachers, expert teachers and head teachers who work in kindergarten, primary, secondary and high schools during the academic year 2022-2023. The study was carried out using the phenomenological pattern, which is a qualitative research method. In this study, the opinions of 85 teachers were taken using semi-structured interview forms to collect qualitative data. Moreover, to obtain the widest possible range of perspectives, the maximum variation sampling method was employed. According to the data obtained from the research, it was concluded that most teachers disapproved of the current examination system and caused discrimination in terms of salary increase and status.

Citation:

Kıranlı Güngör, S. & Shaikh, G. (2024). Exploring the Impact of Career Steps and Evaluation Systems on Teacher Professional Development: Teachers' Opinions on Career Step Exams. *International Journal of Modern Education Studies, 8*(2), 251-290. https://doi.org/10.51383/ijonmes.2024.376

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[1] Assoc. Prof, Eskişehir Osmangazi University, Faculty of Educational Sciences, Eskişehir, Türkiye. semk2009@gmail.com
   https://0000-0001-5785-8137

[2] English Language Teacher, Ministry of National Education, Kocaeli, Türkiye. gulershaikh@gmail.com
   https://0000-0002-1094-6110

INTRODUCTION

Education has always been an important phenomenon in human history (Saunders, 1999; Tiberius, 2002). Throughout history, many policies and regulations have been implemented to improve the quality of education (Tiberius, 2002). The ministries of education have been trying to implement original ideas that will increase the quality of education, such as acquiring teaching/learning resources, supporting student-centeredness, providing technological devices, and offering professional development for teachers to improve self-efficacy (Wilson, 2011; Xu & Gulosino, 2006). Education and teachers are considered two inseparable phenomena because the teachers' primary role is to transfer information and guide students to improve the effectiveness of the learning process (Creemers et al., 2012; Hanushek & Rivkin, 2007). Since teachers are the cornerstone of education, they are always receiving increased attention from associated groups and policymakers (Hou et al., 2023; Kennedy, 2008). Authorities and society expect teachers to be knowledgeable, experienced, and competent (Toole & Louis, 2002). Since teachers are considered one of the crucial factors that affect the quality of education, most regulations and policies focus on teachers' professional development (Darling-Hammond, 2012; Creemers et al., 2012). Among the arrangements and activities that contribute to the professional development of teachers, activities such as in-service training, seminars, and courses are conducted, as well as activities aimed at increasing motivation (Kuznetsova, & Yarovaya, 2021). On the other hand, these policies sometimes get a strong and adverse reaction from teachers, especially when teachers' opinions are not taken into consideration, which creates a sense of struggle, disgrace, and demotivation in their careers (Wood, 2007). Hence, this study sets out to investigate the experiences of teachers on career-stage exams, including their general opinions about exam policies, procedures, and the resulting impact on teachers' professional development and ethics.

As a continually evolving system, the notion of education has been a great deal for governments and associated organizations. Therefore, regulations and policies for teachers, indispensable elements of education, are meticulously implemented by the states. Moreover, since teachers are models that impact the lives of students, they are among the people who are constantly observed by society, creating constant pressure on teachers about their experience, knowledge, and competence. There is a common prejudice against novice teachers because parents often prefer their children to be taught by experienced teachers. To minimize these concerns, the Ministry of Education conducts actions regarding teachers' professional development (Lockton & Fargason, 2019).

Therefore, throughout history, various educational reforms and approaches have been developed to improve the teaching profession. In ancient Greece in the 5th century BC, Socrates' teaching methods based on inquiry and discussion helped teachers encourage interactive and critical thinking to develop the teaching profession (George, 2015). In the 17th century, Jean-Jacques Rousseau proposed an education model that supports the natural

development of children in his work "Emile". This approach encouraged teachers to focus on individual student needs (Lu, 2019; Rousseau, 2021). In the 19th century, under the leadership of Wilhelm von Humboldt, a modern research-oriented education model was developed at universities in Germany. This model helped teachers transfer scientific thinking and research skills to students (Albritton, 2006). In the 20th century, John Dewey encouraged teachers to adopt a student-centred approach with his progressive education philosophy. According to Dewey, teachers must provide learning experiences that match students' interests and needs (Cowles, 2020; Dewey, 2012).

The National Education Association, which was established in 1857, is an organization that works to contribute to the professional development of teachers. The association operates to develop teacher training programs, support teacher professional development, and encourage cooperation among teachers (Sleeter, 2011). Reform movements in teacher training programs that began in the United States in the 1960s aimed to provide teachers with more practical experience. These reforms included changes made to increase preservice teachers' classroom practices and to better prepare them for the teaching profession The normal school movement emerged in the United States in the late 19th and early 20th centuries. This movement focused on the professional development of teachers and enabled teachers to receive regular education. Normal schools are schools where pre-service teachers receive training in teaching techniques, teaching materials, and curricula to improve their teaching skills (Gordy, 2016; Ogren, 2003; Ogren, 2005). In recent years, innovative teacher training programs have been developed for the professional development of teachers. The Teach for America Program is designed to accelerate the professional development of teachers. This program enables young adults with tertiary education to work as teachers in low-income schools (Donaldson & Johnson, 2011; Heilig & Jez, 2010). The educational reforms implemented in Finland since the 1980s have placed significant emphasis on the professional development of teachers. Teachers are encouraged to continually improve themselves, collaborate with colleagues, and adopt research-based practices (Aarrevaara et al., 2009; Hardy, et al., 2021; Webb, 2004).

The new education system has resulted in innovations in teacher training and professional development in line with contemporary education principles. Therefore, in the late 19th and early 20th centuries, pedagogical formation programs were developed to train teachers. These programs were aimed at increasing the pedagogical knowledge and skills of teacher candidates. In 1924, the Law of National Education laid the foundation for the modern education system in Türkiye (Aslan, 2011). A radical change has been made to the teacher training system in Türkiye. Teachers' schools were transformed into teacher high schools. In addition, the Teachers' School Reform was carried out in 1933 to train professional teachers (Oğuzkan, 1982). In the 1960s, a series of reforms were carried out in education in Türkiye. In this period, teacher training programs were reviewed, and the status and importance of the teaching profession were emphasized (Bilir, 2011; Çelebi & Kazancı, 2021; Kılıç, 2015). The Education Policy Document, adopted in Türkiye in 2005, has been an

important reference point for the professional development of teachers. In the document, subjects such as teacher training, career development, and continuing education were discussed, and the aim was to increase the quality of teachers (Bağci, 2011). National Teacher Standards, developed in 2006 in Türkiye to contribute to the professional development of teachers, are used to determine teachers' qualifications and support their professional development (Şişman, 2009). Moreover, in Türkiye, many programs are organized by various institutions and non-governmental organizations to support professional development. The Ministry of National Education's Professional Development Project (MEGEP) offers professional development materials for teachers (Emirgil, 2009).

The career step reform implemented in 2005 aimed to introduce a new system for advancing and progressing teachers' careers based on performance. The reform established a career steps system for teachers that included different levels based on performance and qualifications. The Career Steps were categorized as the "Teacher," "Expert Teacher" and "Senior Master Teacher" levels. The reform emphasized performance-based evaluation to determine teachers' progression in the career steps system (Güven, 2010). The evaluation criteria considered various factors such as classroom performance, student outcomes, professional development activities, and school community contributions. The reform recognizes the importance of teacher training and professional development to enhance teaching quality. The program encouraged teachers to participate in professional development programs, courses, workshops, and seminars to improve their pedagogical knowledge and skills. The reform introduced differentiated salary scales corresponding to career steps (Çelikten, 2008). Teachers at higher career levels with exemplary performance were eligible for higher salaries and additional benefits (Gündoğdu & Kızıltaş, 2008). The reform aims to promote meritocracy in the education system by rewarding teachers' performances and dedication. Teachers who consistently demonstrated outstanding performance and met specific criteria were able to progress to higher career steps. The reform introduced mentorship programs where experienced teachers supported and guided novice teachers, fostering professional growth and collaboration within the teaching community. Later on, the 2011 career step reform aimed to enhance the quality of education by recognizing and rewarding teachers' performance and encouraging continuous professional development.

The Teacher Performance System, launched in 2014, aims to evaluate and improve the performance of teachers. This system enabled the monitoring and evaluation of teachers' in-class activities, student achievements, teaching methods, and professional contributions. Performance evaluations are an important source of data on teachers' career progression (Çelikten & Özkan, 2018).

Conversely, requirements in most countries differ significantly depending on the industry, profession and, in some instances, region. In both the United States and Europe, career steps are implemented through a structured progression that begins with entry-level positions, allowing individuals to acquire the fundamental skills required for the role. Moreover,

Teachers develop their expertise through training and mentorship, with regular performance reviews guiding their progress. As they demonstrate capabilities, they can move up to mid-level and senior roles, often requiring ongoing education and certifications. Furthermore, career progression pathways for teachers exist in numerous countries. These pathways facilitate the advancement of teachers within the profession. Nevertheless, no single, universally applicable, standardized examination for career advancement has been proposed (Acarbaş & Gözler, 2023; Yücel, 2023).

Purpose of the Study

The purpose of this study is to evaluate teachers' opinions regarding policy, procedures, criteria, effects on teaching professional ethics, and suggestions regarding "The Career Step Exam" implemented by the Ministry of National Education in Türkiye. This research seeks to understand whether progression through the career step exams significantly contributes to professional development among educators. A comparative analysis between the career steps examinations of 2005 and 2022 is conducted to discern similarities and differences, shedding light on potential advancements and changes in evaluation methodologies over time. Additionally, the study explores the effects of implementing a structured teacher professional step on educators' overall professional growth. Furthermore, it delves into alternative approaches that could be considered for the teaching career stage, offering insights into potential enhancements or modifications to existing systems. Through these inquiries, this study aims to provide a comprehensive understanding of the role of career steps in teacher development. This research is considered important in observing comparative data in the literature and designing future studies. Therefore, the study seeks to answer the following research questions:

1. What are the teachers' opinions about the Career Steps and Examination?

2. What are the similarities and differences between the Career Steps Exam in 2005 and the Career Steps Exam in 2022?

3. What are the effects of establishing a professional teacher's role on the professional development of teachers?

4. What are the possible alternatives for the teaching Career Step?

METHOD

This section covers the nature of the study, data collection process, criteria setting process, validity and reliability of measurement findings concerning the coding form, and data analysis.

Study Design

In this study, we utilized a case study approach. A case study is a method that thoroughly explores a specific case, situation, or subject, usually within its real-life context. This

approach can target an individual, group, organization, event, or phenomenon and is frequently applied in fields like social sciences, business, education, and health (Baxter & Jack, 2015).

This study sought to conduct a situation analysis of the circumstances encountered by teachers following the administration of the Career Steps Examination. The objective was to solicit feedback from teachers to facilitate an evaluation of these circumstances (Downe-Wamboldt, 1992). Moreover, a phenomenological research method, which is frequently used in qualitative research, was implemented. Phenomenological research is a qualitative research method based on a philosophical approach called phenomenology. It is a philosophical and phenomenological approach to psychology that focuses on the subjective experiences of individuals or participants to understand how events or experiences (phenomena) are perceived, made sense of, and experienced (Dibley et al., 2020). Additionally, content analysis was used in the study for qualitative data. Content analysis is a research method used to systematically analyze and interpret the content of various forms of communication, such as written texts, audio recordings, videos, and images (Kleinheksel et al., 2020). The context is systematically analyzed by applying a coding scheme to identify and assign relevant codes to different parts of the content. Once the coding was complete, the researcher analyzed the coded data to identify patterns, frequencies, or relationships among categories (Downe-Wamboldt, 1992).

The triangulation strategy is widely used in social sciences as a way to strengthen reliability and validity. According to this strategy, four qualities are required to increase credibility: credibility, dependability, confirmability, and transferability (Carter et al., 2014). This requires the use of multiple data sources. These sources of data can be from different people, places, times, or methods (Breitmayer et al., 1993; Decrop, 1999; Heale & Forbes, 2013). Accordingly, the present study encompassed the perspectives of educators at diverse educational levels and institutions, including those engaged in kindergarten, primary, secondary, and high school settings.

For the reliability of the data obtained, one or more of the aforementioned qualities must be present (Fusch et al., 2018). To determine the reliability and authenticity of qualitative findings, four types of triangulations are used: Method diversity, diversity of sources, analyst diversity, and theory/perspective diversity' (Carter et al., 2014). In this study, method, source, and analyzer triangulations were used. To increase validity and reliability, the responses provided by the teachers were not modified, nor was the content altered. Furthermore, the information provided by the teachers was strictly confidential to maximize internal reliability. Descriptive techniques such as frequency and percentage were used to obtain personal information in the first part of the form.

Instruments

The questions on the semi-structured interview form were prepared based on other studies in the field. In this study, semi-structured interviews were conducted as a data collection technique. The semi-structured interview is frequently used in the phenomenological research model, which is a qualitative research method. The researcher guided the participants through the research questions while allowing them to freely express their thoughts and experiences (Kallio et al., 2016).

A total of 20 questions were formulated within the scope of the research project. The questions were revised following the recommendations of the expert reviewers, who included four Turkish teachers and two literature teachers, as well as two associate professors, concerning the items, semantic integrity, and grammar. Three questions were excluded on the grounds of their lack of relevance to the subject matter, while four questions were requested to be removed by the experts based on their ambiguity and lack of clarity. Subsequently, the interview questions were pre-applied to teachers at various levels as part of a pilot study that included the participation of 30 teachers. Semi-structured interview questions were prepared through Google Form at the beginning of the spring semester of the 2022-2023 academic year and transferred to electronic media. Semi-structured interview questions were also sent to educational institutions through the Gebze, Kocaeli Directorate of National Education. To obtain the opinions of kindergarten, primary, middle, and high school teachers currently employed in Gebze, the interview forms were distributed to these educators, either by instant text message or in person, with the latter approach being employed to facilitate more candid responses.

Participants

The study group comprises 85 teachers and administrators employed in public schools in the Gebze district of Kocaeli during the 2022-2023 academic year. The research population comprises teachers employed at educational institutions in Gebze, representing a diverse range of socioeconomic backgrounds, age groups, genders and grade levels. A sample size of 85 was identified as appropriate for the study within the population, according to the sample size (Başaran, 2024; Yazıcıoğlu & Erdoğan, 2004).

Participants who engaged in the research but did not undertake the examination or did not meet the prerequisites for doing so were also included. Furthermore, the participants provided feedback regarding their perceptions of the examination and prospective career progression within the subject matter domain. Table 1 presents the demographic information about the participants.

Table 1.
Demographic Characteristics of the Participants

Variables	Category	f	%
Institution Type	Preschool	4	4.7
	Primary School	26	30.6
	Secondary School	39	45.9
	High School	16	18.8
Gender	Female	35	41.2
	Male	50	58.8
Age	20-24	0	0
	25-30	5	5.9
	31-35	11	12.9
	36-40	15	17.6
	41 years and above	54	63.5
Career Status	Teacher	22	25.9
	Expert	46	54.1
	Headteacher	17	20
Degree of education	Bachelor	70	82.4
	Master	15	17.6
	Doctorate	0	0
Position	Principal	5	5.9
	Vice Principal	9	10.6
	Subject Teacher	44	51.8
	Classroom Teacher	19	22.4
	Preschool Teacher	4	4.7
	School Counselor	4	4.7
Total		*85*	*100*

The principle of confidentiality was respected throughout the research. The titles of the participants in the study were "T" for "Teacher", "U" for "Expert" and (H) for "Head Teacher". Abbreviations were used for Principal (P), Vice Principal (VP), "Subject" teacher (S), "Class" teacher (C), School Counselor (SC), and preschool teacher (PS). In addition, the letters (b) for "between" and (a) for "above" were used for age groups. In addition, (F) were used for female participants and (M) for male participants.

Ethical Consideration

Ethical Review Board: Rectorate of Eskisehir Osmangazi University Social Sciences and Humanities Human Research Ethics Committee

Date of Ethics Review Decision: 03.05.2023

Ethics Assessment Document Issue Number: 2023/07

FINDINGS

In this section, the findings obtained from the teachers' opinions are presented within the framework of the sub-objectives of the research.

Upon posing the question, "What is your opinion of the categorization of teaching roles into Teacher, Expert Teacher, and Head Teacher?" to the participants, the responses provided by the teaching professionals are presented in Table 2.

Table 2.

Teachers' Opinions on the Division of Careers into Teacher, Expert Teacher, and Headteacher

	Reference Codes	
	f	%
Theme/ Sub-theme	112	100
Injustice	8	7,14
Beneficial/Supportive	32	28,57
Unfavorable	53	47,32
Motivating	4	3,57
Discriminative	15	13,39

Considering Table 2, the teachers' opinions on the division of the teaching profession into teachers, expert teachers, and headteachers are categorized into five themes. These themes are *unfair, beneficial/supportive, unfavourable, motivating, and discriminatory*.

Some of the teacher's views on the division of teaching careers into teacher, expert teacher, and head teacher are as follows:

Teachers' opinions on the theme of "*Injustice*": *"It is not fair"* (F C41H), *It is unfair."* (MC36-40E), "*It is completely unfair*" (FCb3640E), *"It creates an unfair salary difference between teachers doing the same job*." (FS25-30T), "*It would be better if it were done to every teacher according to the year of profession, but reflecting salary differences is an unfair practice."* (MPa41E).

Teachers' opinions on the theme of "*Beneficial / Supportive*": *".... Teacher opinions on the theme of "Useful / Supportive": "It is a good thing"* (EVPa41E), *"It is an appropriate practice"* (MSa41E), *"It should be divided, teacher competence should be monitored."* (MPa41E), *"I support it, I find it positive."* (MCa41H) *"There should be a career step, but the method should be correct and well-planned"*, (MVPa41T), *"I find the distinction appropriate if there is high-level evaluation for teachers' subjects."* (FSb25-30T), "*As in every profession, there should be career steps in teaching. Every teacher should update themselves and should not stop working."* (FCa41H).

Teachers' opinions on the theme of "*Unfavorable*": "*I do not find it appropriate to use the title of Head Teacher other than Atatürk.*" (FSCb36-40E), *"It is an unnecessary chaos, career steps should not be determined by such a meaningless exam."* (FSb36-40E), "*The teaching profession is a professional group that requires expertise in the field of education. In my opinion, there is no need to divide it into career steps*." (FCa41E), *"…The head teacher issue is a scandal in itself. Such a title goes against my sacred values. In our profession, which has turned into an arena for political fulfilment, if someone with qualifications such as Head Teacher Atatürk is to be appointed, I am in favour of discussing it in the parliament, not through an exam or length of service, but depending on what it brings us in a vital situation"* (MSb25-30T).

Teachers' opinions on the theme of "*Motivating*": "*As the years of service increase, the teacher gains experience and makes a career.*" (MCa41E), *"It is encouraging for the teacher to improve himself/herself and contribute financially."* (MCb36-40E).

Teachers' opinions on the theme of "*Discriminative*": *"It is a very wrong practice. It has caused discrimination among teachers. A teacher's expertise cannot be measured by an exam."* (FSCb36-40E), *"I believe that it will discriminate against teachers in the eyes of parents and categorize them as qualified teachers and novice teachers."* (MVPa41E), *"There should be no discrimination."* (FSb31-35E), *"I find it wrong to discriminate against teachers."* (MSa41E), *"I do not find it appropriate to categorize teachers as it may lead to comparisons between teachers by parents."* (FPSb31-35T), *The discrimination is wrong. The teaching profession is a work of heart. You can study this knowledge and become an expert, but that is not the point. The important thing is to connect with the child and touch his/her soul."* (FSa41E), *"A teacher is an expert in their field." There is no need to discriminate."* (MVPb31-35T).

The views of the teachers who participated in the interview revealed that the majority of the teachers had negative views on the categorization of teachers as teacher, expert, and head teacher. They described this classification as unfair, discriminatory, wrong, and humiliating. Conversely, teachers advocate this categorization and find it beneficial.

Upon being asked, "What are your thoughts on organizing an examination for Career Steps Exams?" the teachers provided the following responses, which are presented in Table 3.

Table 3.
Teachers' Opinions on Conducting Exams for Career Steps

	Reference Codes	
	f	*%*
Theme/ Sub-theme	104	100
Redundant	65	62,49
Essential	15	14,42
Degrading	8	7,69
Inappropriate	9	8,65
Reliability and Credibility	7	6,73

Considering Table 3, the teachers' opinions on conducting an examination for the Career Step were categorized into five themes. These themes are *"Redundant", "Essential", "Degrading", "Inappropriate", "Reliability" and "Credibility."*

Some teachers' views on conducting an examination for the Teaching Career Step are as follows:

Teachers' opinions on the theme of *"Redundant"*. " An examination scores should not determine a teacher's career." *If it needs to be measured, there should be an in-class performance*

evaluation and a parent and student evaluation for teachers. One should not have a career by simply memorizing books." (FSCb36-40E): *"The teachers are already acquiring a professional career by passing so many exams. Which profession takes the examination after years? In addition, the exam does not include measurements of a career."* (FSa41E), *"Teachers are currently appointed with the civil service recruitment examination (KPSS) and start to work equipped with general culture and general competence. I do not find an exam right for a career. However, if one wishes, he/she can become an expert by taking a master's degree."* (FSCb36-40E): *"It is completely unnecessary, a time waster and an extravagance."* (FSb31-35T).

Teachers' opinions on the theme of "*Essential*": *"Examination keeps teachers informed about legislation, regulations, and so on." There should be an exam."* (FCa41H), *"The exam should be held every year."* (MSa41E), *"There must be an examination."* (FCa41E), *"The examination is positive,"* (MVPa41E), *"Positive"* (MPa41H), *"Very good."* (MSa41E), *"It is positive."* (MSa41H), *"Positive."* (FCa41H).

Teachers' opinions on the theme of "*Degrading*": *"It is a practice that offends the teacher."* (MVP. a41E), *"If a teacher who has been practising his/her profession for many years fails in the exam, it will reflect negatively on the teacher's career in front of the society, such as "Successful Teacher "Failed Teacher".* (MVPa41E), *"Humiliating"* (MSa41T), *"It's stupidly humiliating."* (MSa41T), *It devalues teachers."* (MSa41T).

Teachers' opinions on the theme of "*Appropriate*": *"If it needs to be measured, there should be an in-class performance evaluation and parent and student evaluation for teachers. One should not have a career by simply memorizing books."* (FSCb36-40E), *"Each teacher must take the exam in his/her subject."* (MSa41E)," *The questions must be from our subject area"* (FSa41E), *"Written exam is not a suitable test type for the career step exams."* (FSb 36-40E), *"It may be more accurate to look at the competence with a different evaluation system."* (FPSb31-35T), *"It should be fifty per the cent exams and fifty per the cent self-improvement."* (MCa41H).

Teachers' opinions on the theme of "*Reliability and Credibility*": *"Such a practice is used because of the lack of trust in teachers and in favour of forcing them."* (FSb25-30T), *"The examination is unnecessary in this form."* (FSa41E), *The process should be evaluated. In other words, the activities could have been evaluated impartially."* (FCa41T), *"The poor quality and simple preparation of the questions has made the teaching profession ordinary."* (FCa41E), *"The test may be appropriate if there is a measurement with high reliability and validity."* (FSb25-30T), *"I am sceptical that an easy exam will determine career progression."* (FSb31-35T), *"For the sake of appearance",* (MSb25-30T), *"The last exam does not have any reliability and enslaves teachers only to the exam system. The exams conducted as an output are useless even as a procedure."* (FCb31-35T).

Considering the teachers' opinions on the examination for the Teaching Career Step, it can be seen that teachers evaluate the exam in different ways. Some teachers stated that the examination humiliates them. In addition, it can be seen that the exam does not have

sufficient criteria in terms of evaluating the professional competence of teachers and the reliability of the exam is not sufficient.

When asked, "What are your thoughts regarding the entry requirements for the current Career Steps Exams?" Teachers' responses regarding various factors, such as seniority, educational qualifications, and in-service training, are presented in detail in Table 4.

Table 4.
Teachers' Opinions on the Entrance Requirements for the Current Career Step Exams

	Reference Codes	
	f	%
Theme/ Sub-theme	101	100
Length of Teaching	25	24,75
Seniority	12	11,88
Fairness	9	8,91
Examination	12	11,88
Revision	43	42,57

The teachers' answers about the entrance requirements for the current Career Step exams were generally categorized under five themes. These themes are *"Length of Teaching"*, *"Seniority"*, *"Fairness"*, *"Eligibility"*," Revision" and "Examination".*

Teachers' views on the entrance requirements for the current teaching career step examination are as follows:

Teachers' opinions on the theme of "*Length of Teaching*": "*Years cannot judge a teacher's career.*" (FSC b 36-40E), "*10 years is a very long time to stay an expert.*" (FSa41E), "*The length of the seniority year should be kept shorter*" (FCa41E), "*10 years for being an expert teaching is reasonable, but waiting for another 10 years after being an expert to become a headteacher is too long. It should be shortened*" (MPa41E), "*The length of service is meaningless to measure the academic level.*" (MSb25-30T), "*A 10-year experience is unnecessary. Teachers should be able to progress not with the years they work but with the training they receive and their self-development.*" (FSb31-35T), "*I do not find the 10-year term of seniority application correct, but it can be considered according to the educational conditions.*" (FSb31-35T), "*The number of years of seniority may be less. It is also a long time to wait to become a head teacher.*" (MCb36-40E) Moreover, "*10 years is a long time for an exam.*" (MCa41E).

Teachers' opinions on the theme of "*Seniority*": "*10 years of seniority can be in terms of setting a criterion. In-service training is necessary for teachers to improve themselves and update their knowledge. But these may not be a condition for the exam, but may be necessary for a career step.*" (MVPa41E) remarked, "*It should have been seniority-based.*" (MSa41T), "*An additional 10 years of service may be sufficient. To become a headteacher, it should be enough to work for 20 years.*" (MSa41E), "*5 years is enough for the expertise and 10 years is enough for the head teacher.*" (MPa41E), "*Teachers over 10 years should be experts without examination and teachers over 15 years should be head teachers.*" (MSa41E).

Teachers' opinions on the theme of "*Fairness*": "*A teacher who has become an expert has to wait for 10 years to become a head teacher but meanwhile s/he could get her/his retirement.*" (FSCb36-40E), "*The conditions are tough*" (MVPa41E), "*Everyone should have equal conditions.*" (FSb36-40E), "*I don't find the 10-year requirement fair.*" (FSCb36-40E), *It is a serious injustice for teachers with less than 10 years of experience. It is also a serious problem that some are exempted from exams just because they did a master's degree by paying money.*" (FSb25-30T), "*It's unfair.*" (FSb36-40, E), "*The biggest deficiency is that paid teaching and unpaid leave are not included in this process.*" (MCb36-40E), "It is not fair" (MCa41H).

Teachers' opinions on the theme of "*Exam*": "Exams are unnecessary." (MVPa41E), "Everyone must take the test, no exceptions." (MSa41H), "*It would be better if there is no exam or no year requirement.*" (MPa41H), "*Requirements for taking the exam are sufficient.*" (FPSb31-35T): "*There must be certain conditions without an exam.*" (FSb25-30T): "*These conditions should be for career steps, not for examination.*" In other words, those who meet these conditions should be experts without an exam.", (FCa41E), "*I find the time reasonable. But I don't find the exam reasonable.*" (FSCb31-35T).

Teachers' opinions on the theme of "*Revision*": "*There should be in-service training followed by an exam.*" (MVPa41E), "*Seniority must be a maximum of 5 years*" (MSa41H), "*The exam should be held every year*", (MSa41E), "*It should be improved.*" (FSa41E), "*There must be criteria, but existing criteria should be revised.*" (MCa41H), "*The seniority year should be kept shorter, but in-service training is a must*" (FCa41E), "*If there is to be such a system. The length of time can be reasonable.*" (MPa41H) remarked, "*The biggest problem is seniority. Other than that, the conditions meaningful in terms of the teacher's self-development and training.*" (FSa41E), "*The criteria are considered inappropriately.*" (MPSb36-40E), "*All conditions are incomplete or incorrect. It must be re-planned.*" (MVPa41E), "*It should not be a condition, it should depend on situations such as a master's degree etc.*" (MCb36-40E), "*There must be certain conditions without an exam.*" (FCb25-30T), "*Teaching is learnt in the field, seniority is reasonable, but it could be based on the quality rather than the number of training received.*" (FCa41E): "*These conditions should be for career steps, not for examination.*" In other words, those who meet these criteria should be experts without an exam." (FCa41E), "*There are conditions that have been considered.*" I would like these conditions more if they recognized other privileges even if they did not provide financial benefits (degree, rank, service points ...*" (MSb25-30T), "*Of course, years of service is important, but incentives should also be given to teachers who are committed to development and change.*" (FCb31-35E), *The exam should be linked to objective criteria, for example, teachers who have completed every 10 years should become experts.*" (FPSb31-35T).

When the opinions of the teachers about the entrance conditions for the Teacher Career Steps Examination are taken into consideration, it can be seen that teachers generally find the length of the examination entrance period long. In addition, the teachers emphasized that the seniority requirement would be more reasonable than the examination requirement and that the entrance requirements for the examination should be improved.

When the participants were asked the question 'What do you think about the question distribution and content of the Career Step Exams?', the answers given by the teachers are given in Table 5.

Table 5.
Teachers' Opinions on the Question Distribution and Subject Content of the Career Step Exams

	Reference Codes	
	f	%
Theme/ Sub-theme	88	100
Relevant	30	34,09
Simplicity	22	24,99
Humiliation	6	6,81
Improvement	12	13,63
Appropriateness	20	22,72

The teachers' answers regarding the question distribution and content of the teaching career step examination were generally categorized under five themes. These themes are *"Relevant"*, *"Simplicity"*, *"Humiliation"*, *"Improvement"* and *"Appropriateness"*.

Some teachers' views on the question distribution and content of the teaching career step examinations are as follows:

Teachers' opinions on the theme of "*Relevant*": "*The questions were not related to the teaching profession.*" (MVPa41E), "*There were subjects that were not very related to the teaching profession*" (FSCb36-40E), "*Not relevant to my field*" (MSa41T), "*The topics are not relevant.*" (MSa41E), "*The questions were irrelevant for teaching.*" (MPSb36-40E), "*Out of field questions are unnecessary*" (FSa41E), "*The questions are not designed to determine a teacher's career.*" (MSa41H), "*It had very little to do with education.*" (FSb35-30T): "*The content was not right.*" *There were too many details. Even the lecturers read from the slide…* "(MSa41H), "*I don't know because I didn't take the exam, but I concluded that it was irrelevant according to the comments of the friends who took it.*" (FSa41E). *There are many irrelevant questions.*" (MCa41H), "*Some topics have nothing to do with the teaching profession.*" (MSa41E), "*There are content and topics that will not contribute to my field.*" (MCb36-40E).

Teachers' opinions on the theme of "*Simplicity*": "*The questions were very, very simple*" (FSCb36-40E), " *It's very simple*" (MVPa41E), "*The questions were quite simple.*" (MSa41E): "*The exam was easy. We were unnecessarily stressed.*" (MSa41E), "*Easy.*" (MSa41E), "*Very Simple*" (FSa41T), "*They were very simple and unnecessary questions.*" (F S. b25-30T), "*Prepared without level.*" (FCa41E), "*The exam is too simple*" (MCb36-40, E), "*It was very simple. You can't specialize in these questions.*" (MSb36-40E): "*Its measurement and discrimination are zero. In other words, a level should be given according to the score. Passing or failing is a very simple matter.*" (MSb25-30T), "*The questions do not serve the purpose of the exam and it is unfair to the teachers who spend their time and energy working for weeks for this.*" (FSb25-30T), "*The questions were rather easy*" (MCa41H), "*The first exam was very good, the last one was not selective and not developmental.*" (MCa41H).

Teachers' opinions on the theme of "*Humiliation*": "*Very offensive*" (MVPa41E), "*Asking these questions to teachers for a career step reduces the value and importance of the profession.*" (MVPa41E), "*It was like a mockery.*" (FSb25-30T), "*It's unbelievably ridiculous*" (FSb.36-40E), "However, the Ministry of National Education is implementing the exam to increase the salaries of all teachers." (FCa41H), "*Questions to determine whether you have dementia or not.*" (FCa41T), "*It is inconsistent and devalues the teaching profession.*" (FSb31-40T).

Teachers' opinions on the theme of "*Improvement*": "*Question distribution should be from general culture and field.*" (MSa41E), "*Activities should also be added*" (MSa41H), "*Fifty per cent should be subject area and fifty per cent should be educational discipline.*" (MSa41E), "*The questions other than the subject area are unnecessary.*" (FSa41E), "*Some subjects need to be changed.*" (MCa41H), "*It is necessary to prepare questions according to the subject area*" (MSa41E), "*The subjects should be more practical. There should be information to be applied in the classroom. Theoretical details are of no use.*" (MSa41H), "*There may be an exam according to the subject area.*" (MPSa41E), "*If there is to be an exam, there should be the following: Turkish, education, subject, and general culture.*" (The teacher should follow newspapers, magazines and read books every day)." (MSb36-40T): "*There should be no subject area questions*" (MPa41H).

Teachers' opinions on the theme of "*Appropriateness*": "*It's not bad.*" (MVPa41E) and "*It's okay.*" (MSa41E), "*Unfavorable*" (MSa41E), "*Good*" (MSa41E) "*The content is very detailed. Theoretically, the content is good, but I wonder if an educator can apply it in terms of practice.* (FSCb36-40E), "*Quite adequate*" (MSa41E), "*The content was not very appropriate.*" (MPa41E), "*An instructive exam*" (MSa41E), *The questions are clear and understandable. It is suitable in terms of content, as it addresses a wide audience.*" (FPSb31-36T) stated, "*Teaching is not only a profession of knowledge but also a skill. It is impossible to determine the career steps of teachers with an exam that does not even measure this knowledge.*" (MVPa41E) Moreover, "*There was no problem in the content and distribution.*" (FCa41E): "*Although some of my colleagues do not like it, it is useful for me in some subjects. While studying for the exam, I had an idea about many subjects that I did not know. In short, this exam has added a lot to me. I went back to my student days again.*" (FSa41E), "*The questions and content are insufficient.*" (MPa41E), "*Question distribution and content appear to be a formality.*" (FSCb31-35T), "*It's a made-up test.*" (MS36-40E): "*The exam was unnecessary, but the question distribution was good.*" (MPa41E), "*It's a generalized one.*" (MSb25-30T).

When the opinions of the teachers about the distribution and content of the career steps exam are reviewed, it is seen that the teachers considered the exam to be too simple. It is also stated that the content of the current examination does not include questions suitable for the teaching profession. In addition, it is expressed that the exam should be improved, and an application should be chosen for practice rather than theory.

When the participants were asked the question 'How do you evaluate the exemption from the Career Step Exams as a result of Master's Degree education?', the answers given by the teachers are given in Table 6.

Table 6.
Teachers' Opinions on Exemption from the Career Steps Exam through Master's Degree Education.

	Reference Codes	
	f	*%*
Theme/ Sub-theme	92	100
Motivating	8	8,69
Relevance	12	13,04
Fairness	19	20,65
Supportive	53	57,60

The teachers' opinions on being exempted from the career steps exams through master's degree education were generally categorized under four themes. These themes are *"Motivating", " Relevance", "Fairness" and "Supportive."*

Some teachers' views on exempting themselves from the career step examination through master's degree education are as follows:

Teachers' opinions on the theme of *"Motivating"*: *"It is considered as a reward."* (FSCb35-40E): *"I see it as positive in terms of encouraging teachers to postgraduate education. However, I believe that it will turn into a profit gate for universities and will lower the importance of postgraduate education."* (MVPa41E), *"It is positive in terms of encouraging postgraduate studies."* (MCa41H), *"It is positive in terms of encouragement."* (MVPa41T), *"It encourages teachers to do a master's degree, which is a step toward improving the quality of education."* (FSa41E), *"Although it is positive in terms of encouraging teachers to pursue a Master's degree, I do not think it is a valid scale."* (FSb25-30T), *"Although it is an encouraging decision for me in today's world where a bachelor's degree is equivalent to a high school diploma, I cannot ignore that it creates a new income gate for private and public universities."* (MSb25-30T): *"It enables teachers to improve themselves instead of taking exams. At least it has opened a door for those who want to improve themselves academically."* (FSb31-35T).

Teachers' opinions on the theme of *"Relevance"*: *"Master's degree has no connection with teaching"* (MSa41T), *"The two are different."* (FSa41E), *"It should be for the teaching profession"* (MSa41E), *"I do not find it right because of the postgraduate education in unrelated fields."* (MCa41H), *"If the master's degree is done properly, why not?"* (FCa41T), *"Master's degree must be with thesis and must be in the field of education"* (MPa41E), *"The master's degree has nothing to do with it."* (MSa41.30-40. E), *"I find it right that teachers who have a master's degree in their field should be exempted from the exam"* (FPS.31-35T), *"Each subject teacher should be exempted if they have a master's degree in their field.",* (MC36-40E).

Teachers' opinions on the theme of *"Fairness"*: *"Negative, most people did a master's degree in three months"* (MVPa41E) *"The two are different, most people paid the money and did a master's degree."* (MSa41E), *"Non-thesis master's degrees must take the exam"* (MSa41E) *"It led to a paid master's degree. It needs to be taken more seriously."* (MSa41E), *"Unfair"* (MSa41E), *"It's a great injustice."* (FSb25-30T): *"It is unfair. They already take the advantages and privileges of this in the additional course fee."* (FSb36-40E), *"Not right. Not at all. It should be for the teaching*

profession.″(MSa41H), *"It′s not fair"* (FSb25-30T), *"It is unfavourable, it is unfair for those who do not have the opportunity."* (FCa41H), *"If we had known about it before, we would have done it. Being an expert didn't change anything."* (FSCa41E), *"This is also not a very fair practice"* (FSb25-30T), "Master's degrees without a thesis were also accepted. They paid the money and became experts in a way." (FSb31-35E), *"There should be no exemption in career steps."* (MCa41.H), *"The degree holders have worked for themselves. Those who work for their students should be given priority. I find it wrong"* (MPa41H), *"Unlawful"* (MCa41T).

Teachers' opinions on the theme of *"Supportive"*: *"Appropriate"* (MVPa41E): *"A master′s degree in a field related to education may be considered."* (FSCb35-40E), *"An appropriate application"* (MSa41E) *"it is suitable."* (FSa41T), *"It′s good"* (MSa41T), *"It′s normal"* (MVPa41.H), *"The career steps exam is not right, but a master′s degree should be an option for teachers who want to make a career."* (MSCb36-40E), *"They should be exempted"* (MSa41E), *"Master′s degree with thesis should be exempt. Non-thesis master′s degrees should take the exam."* (MSa41E), *"That′s right"* (MPSb36-40E), *"This opportunity should be offered to every teacher with or without an exam. It is a serious education with its own rules and should be compulsory and free of charge for every teacher who has completed a certain number of years."* (MVPa41E), *"It is usual."* (FSb31-35E), *"A teacher who has completed his/her master′s degree should of course be exempted."* (FCa41H), *"It can be. There is also a serious effort in the master′s degree."* (MSa41E): *"It makes sense, it is fair for those who have a master′s degree."* (FSa41E), *"It makes sense if it is related to their field and subject."* (MSCa41E), *"It is appropriate."* (FSa41E), *"It was the right decision"* (FPSb25-30T), *"If there is necessarily a career step, it is a positive condition for those who have a master′s degree to be exempted."* (FCa41E).

Considering the opinions of teachers regarding the exemption of Master's Degree holders from the Teaching Career Examination, it is seen that the majority of teachers support this practice. On the other hand, it is emphasized that only those who have a master's degree and thesis in the field of education or their field should be exempted from the examination. However, some teachers have expressed that this has caused an injustice.

When the participants were asked the question 'How do you evaluate the Career Step exams in terms of the prestige and reputation of the teaching profession?', the answers given by the teachers are given in Table 7.

Table 7.
Teachers' Views on Career Steps Exam in Terms of the Prestige and Reputation of the Teaching Profession

	Reference Codes	
	f	%
Theme/ Sub-theme	86	100
Discriminative	12	13,95
Supportive	20	23,25
Ineffective	24	27,90
Disrespectful	30	34,88

The teachers' opinions on their career step exams in terms of the prestige and reputation of the teaching profession were generally categorized under four themes. These themes are *"Discriminative", " Supportive", "Ineffective" and "Disrespectful."*

Some teachers' views on the career step exams in terms of the prestige and reputation of the teaching profession are as follows:

Teachers' opinions on the theme of *"Discriminative"*: *"In the view of parents and students, expert teacher and head teacher discrimination have emerged."* (FSCb35-40E), *"Teachers may undertake a career step after a certain number of years in the profession (eg. 5 years, 8 years, and 10 years). However, discriminating this with an examination will not contribute to the prestige of the teaching profession as a "Good Teacher", or "Successful Teacher."* (MVPa41E), *"It is discrimination."* (FSb36-40T), *"Divide, part, discriminate."* (MSa41T), *"A practice that discriminates against teachers"* (MPSb36-40E), *"Parents discriminate between teachers. Such as this one is an expert, and that one is the head teacher."* (FSb31-40T)

Teachers' opinions on the theme of *"Supportive"*: *"It has a positive effect."* (MVPa41E), *"Positive",* (MVPa41E), *"Sufficient"* (MSa41H), *"Positive."* (MVPa41H), *"It is favourable"* (MSa41E), *"I feel very good as an expert."* (FSa41E), *"It certainly gives teachers prestige."* (FSa41E), *"It's very good"* (FCa41E), *"If it separates successful teachers, that's good."* (MCb35-40E), *"It is appropriate"* (MPa41E), *"It contributes positively to the prestige of the teacher."* (FSCb31-35T), *"It will be beneficial."* (MSa41E), *"A teacher is a teacher. S/He should always be respected and honoured."* (MCa41H).

Teachers' opinions on the topic of *"Ineffective"*: *"Since it was reflected the society as a salary difference, it had no effect."* (MVPa41E) remarked, *"It has nothing to do with dignity."* (MSa41E), *"It has no effect."* (MSa41E): *"There was no change."* (MSa41E), *"It has much of an effect."* (FSa41E), *"The first factor that determines prestige in society is material status, not career steps."* (MCa41H), *"It's no contribution."* (MSa41H), *"The prestige of the teaching profession does not come from the career steps, but from the teacher's self-education and respect for his/her profession."* (FCa41H), *"It does not affect reputation and dignity."* (MSa41. E), *"it does not contribute much."* (MSCa41E), *"The teaching profession is currently a profession with very little respect in society, so any career exam will help to gain or lose prestige to the profession."* (FSCb35-40E), *"It is disrespectful."* (MVPb31-35T).

Teachers' opinions on the theme of *"Disrespectful"*: *"This exam has lowered the prestige of teaching."* (FSCb35-40), *"An offensive practice in public"* (MSa41E), *"The dignity of the profession has already been abolished and this has been added on top of that."* (FSa41E), *"Since the first day of my professional life, I have tried to live the word "teacher" to the fullest. The exam made me anxious."* (MVPa41E), *"It's discrediting."* (MSa41T), *"It has further destroyed the already dwindling prestige of teaching."* (FSb25-30T), *"It completely damages the reputation of the teacher."* (MSa41E) remarked, *"I felt like an idiot when I took the exam. The fact that they supposedly tested me with such simple questions ended the dignity of the profession."* (FSb36-40E): *"Our reputation was ruined*

in the last examination." Either it shouldn't have been done, or it should have been more serious." (MVPa41H), stating, *"The question distribution and content of the exam was quite inadequate and discrediting."* (FSa41E), *"It will negatively affect the prestige and reputation of the teaching profession."* (FPSb31-35T), *"Humiliating, offensive."* (MCa41H), *"The fact that the career steps are examined has damaged the reputation."* (MSb36-40E): *"Teachers are already devalued. In this way, they are further lowering our dignity."* (MSb36-40E), *"We become a subject of gossip."* (MSb25-30T).

When the participants were asked the question 'How do you evaluate the current Career Step exams in terms of teaching ethical principles (Professionalism, Equality, Solidarity, Justice, etc.)? The answers given by the teachers are given in Table 8.

Table 8.

Teachers' Evaluations of the Current Career Step Exam in Terms of Ethical Principles of Teaching

	Reference Codes	
	f	*%*
Theme/ Sub-theme	74	100
Solidarity	7	9,45
Professionalism	12	16,21
Equality	20	27,02
Justice	35	47,29

The teachers' answers to the evaluation of the current career step exams in terms of ethical principles of teaching were generally categorized under four themes. These themes are *"Solidarity", " Professionalism", "Equity" and "Justice."*

Some teachers' views on the evaluation of the current career step exams in terms of ethical principles of teaching are as follows:

Teachers' opinions on the theme of *"Solidarity"*: *"Dissociative"* (MVPa41E): *"It can be difficult at school."* (MSa41E), *"Discriminator"* (MPSb36-40E). *It causes hierarchy and grouping among teachers and damages professional solidarity"* (FPSb31-35T), *"It increases discrimination."* (MSb31-35T).

Teachers' opinions on the theme of *"Professionalism"*: *"It's professional and equal and fair."* (FSa41E), *"I find it unprofessional and unfair."* (FSCb31-35E), *"Professionalism"* (MSa41E), *"In a professional manner"* (MSa41E), *"Professionalization"* (FCa41H), *"It can be considered positive for professionalism."* (FCa41H), *"Professionalism and fairness must be ensured."* (MPa41E), who stated, *"The current way of awarding titles is unprofessional."* (FSCb31-35T): *"It may be professional, but it has shortcomings and many items that need to be completed."* (FSb31-35T), *"If we see it as a professional stepping stone, how right is it to provide such financial gains in an economic system?" In other words, even if only the titles in question were taken, how many teachers would receive that training?"* (MSb25-30T) said, *"It has ceased to be a process of justice, solidarity, learning organization, or professional development. On the contrary, it is purely purposive; it does not benefit the teacher or the student."* (FSb31-35T), *"It should be more professional."* (MCa41H).

Teachers' opinions on the theme of "*Equity*": "*As a teacher working in 3/6, I am in favour of hiring new teachers who are dealing with the absurdity of candidacy, who are subjected to all kinds of mobbing, who are ignored, and feel valued.*" If we all work in the same state, I would like the same hand to pat our heads. It does not provide equality and justice.*" (MSb25-30T), "*The current Teaching Career Step is perceived only as a difference in salary. They are perceived as underpaid teachers and overpaid teachers.*" (MVPa41E) "*There was no equality, unfortunately.*" (FSb36-40E): "*There is never equal work; there are equal working hours. Every teacher's work is different.*" (MCa41H) said, "*It is against equality and justice.*" (FSb25-30T), "*Equality can be achieved if everyone can take the exam every year.*" (MSa41E), "*It is not by ethical principles*" (FPSb31-35T), "*It is against the principle of equality.*" (MCa41H), "*The labour given in the classroom is the same or even more; but the difference in wages may create a lack of motivation in our young teachers.*" (FCa41E).

Teachers' opinions on the theme of "*Justice*": "*The restriction of teacher career to salary has led to injustice among teachers.*" (MVPa41E), "*Unjust, shameful, humiliating and degrading.*" (MSa41T), "*It's unfair*" (FSa41E), "*It is unfair*" (MSCb36-40E), "*There must be teachers who get sick on the day of the exam and cannot take the exam. It is an exam that cannot be completed. It is an examination held in a limited time interval.*" (MVPa41E) remarked, "*Equality, justice is very debatable. The material conditions in Istanbul and the security conditions of a teacher in Hakkâri are not the same. The fact that vocational teachers and classroom teachers are subjected to the same exam is also debatable.*" (MCa41T), "*How does one explain the fact that one could have been an expert ten years ago, but cannot become a headteacher until ten years later?*' (FCa41E), "*I do not find it fair and equal to do the same job and receive different titles and salaries.*" (FCa41E), "*Although there is the perception of the same salary for the same job, it is necessary to take into account the experience of those who have reached a certain seniority and give them their right.*" (MCb36-40E), "*It must be right for the career but also should be fair*" (FCa41H).

When views on the evaluation of the current career step exams in terms of teaching ethical principles are reviewed, it is seen that teachers did not find an exam related to professionalism. They also stated that it is inadequate in terms of equality and justice. In addition, it creates discrimination among teachers.

When the participants were asked the question "Can you explain the contributions of the Career Steps Exam to the teaching profession?" the answers given by the teachers are given in Table 9.

Table 9.

Teachers' Opinions on the Contributions of the Career Steps Exam to the Teaching Profession

	Reference Codes	
	f	%
Theme/ Sub-theme	86	100
Financial benefits	17	19,76
Development	17	19,76
Ineffective	52	60,46

The answers given by teachers' opinions on the contributions of the teaching career step examination to the teaching profession were generally categorized under three themes. These themes are "*Financial*", "*Development*" and "*Ineffective.*"

Some teachers' views on the contributions of the examination of teaching career step examination to the teaching profession are as follows:

Teachers' opinions on the theme of "*Financial*": "*Salary increase*" (MSa41E), "*Only economic*" (FSb35-40T). "*It has no contribution other than the salary. Because my general observation is that many teachers took the exam for an extra payment.*" (FSCb36-40H), "*It has made some economic contribution.*" (MPa41E), "*It does not contribute to the teaching apart from financial income.*" (MSa41H), "*It is just a little salary increase*" (MSa41T), "*It contributed financially.*" (MSa41E), "*Economically, it contributes well.*" (MSa41E): "*It does not contribute much, except for the salary difference* (MVPa41H).

Teachers' opinions on the theme of "*Development*": "*It's an opportunity for self-updating.*", (MVPa41E), "*Teachers revise and update their knowledge through the exam.*" (MSa41H), "*The information is being updated.*" (MVPa41H), "*It has contributed to some extent in terms of professional development.*" (MPa41E), "*We can understand that the subjects given before the exam have been read and learned by the exam results. The topics should consist of subjects that will take the teacher to the next level.*" (MSa41H), "*Every interaction has a contribution. In a short period of one year, I have repeated the gains we made while starting the profession, especially with the master's degree and training CDs. It was the information that we were already familiar with and provided our living. We have sealed our competence with the exam.*" (MVPa41E), "*Teachers should be aware of the fact that they have to constantly renew themselves on the subjects such as laws, regulations, legislation, etc. during the preparation phase and that they should embrace the profession wholeheartedly.*" (FCa41H), "*Self-development in education and training.*" (MSa41E).

Teachers' opinions on the theme of "Ineffective": It does not contribute. You cannot have a career by memorizing books and questions." (FSCb35-40E), "The career step exams have not contributed to the teaching profession." (MVPa41E), "I did not contribute much." (MSa41E), "It contributes nothing" (MSa41E), "I didn't see any effect." (MSa41E), "No contribution so far" (MSa41E), "No contribution to the teaching profession" (MPSa41E), "Nothing has changed except the title." (FSb35-40E), "It does not contribute much." (MVPa41H), "It has not contributed at all and it has caused a lot of negative damage." (MVPa41T), "It did not contribute anything, it did not have a pushing effect, and it offended teachers to enter for financial gain." (FCa41T), "It does not have any contribution. Of course, there should be self-development seminars and training, but the main purpose should not be a career step." (MCa41E).

Based on the opinions of the teachers, they stated that the career-step exam does not bring any benefit to the teaching profession. On the other hand, they argue that there is not much

positive aspect except that it only contributes to salary. However, some teachers stated that this situation provides them with the opportunity to improve themselves.

When the teachers were asked 'How do you evaluate the benefits of the Career Steps Exam for teachers (Salary, Promotion, Seniority, Reputation, etc.), the answers given by the teachers are given in Table 10.

Table 10.

Teachers' Evaluation of Benefits of the Career Steps Exams for Teachers

	Reference Codes	
	f	*%*
Theme/ Sub-theme	84	100
Financial	60	71,42
Seniority	15	17,85
Reputation	9	10,71

Teachers' evaluations of the benefits of the Career Step Exams were generally categorized under three themes. These themes are *"Financial"*, *"Seniority"* and *"Reputation."*

Some teachers' views on the contributions of the examination of teaching career step examination to the teaching profession are as follows:

Teachers' opinions on the theme of "*Financial*": "It has *brought benefits in terms of salary and seniority, but in this case, it has caused negative situations for our colleagues. For example, while one of our colleagues receives 10,000 lira, another colleague receives 25,000 lira, what is ethical about this?"* (FSCb35-40E), "*The teacher career steps exam has resulted in a significant difference in terms of salary. But I do not believe that this is fair."* (MVPa41E) remarked, "*Salary increase is good, but there should be an increase for everyone."* (FSb36-40T) said, "*It's a small amount of money, but it took more than that."* (MSa41T): "*The benefit is only material and there is no moral benefit."* (FSa41E), "*I do not think that there is a benefit other than a small amount of payment reflected in the salary."* (FSCb36-40E), "*In this way, they have already given the raise that should have been given."* (FSb36-40E), "*A payment that is reflected in your salary as long as you work."* (MCa41H), "*There has been only a salary increase, but in other areas, it has created negative effects for the teaching profession."* (MVPa41T), "*In these economic conditions, it is good to have an extra contribution to salaries."* (FCa41E), "*Salary return is good. But isn't it a disappointment for colleagues who can't take it? Do the same job but get paid differently!"* (SCa41E).

Teachers' opinions on the theme of "*Seniority*": "*Seniority promotion is meaningless for those in degree 1, and unfair for doctorates and masters."* (MVPa41E), "*It has been beneficial in terms of seniority"* (FSCb35-40E), and "*I consider "one degree" as promotion seniority to be unfair compared to teachers with a master's degree. It would be fair to have "one step". I also consider it unfair that it does not have any effect on a 20-year teacher with a degree of "1/4."* (MVPa41E), who stated, "*There is no contribution other than seniority and salary."* (FSa41E), "*The salary could be a little higher,*

but the seniority is good." (FSa41E), "It is unfair to a teacher with less than 10 years of seniority. I don't think it is fair that both teachers perform the same job, and even the less experienced teacher works more, but they have the right to be experts due to seniority." (FSb36-40T).

Teachers' opinions on the theme of "*Reputation*": *I don't think it has much effect in terms of reputation" (MPa41E), "It's a good feeling to have the teacher taken care of. The happiness of winning is also very honourable." (MPa41E), "Reputation" (MSa41E), "It's discriminatory."* Reputation should not be performed in this manner. It should be holistic and inclusive." (MCa41H), *"Its benefits in terms of salary, seniority and transition to a green passport are enormous." (FSC31-35E), "I find it interesting at the moment. I congratulate my experts and head teachers. I am sincerely happy for them. I hope one day it will be ours too." (MSb25-30T).*

Evaluating the benefits of the Career Steps Exam, teachers generally noted that it leads to an increase in salary and a higher degree of seniority. On the other hand, some teachers expressed that the benefit of this examination is a change of title.

What are your thoughts about teachers' postgraduate education in any field other than Educational Sciences or their subject to be exempted from the Career Steps Exams?" the answers given by the teachers are given in Table 11.

Table 11.

Teachers' Opinions on Having a Postgraduate Education in any Field Other than Educational Sciences and Their Exemption from the Career Steps Exams

	Reference Codes	
	f	*%*
Theme/ Sub-theme	78	100
Supportive	32	41,02
Opposed	46	58,97

Teachers' opinions about having a postgraduate education in any field other than Educational Sciences/their field to be exempted from the Career Steps Exams are categorized under two themes. These themes are "Supportive" and "Opposed."

Teachers' opinions on the theme of "*Supportive*": "*Teachers should have postgraduate education." (MSa41E), "I agree." (MPa41E), "I find it good." (FSb31-35E), "After all, it's a serious labour. It is appropriate" (MSa41E), "It doesn't necessarily have to be our field." (FSa41E), "It makes sense." (MSCa41E), "I consider it as the best of the bad in such a problematic application." (MVPa41T), "Of course, I am in favour of exempting those who have a master's degree in their field or educational sciences from the career steps. After all, this will contribute to the self-improvement of the teacher." (FSa41E), "Why not, diversity is richness." (FCa41T), "If s/he became a teacher and made it, that's fine." (FSb36-40E): "I find it useful in terms of encouraging teachers to improve themselves." (FSCb31-35T), "Continued academic progress supports the teacher to be a dynamic individual who is open to learning." (FSb25-30T).*

Teachers' opinions on the theme of "*Opposed*": "*Teachers must have postgraduate education only in "Educational Sciences and their fields" to be exempted from the Career Step Exams."* (MVPa41E), "*There is no benefit of postgraduate education outside the field of educational sciences and their field. Therefore, it should not be accepted."* (MSa41H), "*I do not find it right, it is important what a master's degree aims to serve."* (FSCb36-40E), "*I am against any subject other than a subject related to the teaching profession.* (MPSb36-40E), "*What's the relevance?' I mean, this shows how education hangs by the eyelids."* (Fb35-40E), "*It is an application that has no benefit other than increasing the number of paid and non-thesis master's degrees among teachers; everyone does it just to be done. I do not think there is any academic or professional contribution."* (FSb25-30T), "*Even the question of accepting a master's degree from a field other than one's own is funny. Does out-of-field support for expertise in your field make sense?"* (FSb31-35E), "*Expertise means having more knowledge about your field, so I do not find it right to be exempted from postgraduate education in a different field."* (FPSb31-35T).

When the opinions of the teachers are analyzed, it is seen that they are against exempting teachers who have a master's degree out of the field or out of educational sciences from the exam. In contrast, they support this practice because a master's degree is designed to enhance the skills of those entering teaching.

When the participants were asked the question "What are the positive/negative aspects of the Career Steps Exams?" the answers given by the teachers are given in Table 12.

Table 12.

Teachers' Opinions on the Positive and Negative Aspects of the Career Step Exams

	Reference Codes	
	f	%
Theme/ Sub-theme	104	100
Discrimination	30	28,84
Fairness	25	24,03
Financial	25	24,03
Competition	12	11,53
Improvement	12	11,53

Teachers' opinions on the positive and negative aspects of the Career Step Exam are categorized under five themes. These themes are *"Discrimination"*, *"Fairness"*, *"Financial"*, *"Competition"*, *"and "Improvement."*

Some teachers' views on the positive and negative aspects of the teaching career step examinations are as follows:

Teachers' opinions on the theme of "*Discrimination*": "*In terms of parents, it created a classification as "teacher ","good teacher", "very good teacher"*. (MVPa41E). "*Teachers were categorized as "successful teachers" and "unsuccessful teachers". In the eyes of society, the views of teachers who will/will get low exam scores will/will be negative. The exam did not have a positive*

side." (MVPa41E), "*It caused segregation and tensions between teachers.*" (FSCb36-40), "*It may cause some divisions among teachers.*" (MPa41E). "*The negative aspect is that this may lead to categorization among teachers.*" (FSCb35-40T): "*It has brought discrimination.*" (MCa41H) "*It is discriminatory.*" (MCb36-40), "*It segregates.*" (FSb25-30T).

Teachers' opinions on the theme of "*Fairness*": "*The salary increase is unfair.*" (FSb36-40T), "*Inequality*" (MSb36-40E), "*There is no positive side. Injustice*" (MSa41E), "*Different salaries for the same job is unfair*" (MSa41E), "*It is against the principle of equal pay for equal work.*" (MSa41E), "*The fact that we are paid different salaries despite doing the same job may cause miscommunication between teachers. However, it is necessary to respect all teachers who have spent years preparing for and taking exams.* " (FCa41H), "*Different titles and salaries in the school environment are not healthy.*" (MSCa41E), "*The exam held in 2022 hurt issues such as justice, merit, labour peace, and society's view of the teaching profession.*"

Teachers' opinions on the theme of "*Financial*": "*The salary increase is favourable.*" (MSa41E), stating, "*It was good economically.*" (MSa41E), "*It is favourable in terms of salary.*" (MSa41E), "*Of course, it has contributed financially.*" (MPa41E): "*In my opinion, there was no contribution other than salary, nothing changed in our lives, we are still the same teacher.*" (FSa41E), "*It has a positive effect on salary.*" (MSa41E).

Teachers' opinions on the theme of "*Competition*": "*It's all divide and conquer.*" (MSa41T), "*It caused negativity among teachers.*" (FSa41E), "*It caused segregation and tensions between teachers.*" (FSCb36-40E), "*It creates tension by grouping teachers.*" (FCa41T), "*The fact that we receive different salaries may cause communication breakdowns between teachers.*" (FCa41H), "*While it contributes to teachers in terms of social status and economy, it harms professional solidarity by causing competition among teachers.*" (FPSb31-35T).

Teachers' opinions on the theme of "*Improvement*": "*It has a positive effect, not so bad for morale and motivation.*" (MVPa41E), "*Positive in terms of evaluation.*" (MVPa41E), "*It created synergy and refreshed knowledge.*" (MVPa41E), "*It is useful.*" (MSa41E): "*As regards promotion, seniority, money, and expertise, I feel better, but the training before the exam is too long. There was exam stress; it would be better if it was online.*" (MSa41E), "*The positive aspect is that it refreshes the knowledge.*" (FPSb31-35T).

Considering the opinions of teachers on the positive and negative aspects of the Career Step Exams, teachers expressed that there is a positive increase in salary, but they indicated that this situation causes discrimination and injustice among teachers. On the other hand, some teachers state that this situation enables them to improve themselves.

When the participants were asked the question, "Could you evaluate the examination exams held in 2006 and 2022 regarding the Career Steps Exam?" (Those who took the exams held in 2006 and 2022 or those who saw the exam questions should answer)". The answers given by the teachers are given in Table 13.

Table 13.

Teachers' Evaluations of the Exam Held in 2006 and the Exam Held in 2022 Regarding the Career Steps of Teaching (Those who took the exam in 2006 and 2022 or those who saw the exam questions)

	Reference Codes	
	f	*%*
Theme/ Sub-theme	34	100
Similarity	2	5,88
Difference	15	44,11
Scale of Difficulty	17	49,99

Teachers' opinions on the 2006 and 2022 exams regarding the career steps of teaching are categorized under three themes. These themes are "Similarity", "Difference" and "Scale of Difficulty."

Some of the teachers' views on the examination exams held in 2006 and 2022 regarding the career steps of teaching are as follows:

Teachers' opinions on the theme of "*Similarity*": "*Both exams were the same. Of course, for those who study."* (MSa41H), *"We took the first exam by preparing; we succeeded and became expert teachers." We completed our In-Service Training for this exam, studied, and prepared the test books. In this year's exam, all the teachers who prepared and understood what they read were successful. "* (FCa41H)

Teachers' opinions on the theme of "*Difference*": *"The 2006 exam was more detailed and selective; however, the 2022 exam was professionally hurtful and devaluing in front of the public by classifying teachers according to careers with very simple questions."* (MVPa41E), *"I took both. The 2006 one was more serious and professional."* (MVPa41H). *"I could not take the 2006 exam. I know the questions are more difficult than the exam held in 2022. I was curious and looked at the questions.* (FSa41E): *"The exam in 2006 was very difficult, this year's exam was very simple and could have been more comprehensive."* (FCa41H) said, *"The 2006 exam was more advanced. There were questions of all kinds."* (FCa41H), *"The 2006 exam was conducted with an emphasis on educational science." On the other hand, the exam held in 2022 is completely weak in terms of reliability and validity."* (FSb31-35T): *"The 2006 examination was a more comprehensive examination." The exam for 2022 consisted of easier questions."* (MCa41H), *"The exam held in 2006 was the real exam, and the exam held in 2022 was the salary contribution exam which was for show."* (MCa41H), *"The subjects were very different. In the 2nd exam, there were questions about more related occupational subjects.* (MSa41H).

Teachers' opinions on the theme of "*Scale of Difficulty*": "The 2006 exam was more difficult than 2022." (MVPa41H) said, "*I couldn't take the 2006 exam. The 2022 exam questions were very easy."* (MPa41E), *"2006 was very difficult, 2022 was very easy, but it can't be the benchmark."* (MSa41H), *"The 2022 exam is a much easier exam."* (MVPa41T), *"The exam in 2022 was very easy."* (FCa41E), *"The 2006 exam was very difficult and this year's exam was very simple."* (MCa41H), *"The exam in 2006 was difficult. The current exam was very easy."* (FCa41H)

When the opinions of the teachers about the exam held in 2006 and the exam held in 2022 are analyzed, it can be seen that the majority of the teachers found the exam in 2006 more inclusive and difficult, while the exam in 2022 was easier and simpler than expected.

When the participants were asked the question, "Is it possible to pursue teaching career paths through an area other than the standard examination?" Could you elaborate on this matter? the answers given by the teachers are given in Table 14.

Table 14.

Teachers' Opinions on Alternative Systems Other than the Career Step Exams

	Reference Codes	
	f	%
Theme/ Sub-theme	66	100
In-Service Training	8	12,12
Postgraduate	10	15,15
Performance Evaluation	16	24,24
Length of service	30	45,45

Teachers' opinions about alternative systems other than exams for the career steps are categorized under four themes. These themes were "*In-Service Training*", "*Postgraduate*", "*Performance Evaluation*" and "*Length of service.*"

Some of the teachers' views on alternative systems other than exams regarding the career step exams are as follows:

Teachers' opinions on the theme of "*In-Service Training*": "*There are many alternatives. For example, inclusive and proper in-service training according to seniority.*" (MSa41E): "*It can be a course. In-service courses. It would be more efficient and more permanent.*" (MVPa41H), "*I am in favour of supporting in-service training.*" (FSa41E), "*Seminars can be organized, or training can be given, to contribute to professional development.*" Certificates can be given as a result of these." (FSb25-30T).

Teachers' opinions on the theme of "*Postgraduate*": "*It may be an alternative to do a master's degree or doctorate etc. in the field.*" (MVPa41E), "*Master's degree*" (MSa41E), "*I am in favour of supporting postgraduate education and in-service training that support it.*" (FSa41E), "*Postgraduate education is a good alternative or for those who cannot do it; it can be evaluated not according to years (that is, not as those who fill 10 years), but according to the product or attitudes and approaches to the student. However, it is an absurd practice to differentiate them as career steps and that every teacher should set out on this path through certain training, exams and experiences.*" (FSb25-30T), "*Master's degree holders should be promoted in the career steps.*" (MCb36-40E).

Teachers' opinions on the theme of "*Performance Evaluation*": "*...In addition to these, professional studies can be carried out in terms of the use of current technology and educational*

teaching materials that can contribute to the profession and in-school administrator observations can be added." (MVPa41E), *"Performance evaluation can be done by administration-teacher-parent-student."* (FSCb35-40E), *"It can be an interview at most"* (FSb36-40T), *"The head of the institution should be able to make an assessment."* (MVPa41E), *"It would be much better to have a training background only for the teacher."* (FSa41E), *"The opinion of the school principal and head teachers may be consulted."* (MVPa41E), *"It can be the activities of teachers in the classroom and educational activities at school."* (MSa41H).

Teachers' opinions on the theme of "*Length of service*": "*It can be evaluated as professional years. 10 years Expert Teacher, 20 years Head Teacher."* (MVPa41E), *"It could have been determined as the duration of the profession. For example, 5 years, 8 years, 10 years, 15 years, 20 years, etc."* (MVPa41E), *"Years of seniority should be taken as a basis,"* (MSa41E), *"A teacher who has worked for 10 years should be an expert teacher and a teacher who has worked for 20 years should be a head teacher."* (MSa41E), *"If expert teacher titles are given to those who work in the Southeast for 5 or 10 years or a certain period, there may be a chance to keep the teachers there for a long time."* (MCa41H), *"There should be no exams. A person who has served 25 years is already a head teacher."* (MVPb31-35T), *"After 5 and 10 years, every teacher has a certain amount of experience. Expertise comes with experience, not with a simple exam."* (FSa41T).

Considering teachers' suggestions for an alternative system other than the career step exams, the majority of the suggestions are based on seniority years. In addition, there are suggestions for in-service training and performance.

DISCUSSION

The teaching profession has been an important phenomenon throughout history because it plays a significant role in the education of individuals and society. Since countries are aware of this importance, they have tried and continue to work on the development of the teaching profession through different strategies and reforms. In Türkiye, different reforms have been implemented for the teaching profession. The teaching career step exam, which is one of these reforms, has an impact on all teachers. Therefore, this research took the opinions of teachers about current practices.

Teachers' views on the division of the teaching profession into "Teacher", "Expert Teacher" and "Head Teacher" were generally negative. Teachers stated that this distinction had effects such as injustice, inequality, and humiliation for teachers. Considering the answers given by the teachers to the issue of organizing an exam for the career step exams, it can be seen that the teachers disapproved of the exam. Teachers have emphasized that the examination is not a suitable tool to measure the knowledge that teachers have acquired over the years. In addition, teachers stated that the examination shook their self-confidence and was low in terms of validity and reliability. Furthermore, research on the subject has demonstrated that teachers' evaluations exhibit similar fundamental characteristics. (Çobanoğlu & İlkin, 2023; Pınar & Akgül, 2023).

Additionally, the study has revealed that educators believe the prerequisites for the current teaching career step examination should be reorganized. In particular, it is argued that the duration of examination should be regulated in a manner that does not disadvantage teachers. Conversely, some teachers argued that the conditions were appropriate. It was found that similar results were achieved in the field (Demir, 2011; Gülmez, 2022; Pinar & Akgül, 2023).

Teachers' opinions on the distribution and content of the questions in the teaching career step examinations generally indicated that the content validity of the questions was low. In addition, the study stated that it did not contain questions related to teaching. Moreover, it was stated that the questions were easier than normal; therefore, they were not sufficient in terms of validity and reliability. Teachers state that questions should be organized in a field-specific manner to cover the teaching profession. These studies yielded comparable outcomes (Bakioğlu & Banoğlu, 2013; Özdemir et al., 2022).

The opinions of teachers regarding the exemption from the teaching career step examination as a result of master's degree education vary. While the majority of teachers find it positive that master's degrees in the field of education or their field grant exemption from the examination, some of them state that it is unfair to give this privilege to those who have a master's degree. On the other hand, it is seen that there are teachers who argue that master's degree holders, regardless of their field, should be exempted from the examination to improve themselves (. It was observed that teachers with master's degrees especially found this practice positive. It has been stated that postgraduate education can be a criterion to achieve this because it is a challenging process. On the other hand, some teachers have emphasized that this practice will have negative consequences. For example, there was concern that there would be an increase in the number of master's programs paid for and conducted in private universities. In particular, the view that those who have a master's degree without a thesis should not be exempted is predominant. Teachers' evaluations of the career step exams in terms of the prestige and reputation of the teaching profession are mostly unfavourable. Teachers believe that examinations humiliate and offend the teaching profession in front of the public. There is also a concern that it will lead to the selection of teachers as "teacher", " expert " and "head teacher" by parents and students. Studies conducted on the subject revealed that teachers' evaluations of the Career Steps Exams (Alabaş et al., 2012; Çelikten, 2008; Gündoğdu & Kızıltaş, 2008; Kaplan & Gülcan, 2020; Yağiz & Bozkurt, 2022)

Teachers stated that the exam did not contribute to anything other than salary; on the contrary, it damaged their reputation. On the other hand, it is seen that there are teachers who emphasize that the teaching profession is already at a low level in terms of reputation; therefore, the current exam has no effect. Although the majority of teachers are against the exam, some teachers stated that this practice is beneficial in terms of reputation. Teachers criticized the current Career Step Exams in terms of ethical principles of teaching and

expressed similar opinions that the current practice was against ethical values. Teachers emphasized that the current practice is discriminatory against teachers and that it is not in line with the principles of equality, justice, and fairness. They stated that doing the same job and receiving different salaries causes teachers to be unfair. It was noted that this situation negatively affects teachers' motivation. Teachers believe that the contribution of the career step exams to the teaching profession is generally an additional payment reflected in salary. It is also seen that there are teachers who argue that this practice causes more harm than its contribution. On the other hand, it was observed that some teachers found the practice useful because it allowed them to update their knowledge (Aksan et al., 2023; Demir, 2011; İnadı & Gılıç, 2020; Kaplan & Gülden, 2023; Pinar & Akgül, 2023; Tarakçi, 2023).

Teachers' evaluations of the benefits of the teaching career step exams were similar to responses given regarding the contributions. Teachers stated that the contribution reflected in salary is especially meaningful. However, there are opinions that degree contributions are very good, especially in terms of enabling them to obtain a green passport. However, it is emphasized that those who are at the last stage of degree progression are unfairly treated. On the other hand, a majority of teachers argue that this practice does not bring any benefits in terms of reputation. Teachers' opinions on the exemption from the Career Step Exams in cases of postgraduate education showed some differences. Most teachers stated that to be exempted from the examination, teachers should only pursue postgraduate education in the field of education or their field. Some teachers have argued that postgraduate education is not related to the Career Step Exams. Therefore, there should not be any exemption (Arslan & Taş, 2023; Çobanoğlu & İlkin, 2023; Genç & Balyer, 2023; İbrahim & Dikbaş, 2023; Özdemir et al., 2022).

The opinions expressed on the positive or negative aspects of the Career Step Exams are generally more focused on the negative side. Teachers were concerned that the current career system would categorize teachers as "successful teachers" and "unsuccessful teachers". Moreover, teachers have concerns that society will view teachers with low exam scores negatively. In addition, one of the most negative aspects is material and moral discrimination among teachers. On the other hand, most teachers stated that their financial contribution was a positive outcome. Moreover, some teachers stated that the current practice has positive aspects in terms of the development and updating of knowledge. In general, teachers gave similar answers about the exams held in 2006 and the exam held in 2022 regarding the career step exams. In the 2006 examination, the teachers who attained the status of experts obtained the status of head teacher in the examination in 2022. Therefore, most opinions on the differences and similarities between the two examinations come from individuals with the title of headteacher. Teachers generally reported that the exam in 2022 was less comprehensive and easier than that in 2006. Teachers have stated that it would be more appropriate for the teaching profession to reorganize the scope of the

current examination and to include field-oriented questions (Bakioğlu & Banoğlu, 2013; Kaplan & Gülcan, 2020; Tosun & Sarpkaya, 2014).

Teachers' suggestions for alternative applications other than examinations for the career step exams were generally centred on years of seniority. Teachers stated that it would be fairer and more credible to consider seniority years other than exams. In addition, professional training, the successful work of the teacher within the school, the training received at the point of self-development, the pursuit of postgraduate studies, and the support given to social responsibility projects, etc., can be evaluated as alternatives (Buyruk, 2014; Göksoy et al., 2014; Şirin et al., 2010).

CONCLUSION

The teaching career step examination in Türkiye has revealed deep-seated concerns among educators regarding its fairness, effectiveness, and impact on the teaching profession. The research shows that many teachers perceive the division into "Teacher," "Expert Teacher," and "Head Teacher" as a source of inequality and humiliation, rather than a genuine reflection of professional expertise. This stratification has led to a sense of injustice within the teaching profession, where educators feel that their years of experience and dedication are not adequately recognized or valued. Many view the examination as an obstacle that undermines confidence and diminishes professional identity, rather than a tool for professional development. Moreover, the validity and relevance of the exam have been questioned, with teachers arguing that it fails to accurately measure the skills and knowledge that are crucial for effective teaching. The content of examinations, as reported by educators, often lacks alignment with the practical realities of the teaching profession and does not sufficiently address subject-specific expertise. This mismatch not only devalues the examination as a measure of competency but also contributes to a broader sense of disillusionment among teachers who feel that their professional growth is being hindered rather than supported by the current system. Additionally, the potential for moral and material discrimination based on examination results further exacerbates the issue, raising concerns about the impact on teachers' reputations and public perception.

Given these significant concerns, the current approach to career advancement within the teaching profession in Türkiye requires a thorough re-evaluation. Teachers propose that alternative methods, such as considering years of seniority, professional achievements, and contributions to the educational community, could provide a more equitable and motivating framework. Shifting the focus from a singular examination to a more holistic assessment of a teacher's career, policymakers can support the professional development of educators while preserving the dignity and integrity of the teaching profession. This reformed approach could foster a more inclusive and supportive environment that recognizes the diverse talents and contributions of all teachers.

LIMITATIONS AND RECOMMENDATIONS

One significant limitation of this study is the potential bias in the responses of the teachers who participated. Given the nature of the career step exams examination, teachers who have had negative experiences or disagreed with the structure and content of the examination may have been more motivated to express their dissatisfaction. This could result in a skewed representation of opinions, in which the voices of those who may have found some merit in the exam are underrepresented. Another limitation is the geographical and demographic scope of the study.

Based on these findings, it is recommended that policymakers consider revising the teaching career step examination to address the concerns raised by educators. One approach would be to develop a more comprehensive evaluation system that incorporates multiple measures of teacher performance, including classroom observations, peer reviews, and contributions to professional development. This would provide a more balanced assessment of a teacher's abilities and reduce reliance on a single examination. Additionally, exam content should be reviewed to ensure it is aligned with the practical and theoretical knowledge required for effective teaching, with a focus on subject-specific expertise.

Furthermore, alternatives to the current examination should be explored, such as considering years of seniority, professional achievements, and ongoing education as part of the criteria for career advancement. Providing opportunities for teachers to engage in continuous professional development, with recognition for their efforts, could also enhance motivation and ensure that teachers are continually updating their skills. Finally, efforts should be made to involve teachers in the reform process, allowing them to provide input and feedback on proposed changes and ensuring that any revisions are grounded in the realities of the teaching profession and are supported by those who will be most affected by them.

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Data Availability Declaration

Data Availability Upon Formal Request:

While the primary datasets utilized in this study are not publicly accessible due to certain constraints, they are available to researchers upon a formal request. The authors have emphasized maintaining the integrity of the data and its analytical rigor. To access the datasets or seek further clarifications, kindly reach out to the corresponding author. Our aim is to foster collaborative academic efforts while upholding the highest standards of research integrity.

Author Contributions

All authors, Semra Kıranlı GÜNGÖR and Güler SHAIKH contributed equally to this work. They collaboratively handled the conceptualization, methodology design, data acquisition, and analysis. Each author played a significant role in drafting and revising the manuscript, ensuring its intellectual depth and coherence. All authors have thoroughly reviewed, provided critical feedback, and approved the final version of the manuscript. They jointly take responsibility for the accuracy and integrity of the research.

Author(s)' statements on ethics and conflict of interest
Ethics statement: We hereby declare that research/publication ethics and citing principles have been considered in all the stages of the study. We take full responsibility for the content of the paper in case of dispute.

Biographical notes:

Semra Kıranlı Güngör 1: She holds a Master of Arts in Educational Administration from Eskişehir Osmangazi University's Social Sciences Institute, with a specialisation in supervision and planning. She also holds a Bachelor of Arts in Foreign Language Education from Anadolu University's Faculty of Education. She currently serves as an Associate Professor at Eskişehir Osmangazi University.

SC Scopus Author Identifier Number: 57204102316

Web of Science Researcher ID: CTN- 763-2018

Google Scholar Researcher ID: ImKVSV0AAAAJ

Güler SHAIKH 2: She holds a Master's degree from Mardin Artuklu University and is currently pursuing a doctorate at Osmangazi University. She has previously completed a degree in English Language Teaching at Dokuz Eylül University. She is currently employed as the vice principal at the Provincial Directorate of National Education.

SC Scopus Author Identifier Number: 57222097462

Web of Science Researcher ID: AED-6244-2022

Google Scholar Researcher ID: 6lQ-RlYAAAAJ&hl

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4 Corresponding Author

Research

Primary School Teachers Cannot Give What They Do Not Get: The Teacher Care Scale[1]

Muhammet Baştuğ[2]   **Meltem Atasoy**[3]   **Burak Öncü**[4]

Article Type
Original Research

Abstract:

Achieving the goal of education depends essentially on the primary school teachers who will run the system. It is essential to recognize the damage that the teaching profession can cause to teachers and to provide them with care services. This study aims to develop the "Teacher Care Scale (TeCaS)" for teachers. The scale was gradually applied to two separate sample groups, consisting of a total of 620 randomly selected people. To ensure the content and face validity, the scale, with 33 items, was carried out by consulting expert opinions in the first application. Following the factor extraction method (principal axis factoring), the scale items were identified as a result of exploratory factor analysis for construct validity. As a result of the factor analysis, a nested structure consisting of 25 items and six factors was obtained, parallel to the literature. The results of confirmatory factor analysis on the data showed that the sample to which the scale was applied demonstrated compliance at an acceptable level. This scale revealed the structure of teacher care. Clarifying the complex professional care situations of teachers will be useful in understanding the teacher variable, which is the fundamental component of the education system.

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[1] This study was presented as a paper at the Educational Congress (EDUCONGRESS 2024), held at Dicle University, Diyarbakır, Turkey from September 18-21, 2024.

[2] Prof. Dr., İstanbul University-Cerrahpaşa, Hasan Âli Yücel Faculty of Education, İstanbul, Türkiye. mbastug33@gmail.com, https://orcid.org/0000-0002-5949-6966

[3] Res. Asst., İstanbul University-Cerrahpaşa, Hasan Âli Yücel Faculty of Education, İstanbul, Türkiye. meltematasoy35@gmail.com, https://orcid.org/0000-0002-2547-3897

[4] PhD., Principal of Rega Kindergarten, İstanbul, Türkiye. brkoncu01@gmail.com, https://orcid.org/0000-0002-5706-0448

INTRODUCTION

Students, teachers, and teaching have recently become the focus of policymakers and researchers. Teaching is important. However, the question unasked or only implicitly answered is why teaching is important. Education is a tripod: student, parent or external variables, and teacher. In this system, parent or external variables are generally accepted as factors that educators cannot control. Indeed, the teacher variable is not static but rather dynamic, due to the uniqueness of the individual and is affected by the environment. Despite this, researchers and policymakers position the teaching profession within standardized frameworks. In this context, there is a mistake in thinking that the effect of a tried teaching method, an educational approach, or a teaching material on the student is independent of the teacher's situation. This misconception weakens the process of solving problems in the field of education. Since teaching is a profession, periodic maintenance and eliminating small problems that may cause major educational damage ensures that the teacher works in accordance with the regulations and curriculum and carries out an efficient education process for the students. These systematic checks are indicative of teacher care, and it is important to discover their level.

Teacher care can be defined as the interest and support shown towards the psychological, emotional, and professional well-being of teachers. This concept is grounded in the understanding that increasing teachers' job satisfaction leads to an improved quality of life. To better understand teacher care, it is necessary to focus on how strategies for teacher care are shaped by its basic definition. Teacher care strategies are methods that are shaped according to teachers' needs, and aimed at increasing their professional development, mental health and motivation.

Care for teachers includes various strategies to support their professional development, help them cope with work stress, and increase their overall quality of life. This approach advocates that teachers work in an environment where they not only convey information to students, but also where they are managed, supported, and valued in a way that is sensitive to their own needs. The well-being of teachers can affect their performance in the classroom and determine their contributions to the education system in general. Teacher care includes various strategies such as professional development programs for teachers, psychological support, workload reduction measures, and the creation of positive work environments.

In the context of teacher care, it is important to clarify the distinction between the concept and the strategies used to support it. The term "teacher care" refers to a broad concept that involves providing emotional, mental, and physical support to teachers. This support is essential for improving teachers' well-being and, ultimately, their performance in the classroom (Skaalvik and Skaalvik, 2018). On the other hand, the strategies mentioned in the text are specific actions or practices designed to achieve the overarching goal of teacher

care. These strategies aim to address various aspects of teacher well-being, including job satisfaction and professional development (Brant, 2022; Hattie, 2003).

Teacher care is a two-way concept: the care provided by the teacher to the student and the care provided by the student to the teacher themselves. Noddings (2012) conceptualized teacher care as the degree to which teachers recognize the needs and priorities of their students, value their thoughts, and accept their academic efforts. Ramberg et al. (2019) defined teacher care in terms of understanding, empathy, and sensitivity. Teven and McCroskey (1997) found that teacher care positively affects learning and improves teachers' performance. Caring for students' needs, desires, and preferences has improved their mental health (Lavy and Naama-Ghanayim, 2020) and positively affected their well-being (Stallman et al., 2018).

Another dimension of teacher care is the internal/external support provided to the teacher. The term teacher care refers to support for teachers. This concept plays an important role in increasing teachers' job satisfaction and reducing professional burnout (Johnson, 2006; Skaalvik, and Skaalvik, 2018). At the same time, teachers' overall work efficiency largely depends on the quality of this support. The teaching profession is dynamic and reshaped according to the uniqueness of each student (Day and Gu, 2007). In this context, both the care that teachers provide themselves and the care provided by external sources directly affect teachers' success in the classroom (Kelchtermans, 2009). Brant (2022) emphasizes that, for teachers to perform excellently in the classroom, they must be supported equally and adequately in society. Teachers' professional development and motivation should be built on the fact that they cannot give what they do not receive. Each teacher is unique in his or her professional journey, and thus, the relationship established with the profession is not fixed. Apart from the genetic code, the variable that has the most impact on student success is the teacher (Hattie, 2003). Success in education depends on the role of teachers in the system. Therefore, supporting them in a way that is sensitive to their needs directly contributes to the effectiveness of the education system (Darling-Hammond, 2010). It has been found that teachers contribute to improving students' mental health and positively affecting their well-being (Lavy and Naama-Ghanayim, 2020; Stallman et al., 2018). This critical role of teachers complicates problems in education due to factors that are difficult to control, such as constraints in human resources. This complexity can have long-term effects on education policies and the level of support provided to teachers (OECD, 2018).

The Present Study

Based on the literature, the basic variables of the problems in education have been identified. One of these is "Human Resources," which is difficult to control (Şişman and Arı, 2009; Selimoğlu and Yılmaz, 2010; Tanjung, 2020). Therefore, achieving the goal of education essentially depends on the teachers who will run the system. In all studies conducted on the problem, teacher identity is an important and essentially uncontrollable variable.

Teacher care is a critical phenomenon in terms of the quality and sustainability of the teaching profession. Teaching is a profession where commitment is of vital importance; however, in recent years, turnover rates have been increasing significantly (Ingersoll, and Strong, 2011; UNESCO, 2021). Research on teachers' burnout levels in Turkey indicates a decrease in job satisfaction and an increase in intentions to leave the profession (Yıldırım, 2020; TÜİK, 2023). International reports support these findings as well; according to the TALIS 2018 report by OECD, more than 20% of teachers report low professional motivation (OECD, 2019).

In the literature, variables such as teachers' well-being, attitudes, and self-efficacy perceptions have been widely discussed (Skaalvik, and Skaalvik, 2018; Klassen, 2010). However, the concept of teacher care, which encompasses internal and external support mechanisms ensuring the professional sustainability of teachers, remains underexplored. Teacher care is a multidimensional construct that includes individual, institutional, and societal factors (Hargreaves, 2000). Indeed, an educational environment where teachers feel cared for plays a crucial role in reducing negative outcomes such as burnout (Maslach, and Jackson, 1981), fatigue, and intention to leave, while simultaneously enhancing positive outcomes such as well-being, high motivation, and professional commitment (Bakker, and Demerouti, 2007; Day, and Gu, 2013).

However, the lack of a valid and reliable tool to measure this concept in the literature limits the examination of the phenomenon of teacher care. This gap in the literature requires the development of a scale that will determine the care levels of teachers. The measurement tool to be developed will create a scientific basis to support teachers' professional performance, their level of commitment to the profession, and their well-being. At the same time, it will be a reference point for practitioners and researchers by providing data-based outputs that can be used in planning educational policies and restructuring teacher training programs.

The "Teacher Care Scale (TeCaS)," developed to measure the care levels of teachers, aims to determine the impact of external factors on the teacher variable and to understand the results of this variable. Teachers and their care are a crucial support system on which a society can be lifted towards meaningful progress. If teachers are valued and trusted, teachers reciprocate by transferring this treatment to their students and empowering them to spread these values to the world (Brant, 2022). The importance of this study lies in a data collection tool to be developed to measure the care levels of teachers, it aims to determine the impact of external factors related to the teacher variable, understand the results of the teacher variable with programs support in future studies that meet these criteria, and act towards eliminating the problem. In this sense, the problem of recognizing the damage to teachers and providing them with care services has been determined, along with the aim of developing a "Teacher Care Scale (TeCaS)" for teachers. In this context, with the TeCaS, teachers can be supported by programs in future studies, thereby increasing their

contributions to education. Systematic and continuous support of teachers can guarantee the sustainability of the education system and social development (Fullan, 2015).

METHOD

This scale development study was structured within the framework of quantitative research methods. In this study, we aimed at developing a scale for a concept that is not included in the national literature and does not have a scale in the international literature. In the development of a scale for this concept, the survey design was used to ensure systematic data collection and analysis in line with the positivist paradigm (Cohen et al., 2018). Johnson (2014) emphasized that survey designs enable researchers to collect data from a target group to explore and measure specific concepts comprehensively. Validity in survey design refers to ensuring that the items are consistent with the literature and accurately represent the concept being measured. The items for this research were written based on the literature to develop the scale. Then, statistical operations were performed on the collected data to ensure the validity and reliability of the scale.

Process

After identifying the problem and determining the purpose, the process steps of the study were designed:

Table 1

Process of the research

Determining the Problem, and the Purpose	• Reviewing the literature
Item Pool	• Reviewing the literature • Authors' Cross-evaluation • 35-item item pool
Ensuring Content and Face Validity	• 2 field experts, 1 measurement and evaluation expert, and 1 language expert • 33-item item pool (Revision)
Determining the Population and Sample	• Population: 43,786 primary school teachers working in Istanbul. • Exploratory Sequential Sampling Design from Mixed Sampling Strategies (Non-Probability and Probability Sampling Strategies) • Sample: 620
Application-1	• 313 primary school teachers working in Istanbul through Non-Probability Snowball Sampling
Ensuring Construct Validity-1	• Factor extraction method: Factor analysis was run with 33 items using Principal Axis Factoring. • The factor analysis was run again with the 25 items obtained (as part of the Revision). • Performing exploratory factor analysis (EFA)
Reliability Calculation-1	• Cronbach-Alpha reliability coefficient

Application-2	• 307 primary school teachers working in Istanbul province, different from the first sample, with a systematic sampling strategy through randomness
Ensuring Construct Validity-2	• Performing confirmatory factor analysis (CFA)
Reliability Calculation-2	• Cronbach-Alpha reliability coefficient
Final Version of the Scale	• "TeCaS" scale consisting of 25 items with 6 factor

Creating the Item Pool: An item pool was created by the researchers based on the data collected through document review, consisting of three items for each sub-factor and each sub-dimension.

Ensuring Content and Face Validity: The item pool, which was cross-examined by two researchers, was presented to expert opinion as 35 items to ensure content and face validity. Information was obtained from two field experts working on program development and teacher needs in education, a Turkish linguist to ensure language validity, and a measurement and evaluation field expert to provide scale quality. Expert opinions were examined by both researchers, and then the researchers' revisions of the expert opinions were cross-checked and the scale was finalized before application.

Participants

Determination of the Population and Sample: 43,786 primary school teachers working in public and private primary schools affiliated with the Ministry of Education in Istanbul (MEB, 2023) constitute the population of the study. These data are from the 2022/23 academic year. Based on this data, teachers were recruited and left their jobs in the 2023-24 academic year. Generally, the number of teachers increases in this +/- system. Therefore, the number was rounded to 50,000. A 95% confidence level and a 4% confidence interval for the sample size are a common approach in public opinion poll studies in the field of social science (Cohen et al., 2018). This sample size is 593 people for a population of 50,000 people. Anticipating data loss, data were collected from 620 primary school teachers. Data from 620 people were collected in two separate applications. Data were obtained from over 300 teachers at each stage (This means that each application is more reliab

le than the confidence level being 90% and the confidence interval being 5% [271<].). Regarding the sample size in scale development studies, Kass and Tinsley (1979), Tabachnick and Fidell (2013) stated that the study group should be at least 300 and that 5-10 times more individuals than the number of items should be reached. The minimum number of people required for scale development studies in the literature was exceeded. In the first stage, the number of draft items was 35, and more than 10 times the number of individuals were reached compared to an earlier phase. In this context, the basic conditions for data analysis were provided (See: Data Analysis). Throughout the study, non-probability and probability sampling strategies were used sequentially. In this way, the aim was to prevent the limitation arising from the sampling strategy.

In the EFA section, data were collected using the snowball sampling method, one of the non-probability sampling strategies. In snowball sampling, researchers identify a small number of individuals with the characteristics they are interested in. These individuals are then used as sources of information to identify or contact other individuals who are eligible to be included in the study (Cohen et al., 2018). In EFA, scales must be filled in sincerely and objectively in order for factors to emerge. Otherwise, inconsistently filled scales may disrupt the process and reveal the factors of the structure. To ensure validity, the snowball sampling method was preferred in the first stage of the scale development process to reach participants who would diligently fill in the scale by starting with a familiar network, without limiting the process to only the researchers' connections. On the other hand, the snowball sampling method can be open to biases due to the effect of "first contact" and the problem of only including volunteers in the sample (Heckathorn, 2002). In order to explore the question of whether the factoring process resulting from these biases is also valid in probability sampling strategies, the random stratified sampling method, was used in the CFA process of the study. When the population is quite large and scattered, creating a simple random sample creates administrative problems. In random stratified sampling, the universe is divided into homogeneous subgroups, which makes the process manageable (Cohen et al., 2018). Therefore, in terms of accessibility, gender, and the type of institution in which one works were taken as cross-strata in defining the universe in the study. These strata were selected in terms of separate, statistically accessible from the ministry databases, and known to be effective in the structure of the measurement tool being developed. In terms of percentage, they were also taken into account in the sample selection. Random stratified sampling is a blend of the benefits of randomization and categorization (Cohen et al., 2018).

Table 2

Population of Research

	Female	Male	Total
Population (N)	32.058	11.728	43.786
Total Samples (n)	440	180	620
Application-1 (n1)	242	71	313
Application-2 (n2)	198	109	307

Table 3

Application-1: Findings Regarding Demographic Variables of the Sample

Gender * Institution Type				
Institution Type / Gender	Public	Private	Total	%
Famele	136	106	242	77.3
Male	53	18	71	22.7
Total	189	124	313	100.0
%	60.3	39.6	100.0	
Wage * Institution Type				

Institution Type / Wage	Public	Private	Total	%
Below minimum wage	5		5	1.6
17.000-31.999	6	101	107	34.2
32.000-46.999	137	21	158	50.5
47.000-61.999	39	2	41	13.1
62.000-62.000+	2		2	.6
Total	189	124	313	100.0
%	60.3	39.6	100.0	

Age * Teacher Education

Age / Teacher Education	Teacher training high school	Pedagogical formation training	Faculty of Education	No teacher training	Not specified	Total	%
20-29		3	33	1		37	11.8
30-39		6	104		1	111	35.5
40-49	1	7	83			91	29.1
50-59		9	37	1	1	48	15.3
60-60+	7		18		26	26	8.3
Total	8	25	275	2	3	313	100.0
%	2.6	8.0	87.9	.6	1.0	100.0	

Wage * Education Level

Wage / Education Level	Associate Degree	Bachelor's Degree	Master's Degree	Doctorate	Not specified	Total	%
Below minimum wage		5				5	1.6
17.000-31.999	12	72	22		1	107	34.2
32.000-46.999	2	131	21	3	1	158	50.5
47.000-61.999		27	14			41	13.1
62.000-62.000+	1	1				2	.6
Total	15	236	57	3	2	313	100,0
%	4.8	75.4	18.2	1.0	.6	100,0	

Wage * Year of Seniority

Wage / Year of Seniority	0-4 Year	5-14 Year	15-29 Year	30-39 Year	40-40+ Year	Total	%
Below minimum wage	2	3				5	1.6
17.000-31.999	10	56	21	5	15	107	34.2
32.000-46.999	7	48	82	17	4	158	50.5
47.000-61.999		9	29	2	1	41	13.1
62.000-62.000+		1	1			2	.6
Total	19	117	133	24	20	313	100.0
	6.1	37.4	42.5	7.7	6.4	100.0	

Table 4

Application-2: Findings Regarding Demographic Variables of the Sample

Institution Type / Gender	Public	Private	Total	%
Female	180	18	198	64.5
Male	106	3	109	35.5
Total	286	21	307	100.0
%	93.2	6.8	100.0	

Wage * Institution Type

Institution Type / Wage	Public	Private	Total	%
Below minimum wage	8		8	2.6
17.000-31.999	3	16	19	6.2
32.000-46.999	214	4	218	71.
47.000-61.999	60		60	19.5
62.000-62.000+	1	1	2	.7
Total	286	21	307	100.0
%	93.2	6.8	100.0	

Age * Teacher Education

Teacher Education / Age	Pedagogical formation training	Faculty of Education	No teacher training	Total	%
20-29		27		27	8.8
30-39	1	73		74	24.1
40-49	4	96		100	32.6
50-59	24	71	5	100	32.6
60-60+	1	5		6	2.
Total	30	272	5	307	100.0
%	9.8	88.6	1.6	100.0	

Wage * Education Level

Education Level / Wage	Associate Degree	Bachelor's Degree	Master's Degree	Doctorate	Total	%
Below minimum wage		8			8	2.6
17.000-31.999		16	3		19	6.2
32.000-46.999	6	192	20		218	71.
47.000-61.999	5	45	9	1	60	19.5
62.000-62.000+			1	1	2	.7
Total	11	261	33	2	307	100,0
%	3.6	85.	10.7	.7	100,0	

Wage * Year of Seniority

Wage \ Year of Seniority	0-4 Year	5-14 Year	15-29 Year	30-39 Year	40-40+ Year	Total	%
Below minimum wage	4	3	1			8	2.6
17.000-31.999	5	10	3	1		19	6.2
32.000-46.999	6	55	121	35	1	218	71.
47.000-61.999		4	34	20	2	60	19.5
62.000-62.000+		1	1			2	.7
Total	15	73	160	56	3	307	100,0
%	4.9	23.8	52.1	18.2	1.	100.0	

Ethical Considerations

To conduct the research, ethics committee approval was received from Istanbul University-Cerrahpaşa Social and Human Sciences Research Ethics Committee on April 17, 2024. (Ethics Committee Approval numbered 2024-139). For the Ministry of National Education, MEB institutional permission was granted by the approval letter numbered E-59090411-44-104079614 dated 10.06.2024 from Istanbul Provincial Directorate of National Education and the approval letter numbered E-59090411-20-103917039 dated 06.06.2024 from Istanbul Governorship. After obtaining the application permissions from the necessary institutions, these were also obtained from the school administrations of the primary schools where data would be collected. Teachers were informed according to the Helsinki Declaration, and their written and verbal consent was obtained.

Analysis

In the analysis of the data, exploratory factor analysis and confirmatory factor analysis were used to separate the variables into groups and reveal the factors. Factor analysis is a variable grouping analysis method that determines the variables with common characteristics (EFA), and constructs the latent processes within the structure of the model structure predicted from the literature (CFA), for the variables (Cohen et al., 2018). Variables that are related to each other but largely independent of other variable sets are combined into factors. Factors are thought to reflect the underlying processes that create correlations between variables (Tabachnick and Fidell, 2013). Pallant (2001) evaluated the purpose of factor analysis as a simplification process by turning large data sets into smaller, more meaningful subsets. In this study, the literature determined that there were sub-factors, and items were developed to meet this large data set. First, EFA was carried out to group the draft scale items, and then CFA was carried out to test the factor structure of these groups based on the literature.

Based on the literature, a sufficient study group size greater than 300 was reached for the scale development study. The Kaiser-Meyer-Olkin (KMO) measurement technique, which is the most frequently used method for the adequacy of the sample size, was performed at the beginning of the analyses (Seçer, 2021). The KMO value ranges from 0 to 1

(Cohen et al., 2018). This value is at least 0.60, which means that the sample size is sufficient (Pallant, 2001; Cohen et al., 2018). When the KMO criterion value for sample adequacy was provided, Bartlett's Test of Sphericity, which examines the correlation between variables, was calculated to assess the multiple connectivity problem, an a priori requirement for EFA. After determining whether this value (p<0.05) was significant, the EFA process was started (Tabachnick and Fidell, 2013).

Ensuring Construct Validity-1: In order to ensure validity and reveal the latent structures in the data set, the principal axis factoring (PAF) data analysis method was used. PAF aims to reveal the underlying factors in reality and focuses on explaining the correlations between the original variables and these factors. Unlike principal component factoring (PCF), PAF was preferred because it focuses on the shared variance among the original variables, rather than all variance, in a predetermined factor structure. PAF tries to discover the underlying factors in reality (Hair et al., 2010) and determine the relationships of these factors with the original variables. Factors can generally be correlated with each other, and explain the common variance. After running the factor analysis on the SPSS 25.00 package program, items with eigenvalues less than one were eliminated using Kaiser normalization. In order to examine the factor structure, the scree plot was used in the study, and the number of factors was determined according to the diffraction points by the researchers. Since the relationship between the factors was assumed, the direct oblimin technique, which is one of the non-orthogonal oblique rotation techniques, was applied. Items were removed using the factor extraction method, and PAF was re-run. When the item removal status was fixed after the second EFA group, the next stage, CFA, was started.

Ensuring Construct Validity-2: After grouping the variables and testing the factors, CFA was performed to verify the scale, which had already achieved construct validity in a different study group. CFA is a multivariate statistical technique used by a researcher to test and verify a previously determined theoretical model (Brown, 2015). CFA is used to evaluate the extent to which certain factors fit the variables observed by measurement tools. This analysis helps evaluate the validity and appropriateness of the model by measuring the fit of a theoretical model with real data (Byrne, 2010). AMOS software was also used for CFA in this study. The statistical data obtained through this software are: chi-square statistics, fit indices (such as GFI, CFI, RMSEA), and other criteria (see the Table in the Findings section). When the model did not show the expected fit, the researchers applied various correction steps. As a modification, the measurement model was revised and the relationships between the factors were changed, thus improving the model. This process is intended to ensure that the CFA model fits the data better and strengthens its theoretical representation.

Validity, and Reliability

Theoretical foundations were built to ensure construct validity and the design of the measurement tool was founded upon the theoretical infrastructure from the literature. The construct validity of the measurement tool was increased through expert review and

feedback. To strengthen the validation processes, theoretical foundations were created and feedback from field experts was actively sought. These actions were taken as part of a comprehensive approach aimed at improving the reliability and accuracy of the measurement tool. Content validity was assessed by field experts to ensure that the items in the measurement tool covered all aspects of the concept being measured. Both researchers worked on the items individually to ensure rater reliability, and then a draft scale was developed by cross-referencing until the draft version of the measurement tool was designed. A sample that accurately represented the population for which the measurement tool would be used was determined based on the literature and the characteristics of the population. It was expected that the selection of the appropriate sample would have a positive effect on construct validity. After determining the appropriate sample, the draft version of the measurement tool was first tested in small-scale pilot studies. These studies helped to evaluate how the measurement tool performed in practice. Exploratory Factor Analysis, Confirmatory Factor Analysis, and internal consistency analyses were conducted to check the consistency of the items in the measurement tool, which were used in the data analysis. Validity and reliability were ensured with statistical data by calculating various statistical measures, Cronbach's alpha internal consistency coefficients, score reliability between two independent researchers, and independent groups t-test to distinguish whether the items reveal the difference between the upper and lower 27% groups.

RESULTS

Exploratory Factor Analysis

The prerequisites for its suitability for factor analysis were examined before its construct validity was assessed. The Kaiser-Meyer-Olkin (KMO) coefficient measurement technique was used to ensure the adequacy of the sample size. KMO value was calculated as 0.906. This value is understood to be a "pretty good" sample size for a construct validity study (Tabachnick and Fidell, 2013). The KMO criterion value was provided for sample size adequacy. To eliminate the primary problem of multicollinearity, Bartlett's Test of Sphericity, a sphericity test that examines the correlation between variables, was calculated. This value was found to be significant as $X2(528)= 4167.411; p<0.05$ (Tabachnick and Fidell, 2013). In line with this finding, the analysis showed that the correlations between the items were large enough for exploratory factor analysis (EFA).

Table 5

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.906
Bartlett's Test of Sphericity	Approx. Chi-Square	4167.411
	df	528
	Sig.	.000

Ensuring Construct Validity-1: The principal axis factoring (PAF) data analysis method, one of the factor extraction methods, was used to ensure construct validity and reveal hidden structures in the data set. Since the relationship between the factors is assumed, the direct oblimin technique, one of the non-orthogonal (oblique rotation) rotation techniques, was applied. PAF revealed a seven-factor structure with eigenvalues above 1 for 33 items. It was found that the contribution of these factors to the total variance was 57.542%. Table 6 shows the distribution of the items according to factors and factor loadings.

Table 6

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	9.433	28.586	28.586	8.956	27.140	27.140	5.645
2	3.012	9.128	37.714	2.532	7.673	34.812	5.421
3	1.662	5.037	42.751	1.193	3.614	38.426	5.248
4	1.442	4.369	47.120	.940	2.848	41.275	4.029
5	1.278	3.871	50.992	.694	2.103	43.378	3.891
6	1.131	3.428	54.420	.544	1.650	45.027	1.967
7	1.030	3.122	57.542	.462	1.401	46.429	.958
8	.977	2.961	60.503				

Extraction Method: Principal Axis Factoring.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

When examining the pattern matrix, the distribution of the items into factors can be seen. Since they are contiguous items and the difference between their distributions to factors is less than 0.10, combination-based extraction operations were tried gradually. Initially, the distribution of 33 items according to factors and their factor loadings is given in Table 7.

Table 7

Pattern Matrix

	Factor						
	1	2	3	4	5	6	7
SMEANMD27	.633						
SMEANMD16	.624						
SMEANMD20	.563						
SMEANMD15	.479					.302	
SMEANMD9	.442						
SMEANMD19	.376						
SMEANMD4							
SMEANMD30		-.974					
SMEANMD31		-.667					

	1	2	3	4	5	6	7
SMEANMD32	.345	-.505					
SMEANMD23	.442	-,458					
SMEANMD21		-.452					
SMEANMD10	.326	-.408					.311
SMEANMD2		-.333					.321
SMEANMD3			-.888				
SMEANMD18			-.757				
SMEANMD5			-.624				
SMEANMD6			-.479				
SMEANMD14			-.301				
SMEANMD28				.644			
SMEANMD25				.602			
SMEANMD29				.532			
SMEANMD26				.377			
SMEANMD7							
SMEANMD8					.513		
SMEANMD12					.503		
SMEANMD13			-.340		.464		
SMEANMD11					.338		
SMEANMD22							
SMEANMD33						.425	
SMEANMD17						.396	
SMEANMD1						.378	
SMEANMD24	.349						-.366

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 21 iterations.

All combinations were tried, and repeated exploratory factor analyses were conducted until there were no items that did not fall under any factor or overlapped with others. Before starting the factor analysis, the Kaiser-Meyer-Olkin (KMO) coefficient value and Bartlett's Test of Sphericity were calculated based on 25 items. KMO value was calculated as 0.887 and Sphericity values were calculated as X2(300)= 2770.993 (significance: 0.000, .000, $p<0.05$). After testing that the prerequisites for factor analysis were ensured with 25 items, exploratory factor analysis was carried out again.

Table 8

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.887
Bartlett's Test of Sphericity	Approx. Chi-Square	2770.993
	df	300
	Sig.	.000

PAF revealed a six-factor structure with eigenvalues above 1 for 25 items. The contribution of these factors to the total variance was 58.815%. Table 9 and Figure 1 (Scree Plot) show the distribution of the items according to factors and factor loadings.

Table 9

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	7.156	28.625	28.625	6.661	26.646	26.646	4.011
2	2.492	9.969	38.593	2.002	8.007	34.653	3.917
3	1.515	6.061	44.654	1.051	4.204	38.857	4.310
4	1.351	5.405	50.060	.831	3.324	42.181	2.610
5	1.153	4.613	54.672	.538	2.150	44.332	3.195
6	1.036	4.143	58.815	.452	1.808	46.139	1.727
7	.873	3.492	62.308				

Extraction Method: Principal Axis Factoring.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

Graphic 1

Scree Plot
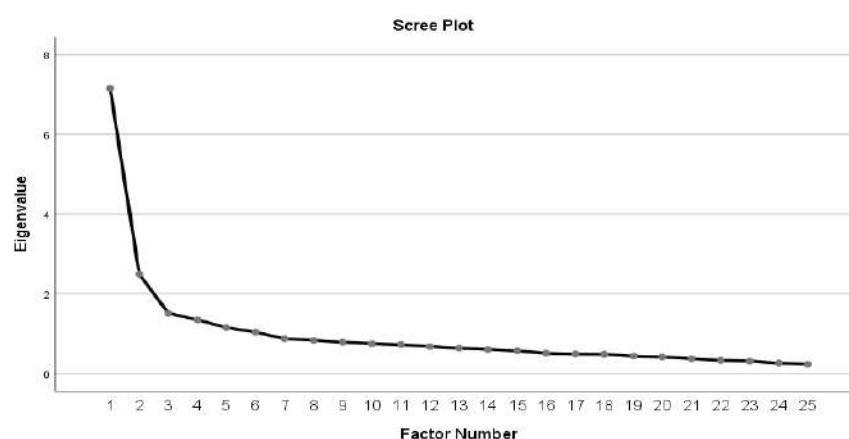
In the final stage, a total of 8 items were removed because MD4, MD7, and MD22 were not included in any subscales; and MD23, MD24, MD13, MD15, and MD32 were overlapping items. Following the item extraction process, an exploratory factor analysis was conducted again with the remaining 25 items. The pattern matrix obtained after item extraction is given in Table 10.

Table 10

Pattern Matrix

	Factor					
	1	2	3	4	5	6
SMEANMD27	.637				-.328	
SMEANMD16	.595					
SMEANMD20	.568					
SMEANMD9	.512					
SMEANMD19	.399					
SMEANMD30		-.935				
SMEANMD21		-.574				
SMEANMD31		-.560				
SMEANMD10	.310	-.527				
SMEANMD2		-.459				
SMEANMD3			-.866			
SMEANMD18			-.769			
SMEANMD5			-.634			
SMEANMD6			-.503			
SMEANMD14			-.320			
SMEANMD8				.560		
SMEANMD11				.475		
SMEANMD12				.322		
SMEANMD28					-.575	
SMEANMD29					-.570	
SMEANMD25					-.570	
SMEANMD26					-.387	
SMEANMD33						.541
SMEANMD1						.421
SMEANMD17						.384

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 13 iterations.

When Table 10 is examined, it can be seen that there are 5 items under each of the first, second, and third factors; 3 items under each of the fourth and sixth factors; 4 items under the fifth factor. Based on the contents of the items, the factors are named sequentially "social acceptance", "economy", "school climate", "social environment", "health", and "professional competence".

When Table 10 is considered in terms of factor loadings, it appears that the factor loadings on the scale are between .320, and .935. This finding shows that the factor loadings of the items are greater than 0.30, indicating that all items are at a sufficient level (Cohen et al., 2018). Following the exploratory factor analysis, the results of the item-total score correlation analysis were performed to reveal the validity coefficient of each item, and the values related to the analysis are shown in Table 11.

Table 11

Corrected Item-Total Correlation

SMEANMD1	.147	SMEANMD12	.455	SMEANMD26	.431
SMEANMD2	.400	SMEANMD14	.517	SMEANMD27	.568
SMEANMD3	.566	SMEANMD16	.666	SMEANMD28	.483
SMEANMD5	.525	SMEANMD17	.366	SMEANMD29	.431
SMEANMD6	.521	SMEANMD18	.528	SMEANMD30	.483
SMEANMD8	.416	SMEANMD19	.341	SMEANMD31	.594
SMEANMD9	.573	SMEANMD20	.467	SMEANMD33	.385
SMEANMD10	.526	SMEANMD21	.535		
SMEANMD11	.293	SMEANMD25	.466		

In examining the item-total correlation, items with a value of .30 or above are considered sufficient to distinguish the variable intended to be measured (Büyüköztürk, 2008). As seen in Table 7, item 11 was not removed because its .293, an item-total score correlation value, was close to .30. Although the first item was below .30 at .147, it was decided not to remove it based on the literature and the opinions of field experts. The correlation values between the factors in the scale are in the Table 12.

Table 12

Factor Correlation Matrix

Factor	1	2	3	4	5	6
1	1,000	-,475	-,362	,175	-,247	,175
2	-,475	1,000	,311	-,248	,153	-,060
3	-,362	,311	1,000	-,367	,396	-,242
4	,175	-,248	-,367	1,000	-,376	,267
5	-,247	,153	,396	-,376	1,000	-,310
6	,175	-,060	-,242	,267	-,310	1,000

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization.

When Table 12 is evaluated, there is a medium-level relationship between the factors. These findings support the view that factors measure different dimensions of the same structure.

Reliability -1: Exploratory Factor Analysis was used in data analysis, and internal consistency analyses were conducted to check the consistency between the items in the measurement tool. The reliability value was calculated as Cronbach's alpha internal consistency coefficient (Table 13).

Table 13

Reliability Statistics (EFA)

	Cronbach's Alpha	N of Items
TOTAL	.892	25
1. Factor	.781	5

2. Factor	.784	5
3. Factor	.803	5
4. Factor	.574	3
5. Factor	.724	4
6. Factor	.494	3

A generally accepted rule is that the size of the reliability coefficient should be greater than or equal to 0.70 for research purposes (Johnson and Christensen, 2014). According to these findings, it is understood that the scale items provide a reliability value of .892. Despite the lower reliability coefficient (Cronbach's alpha = 0.494) for Factor 6, this factor was retained in the scale due to its theoretical significance and its contribution to the overall construct. In scale development, particularly with smaller numbers of items, it is not uncommon for a factor to demonstrate slightly lower reliability (Kline, 1999). Factor 6 was carefully chosen for its relevance to the dimensions of the scale, as it covers an essential aspect that was deemed important for the conceptual framework of the instrument. Moreover, the overall Cronbach's alpha for the full scale remains strong at 0.892, indicating that the inclusion of Factor 6 does not undermine the reliability of the entire scale (Field, 2018). Additionally, the statistical analyses, including item-total correlations and t-tests, supported the inclusion of this factor, showing that it provides meaningful differentiation between groups, which enhances the scale's validity (Büyüköztürk, 2008). Therefore, despite the slightly lower reliability of this factor, it was retained because of its theoretical relevance and the validation provided by other analyses.

For item discrimination, the upper-lower 27% groups, (Table 14) method was applied. Validity and reliability were ensured with statistical data by calculating the independent groups t-test to identify differences between groups.

Table 14

Independent Samples Test

	Groups	n	Mean	s.s	Levene's Test for Equality of Variances		t	P
					F	p		
Teacher Care Scale (TeCaS)	Lower %27	85	63.2457	11.63675	.024	.877	-30.851	.000
	Upper %27	85	118.1439	11.56480				

The total scores obtained from the scale for 313 participants were first sorted from largest to smallest. Afterward, the lower and upper 27% groups were determined based on a score of 84.51, and independent sample t-test values were calculated. Examining Table 14 indicates a statistically significant difference between the lower and upper groups. This finding indicates that the items in the scale have distinctive features.

Confirmatory Factor Analysis

To test the construct validity of the scale used in this study, confirmatory factor analysis (CFA) was applied. CFA is an analysis technique used to test the extent to which the determined factor structure fits the data set (Kline, 2016). Many fit indices are used to demonstrate the adequacy of the model tested in CFA. In this study, Chi-Square Goodness of Fit Test (Chi-Square Goodness), Goodness of Fit Index (GFI), Adjustment Goodness of Fit Index (AGFI), Comparative Fit Index (CFI), Normed Fit Index (NFI), Incremental Fit Index (IFI), Root Mean Square Error of Approximation (RMSEA), Parsimony Normed Fit Index (PNFI), and Parsimony Goodness of Fit Index (PGFI) were examined for the CFA performed. In this regard, the findings are presented below in Table 15

Table 15

Perfect and Acceptable Fit Values for the Fit Indexes Examined in the Research and Fit Index Values Obtained from CFA

X2= 570.203, df = 258, p =.000, 90% Confidence Interval for RMSEA= (.056, .070)				
Examined Fit Indexes	Perfect Fit Criteria	Acceptable Fit Criteria	Obtained Fit Indexes	Conclusion
$\chi 2$/df	$0 \leq \chi 2/df \leq 2$	$2 \leq \chi 2/df \leq 3$	2,210	Acceptable Fit
GFI	$.95 \leq GFI \leq 1.00$	$.90 \leq GFI \leq 95$	,877	Acceptable Fit
AGFI	$.90 \leq AGFI \leq 1.00$	$.85 \leq AGFI \leq .90$	,845	Acceptable Fit
CFI	$.95 \leq CFI \leq 1.00$	$.90 \leq CFI \leq .95$	,897	Acceptable Fit
NFI	$.95 \leq NFI \leq 1.00$	$.90 \leq NFI \leq .95$	,828	Acceptable Fit
IFI	$.95 \leq IFI \leq 1.00$	$.90 \leq IFI \leq .95$	,898	Acceptable Fit
RMSEA	$.00 \leq RMSEA \leq .05$	$.05 \leq RMSEA \leq .08$	,063	Acceptable Fit
PNFI	$.95 \leq PNFI \leq 1.00$	$.50 \leq PNFI \leq .95$	,712	Acceptable Fit
PCFI	$.95 \leq PCFI \leq 1.00$	$.50 \leq PCFI \leq .95$	,771	Acceptable Fit

When Table 15 is examined, it can be said that the fit indices of the model based on the Confirmatory Factor Analysis (CFA) results are generally at an acceptable level of fit. χ^2/df (2.210): The ratio of the chi-square value to the degrees of freedom is 2.210. This value is within the acceptable fit range ($2 \leq \chi^2/df \leq 3$). The significance of chi-square (p = .000) may be related to the large sample, so it would be more accurate to focus on the χ^2/df value. GFI (0.877): GFI (Goodness of Fit Index) shows the fit of the model with the data. The value of 0.877 is within the acceptable fit range ($0.90 \leq GFI \leq 0.95$), but is insufficient for a perfect fit. AGFI (0.845): AGFI (Adjusted Goodness of Fit Index) corrects the GFI by taking into account the complexity of the model. The value of 0.845 is close to the lower limit of acceptable fit ($0.85 \leq AGFI \leq 0.90$). Cole (1987) states that the model can be considered acceptable when the AGFI value is between 0.85 and 0.90. It is stated that this index may not be evaluated very strictly, especially in modeling in social sciences, because this index can take lower values since it is arranged according to the complexity of the model. CFI (0.897): CFI (Comparative Fit Index) evaluates the fit of the model comparatively. A value of 0.897 is close to the acceptable fit limit ($0.90 \leq CFI \leq 0.95$), but it does not provide a perfect fit. Hu,

and Bentler (1999) emphasize that even when the CFI value is slightly below the 0.90 limit, an acceptable fit can be achieved. It has been stated that flexibility can be demonstrated by taking into account factors such as the complexity of the data structure and sample size, especially in models in social sciences. NFI (0.828): NFI (Normed Fit Index) is another index where fit is normed. A value of 0.828 is below the acceptable fit range ($0.90 \leq NFI \leq 0.95$). Bentler and Bonett (1980) emphasize that if the NFI value is below 0.90 but above 0.80, the fit can be considered acceptable. It has been stated that looser criteria can be applied in social sciences and the model can still be valid if the NFI value is just below the ideal limit. IFI (0.898): IFI (Incremental Fit Index) is a comparative fit index. A value of 0.898 is within the acceptable fit limit ($0.90 \leq IFI \leq 0.95$), but it does not reach a perfect fit. RMSEA (0.063): RMSEA (Root Mean Square Error of Approximation) shows the prediction errors of the model. The value of 0.063 is within the acceptable fit limits ($0.05 \leq RMSEA \leq 0.08$), but it does not provide a perfect fit. MacCallum et al. (1996) stated that a RMSEA value below 0.08 indicates a good fit, while values just above 0.05 are acceptable. In the social sciences, ranges of values rather than exact limits for RMSEA should be considered because this index can be affected by sample size and model complexity. PNFI (0.712): PNFI (Parsimony Normed Fit Index) evaluates the fit by considering the parsimony of the model. The value of 0.712 is within the acceptable fit range ($0.50 \leq PNFI \leq 0.95$). PCFI (0.771): PCFI (Parsimony Comparative Fit Index), similar to CFI, evaluates the parsimony of the model. The value of 0.771 is also within the acceptable fit range ($0.50 \leq PCFI \leq 0.95$). These values prove that the model has a good fit and that the scale is valid and reliable enough to be used on different sample groups (Graphic 2).

Grafic 2

Path Diagram for Confirmatory Factor Analysis of the Scale
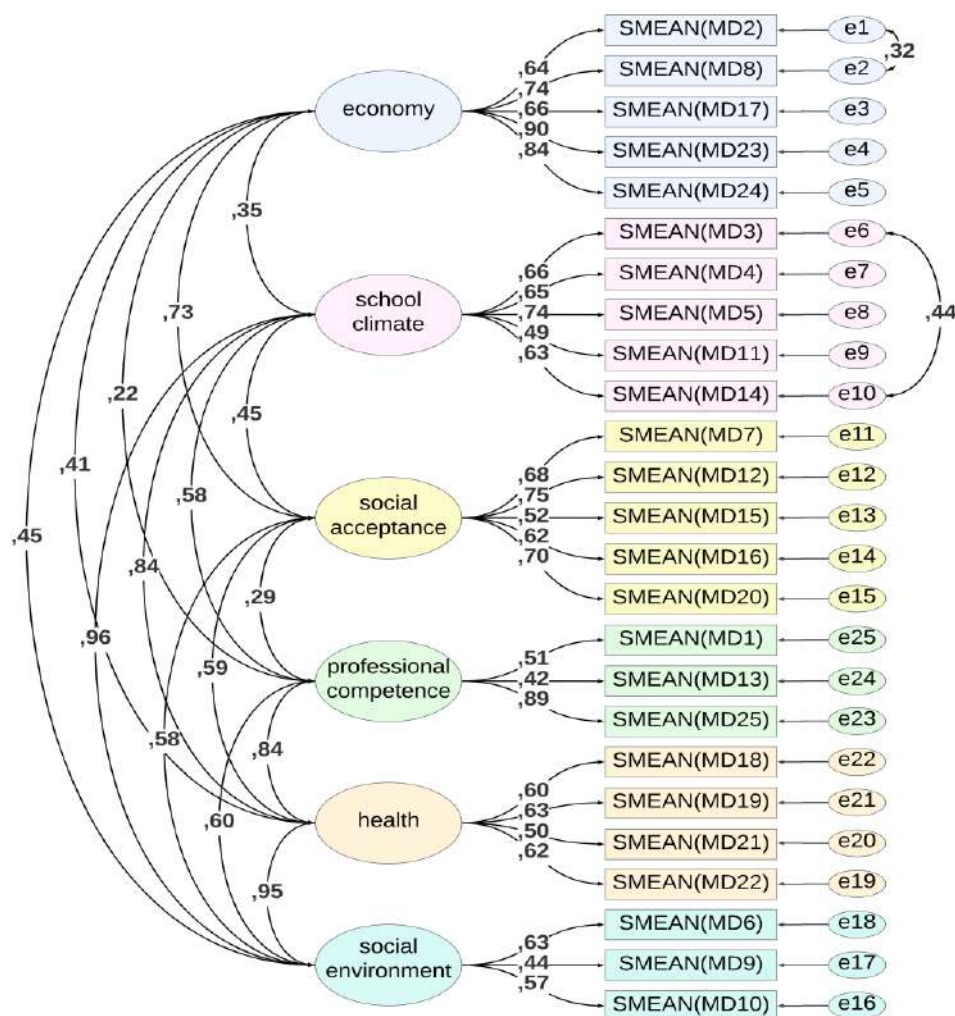
Reliability-2: The reliability value was calculated as Cronbach's alpha internal consistency coefficient (Table 16).

Table 16

Reliability Statistics (CFA)

	Cronbach's Alpha	N of Items
TOTAL	.899	25
1. Factor	.873	5
2. Factor	.791	5
3. Factor	.768	5
4. Factor	.601	3
5. Factor	.676	4
6. Factor	.566	3

A generally accepted rule is that the size of the reliability coefficient should generally be greater than or equal to at least 0.70 for research purposes (Johnson, and Christensen,

2014). According to these findings, it is understood that the scale items provide a reliability value of 0.899 and are close to perfect.

CONCLUSION

In conclusion, the development of the Teacher Care Scale (TeCaS) has provided an important tool for understanding and evaluating the professional care needs of teachers, which are central to the success of the education system. With its six-factor structure, consisting of 25 items in total, the scale helps identify key areas where teachers require support, such as social acceptance, economic well-being, and professional competence. The findings contribute significantly to the literature by offering insights into how teacher care can be conceptualized and measured. Furthermore, the scale's practical implications are substantial for education policymakers and practitioners, as it provides a basis for planning targeted care services that address the multifaceted needs of teachers. By addressing these needs, the scale can help meet teacher needs, ultimately enhancing the effectiveness of the education system as a whole.

LIMITATIONS, AND FUTURE DIRECTIONS

This study has several unavoidable limitations due to sample, data collection method, time, and cultural influence:

- The study was conducted only among primary school teachers in Istanbul; therefore, the results obtained may not be generalizable to teachers in other cities or with different levels of education.
- The use of survey applications caused the teachers' responses to be based on their perceptions. This situation may affect the subjectivity of the responses and therefore the validity of the research results.
- Since the study was conducted in a specific period, the care needs of teachers, which may change over time, and the perception of these needs were not taken into account.
- The perception of teacher care may be affected by cultural and social factors. Therefore, the findings of the study may differ in a cultural context.
- A limitation of this study is the lack of test-retest reliability and criterion validity analyses, which are crucial for evaluating the temporal stability and predictive power of the scale. While the current research demonstrates robust internal consistency via Cronbach's alpha, these additional reliability and validity checks are necessary for a more comprehensive understanding of the scale's performance over time and its capacity to predict relevant outcomes (Cohen et al., 2018; Sijtsma, 2009).

Implications for educational research and practice: The findings of this study hold significant implications for both educational research and practice:

- The development of the Teacher Care Scale (TeCaS) provides a robust tool for future studies examining the concept of teacher care. Researchers can use this scale to explore various dimensions of teacher well-being and its impact on educational outcomes, fostering a deeper understanding of the teacher variable in education systems.

- Teacher care is a concept that should be addressed not only on a branch basis but also from a broader perspective. In this context, examining the levels of teacher care across branches before initiating support processes for teachers will be of great benefit in future studies. A better understanding of the differences and needs across branches will make it possible to plan teacher care more effectively and comprehensively. This approach has the potential to increase the overall efficiency of the education system.

- The results can inform policymakers about the critical importance of teacher care in enhancing educational quality. Recognizing the factors that contribute to teacher well-being can guide the development of targeted policies and initiatives aimed at improving the work environment for educators.

- It is recommended that future research include test-retest reliability and criterion validity studies to confirm the stability and external validity of the scale. These analyses would help solidify its utility and ensure its applicability across different contexts and populations (Nunnally and Bernstein, 1994; Kline, 1999).

In summary, the implications of this study highlight the vital role of teacher care in educational settings and encourage researchers and practitioners to prioritize teachers toward the goal of achieving educational excellence. In this context, supporting and caring for teachers is critical to improving the quality of the education system.

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Data Availability Declaration

Data Availability Upon Formal Request: While the primary datasets utilized in this study are not publicly accessible due to certain constraints, they are available to researchers upon a formal request. The authors have emphasized maintaining the integrity of the data and its analytical rigor. To access the datasets or seek further clarifications, kindly reach out to the corresponding author. Our aim is to foster collaborative academic efforts while upholding the highest standards of research integrity.

Author Contributions

All authors, Muhammet Baştuğ, Meltem Atasoy, and Burak Öncü, contributed equally to this work. They collaboratively handled the conceptualization, methodology design, data acquisition, and analysis. Each author played a significant role in drafting and revising the manuscript, ensuring its intellectual depth and coherence. All authors have thoroughly reviewed, provided critical feedback, and approved the final version of the manuscript. They jointly take responsibility for the accuracy and integrity of the research.

Biographical notes:

Muhammet Baştuğ: Professor at Yıldız Technical University and Istanbul University-Cerrahpaşa. Graduated from Selçuk University Primary School Teaching bachelor's and master's degrees. Completed his PhD in the same field at Gazi University. His research areas are literacy education, reading science, primary school education, and primary school teachers.

SC Scopus Author Identifier Number: 56520075500

Web of Science Researcher ID: D-4711-2019

Google Scholar Researcher ID:

https://scholar.google.com.tr/citations?user=416SeQsAAAAJ&hl=tr

Meltem Atasoy: Research assistant at İstanbul University-Cerrahpaşa Hasan Âli Yücel Faculty of Education. She graduated from Ege University, Department of Primary School Teaching. She is continuing her master's degree in the same field at Istanbul University-Cerrahpaşa. Her research interests are on primary school teachers, and primary school education.

Web of Science Researcher ID: HCH-8258-2022

Google Scholar Researcher ID:

https://scholar.google.com.tr/citations?user=wZqtDaAAAAAJ

Burak Öncü 3: Doctor of Education in Primary School Teaching. He graduated from Istanbul University as a primary school teacher. He completed his master's degree in educational administration at Bahçeşehir University and his doctorate in Primary School Teaching at Istanbul University-Cerrahpaşa. His research areas are literacy education, reading science, primary school education, and primary school teachers.

Google Scholar Researcher ID:

https://scholar.google.com/citations?user=drurEYsAAAAJ&hl=tr

Research

Enhancing Critical Reflection in Preservice Teacher Internships: Examining the Impact of 360-Degree Video and Virtual Reality Technology

Heather Stefanski[1]   Mohamed Ibrahim[2]

Article Type
Original Research

Abstract:

Preservice teachers (PSTs) frequently face challenges with classroom management, a key aspect of effective teaching. Reflective practice is crucial for PSTs to enhance their skills, but their reflections tend to be superficial. This mixed-methods study explores whether integrating 360-degree video and virtual reality (VR) technology with a modified Gibbs Reflective Cycle can improve PSTs' critical reflection on their classroom management practices. Twelve PSTs, engaged in full-time internships at middle schools, recorded their lessons using 360-degree cameras and reviewed the footage via VR headsets. Reflections were completed at three stages for each of two observed lessons: immediately after teaching, following a review of 2D video, and after viewing the 360-degree VR video. Paired samples t-tests revealed significant improvements in PSTs' self-assessments of classroom management after reviewing the 360 VR video compared to memory and 2D video. Despite technical issues, the results indicate that immersive 360 VR video, combined with structured reflection, can enhance PSTs' objective self-assessment, inform their pedagogical decision-making, and foster actionable insights to improve classroom management skills. This study contributes to research on immersive technologies in teacher education and underscores the value of structured reflection in supporting PSTs' professional development.

Keywords: Critical reflection, Preservice teacher education, 360-degree video, Virtual reality headsets, Classroom management.

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[1] Assistant Professor of Teaching & Educational Leadership, Arkansas Tech University, College of Education and Health, Russellville, U.S.A. hstefanski@atu.edu, ⓘD https://orcid.org/0009-0001-0808-9690

[2] Professor of Teaching & Educational Leadership, Arkansas Tech University, College of Education and Health, Russellville, U.S.A. mibrahim1@atu.edu, ⓘD https://orcid.org/0000-0003-4618-2463

INTRODUCTION

During an informal conversation with pre-service teachers (PSTs) just before their full internship experience, the overwhelming majority expressed significant concerns about classroom management. For many of these PSTs, classroom management seemed synonymous with controlling student behavior. They voiced worries about maintaining student attention and ensuring students "do what they are told." Additionally, PSTs revealed anxieties about how they might react in the face of a disruptive or explosive situation and how such events could be prevented. Research has well-documented that classroom management is a prominent concern among PSTs and is often cited as a key reason why some graduates never pursue a teaching career (Theelen, et al., 2018).

In Arkansas, teachers are evaluated using the Teacher Excellence and Support System (TESS) rubric, which is grounded in Charlotte Danielson's Framework for Teaching (Arkansas Department of Education). The development of the TESS rubric can be traced back to the 2002 No Child Left Behind Act, which aimed to improve schools and increase accountability, ultimately becoming the catalyst for the overhaul of teacher evaluation systems across the country. In 2011, Arkansas responded to state legislation by creating the TESS evaluation system, which was revised in 2013 to incorporate Danielson's framework (Byford, 2018). Danielson's framework was chosen due to its research backing and comprehensive approach to evaluating all aspects of teaching, providing principals with a structured method to determine teachers' support needs.

By 2014, 20 states had adopted Danielson's framework or a modified version to qualify for Race to the Top funds, an initiative led by the Obama administration aimed at reforming teacher evaluation systems (Dodson, 2017). The TESS rubric consists of four domains: Planning and Preparation, The Classroom Environment, Instruction, and Professional Responsibilities. PSTs are evaluated using the Aspiring Teacher Rubric, which closely aligns with TESS. Of particular relevance to PST concerns is Domain 2: The Classroom Environment, which encompasses classroom management, the area that many PSTs find most challenging. This domain covers key elements such as establishing respect and rapport, fostering a culture of learning, managing procedures and student behavior, and organizing the physical space. Effective classroom management is crucial because it directly impacts student learning; disruptive behavior can significantly derail lessons, resulting in lost instructional time as teachers are forced to address behavior issues.

Adeyemo (2012) identified common disruptive behaviors faced by teachers, including bullying, hitting, name-calling, sleeping in class, excessive chatting, lateness, unexcused exits, and verbal or physical threats. These behaviors can persistently interfere with academic learning, making it difficult for both students and teachers to maintain a functional and productive classroom environment. To address these challenges, it is essential for PSTs to focus on building relationships, understanding child development, planning effectively, and monitoring classroom dynamics (Emmer & Evertson, 2017).

For PSTs, critical reflection on their teaching practice is key to improving classroom management. Critical reflection involves objectively examining lesson content and teaching processes, then applying these insights to enhance future practice. This is particularly important for PSTs because, as Liu (2015) notes, "the ultimate goal of critical reflection is producing actions for enhanced student learning" (p. 144).

To develop the capacity for critical reflection, PSTs must first learn to assess their own teaching accurately, identifying both strengths and areas for improvement. A common approach to facilitating reflection is having PSTs review video recordings of their lessons. These 2D video recordings provide a concrete representation of what occurred in the classroom, helping PSTs differentiate between their perceptions and the actual events (Walshe & Driver, 2019). Recorded lessons offer a valuable tool for reflection by anchoring the PST's self-assessment in objective evidence rather than memory (Liu, 2015).

Additionally, traditional video recordings, emerging technologies such as 360-degree cameras and virtual reality (VR) headsets offer new opportunities for enhancing reflective practice. Unlike standard fixed-camera recordings, 360-degree cameras capture the entire classroom environment, allowing for a more immersive and comprehensive review of classroom interactions. When paired with VR headsets like the Oculus Quest 2, PSTs can virtually "walk" around the classroom, observing student behavior and classroom dynamics from multiple perspectives (Kosko et al., 2021). This immersive technology has the potential to deepen PSTs' reflections and provide more detailed insights into their classroom management strategies.

Thus, this study seeks to investigate the impact of using 360-degree cameras and VR headsets on PSTs' ability to reflect on their practice more objectively and critically. By exploring how these technologies influence self-assessment and reflective practice, this research aims to enhance the tools available for developing effective classroom management skills among PSTs.

Literature review

Many educator preparation programs incorporate reflective practices throughout their coursework, but the types and processes of reflection vary significantly (Beauchamp, 2015). Reflection is considered essential for PSTs as it bridges their experiences with problem-solving and decision-making. All teachers need to justify their teaching strategies, showing how they guide students toward proficiency and how learning events are sequenced for optimal understanding.

Course instructors in teacher preparation programs often require PSTs to write reflections as a way to externalize their thought processes (Mulryan-Kyne, 2021). However, literature suggests that PST reflections frequently remain at a surface level and are unproductive. Common criticisms highlight that PSTs tend to describe what they did in the classroom without connecting their actions to a clear rationale, emphasizing their strengths

while downplaying weaknesses to influence grades, and writing reflections filled with clichés and educational jargon (Beauchamp, 2015).

Walshe and Driver (2019) recommend scaffolding the reflective process and teaching deliberate methods to help PSTs engage in deeper self-analysis that supports professional growth. Mulryan-Kyne (2021) noted that frameworks such as Ward and McCotter's (2004) outline three essential elements for reflection: reflection as situated practice, cyclic reflection, and incorporating multiple perspectives. This study used a modified version of Gibbs' Reflective Cycle, which includes these three elements, to guide participants. Gibbs' model provides a systematic approach for PSTs to reflect on their teaching, which is particularly helpful for novices until reflection becomes an intuitive practice. The cycle consists of describing the event, acknowledging feelings during or after the event, evaluating and analyzing what happened, drawing conclusions, and determining future actions (Gibbs, 1988).

To promote objectivity in reflection, many educator preparation programs require PSTs to video record their lessons using 2-dimensional video recorders. Video recordings help PSTs capture more detail and provide concrete evidence for their reflections (Rosaen et al., 2008). While video recordings support recall, they offer a limited perspective due to the fixed camera angle, often capturing only a portion of the classroom and interactions—a limitation referred to as the "keyhole effect" (Atal et al., 2023). Additionally, 2D video recordings often suffer from poor sound quality due to the camera's distance from the action, further hindering the reflective process.

In recent years, 360-degree video technology has become more accessible and user-friendly, leading to its increased use in internships and educational settings. Unlike traditional recordings, 360-degree video offers a comprehensive view of the classroom, enabling viewers to observe interactions from multiple perspectives simultaneously. When placed strategically in the center of the room, these cameras also improve sound quality, capturing a more holistic classroom experience. However, while 360-degree video and virtual reality (VR) headsets offer immersive experiences, they do have limitations. Viewers can explore the recorded space but cannot interact with the content directly. Moreover, learning to operate 360-degree cameras and VR headsets can present a steep learning curve, requiring both training for optimal use and some adaptation to the technology (Roche, Kittel, et al., 2021). In addition, VR headsets may cause overstimulation, dizziness, or discomfort, particularly for individuals who wear glasses or are sensitive to wearing devices on their faces (Fransson et al., 2020). Despite these challenges, with practice, the advantages of immersive 360-degree video may outweigh the potential discomforts, transforming how PSTs reflect on their teaching (Roche, Cunningham, et al, 2021).

Schon's (1987) theory of reflective practice distinguishes between two types: reflection-on-action and reflection-in-action. Reflection-on-action occurs after an event, allowing teachers to analyze their past decisions, while reflection-in-action happens in the

moment, requiring teachers to think on their feet and make immediate adjustments (Third, 2022). For PSTs, who have limited teaching experience, opportunities to practice reflection-in-action are scarce. Yet during their internships, PSTs are expected to reflect-on-action in ways that simulate reflection-in-action. This can be challenging, but 360-degree video and VR technology can help PSTs better develop these skills. The immersive nature of technology allows PSTs to mentally revisit their teaching moments, offering enhanced recall of their in-the-moment thinking. Although the video is viewed post-lesson, it can create links to the reflective processes that occur during the lesson itself.

Teacher evaluation systems, such as TESS, assess classroom management and "on-the-spot" decision-making, require PSTs to reflect on their in-the-moment actions, analyze situations, and plan for future improvements. Combining immersive technologies like 360-degree video with structured reflective models such as Gibbs Reflective Cycle offers a promising avenue for developing critical reflection skills that mirror authentic classroom experiences.

This study required PSTs to focus on Domain 2: The Classroom Environment of the TESS rubric (Appendix A) during lessons and under three reflective conditions: memory, 2D video, and 360-degree VR. Domain 2, which addresses classroom management, was chosen because it reflects the concerns frequently expressed by PSTs. The study sought to explore how 360-degree cameras and VR headsets could impact PSTs' ability to objectively reflect on this domain. Gibbs' Reflective Cycle was selected as the reflective framework, as PSTs often reflect superficially, and this model prompts deeper thinking about classroom management, analyzing actions, and decision-making. The immersive nature of 360-degree VR technology offers a realistic setting conducive to objective self-assessment, aligning with the stages of Gibbs' Cycle, which begins with evidence-based description and analysis.

Research Question

Thus, this study's research question was: Can a modified Gibbs' Reflective Cycle, combined with 360-degree video and VR headsets, increase PSTs' ability to objectively self-assess Domain 2: The Classroom Environment?

Theoretical Framework

This study is grounded in constructivist learning theory, with a particular emphasis on active learning. Constructivism asserts that learners actively construct their own knowledge by integrating new information with their existing cognitive frameworks (Fernando & Marikar, 2017). Within this approach, learning is seen as a dynamic process where individuals are not passive recipients of information but active participants in creating meaning from their experiences. Active learning, a key aspect of constructivism, requires students to engage deeply with content by doing something and then reflecting on those actions (Vanhorn et al., 2019).

Active learning encourages students to participate in higher-order thinking tasks, such as analyzing, synthesizing, and evaluating (Bonwell & Eison, 1991). This study adopts this approach through the use of Gibbs' Reflective Cycle, which provides a structured framework for reflection. PSTs in this study taught lessons and then actively engaged in the reflective process by analyzing their classroom management practices using Domain 2: The Classroom Environment from the Aspiring Teacher Rubric. This reflection involved synthesizing insights from their teaching experiences, identifying best practices, and evaluating their classroom management strategies to identify areas for improvement.
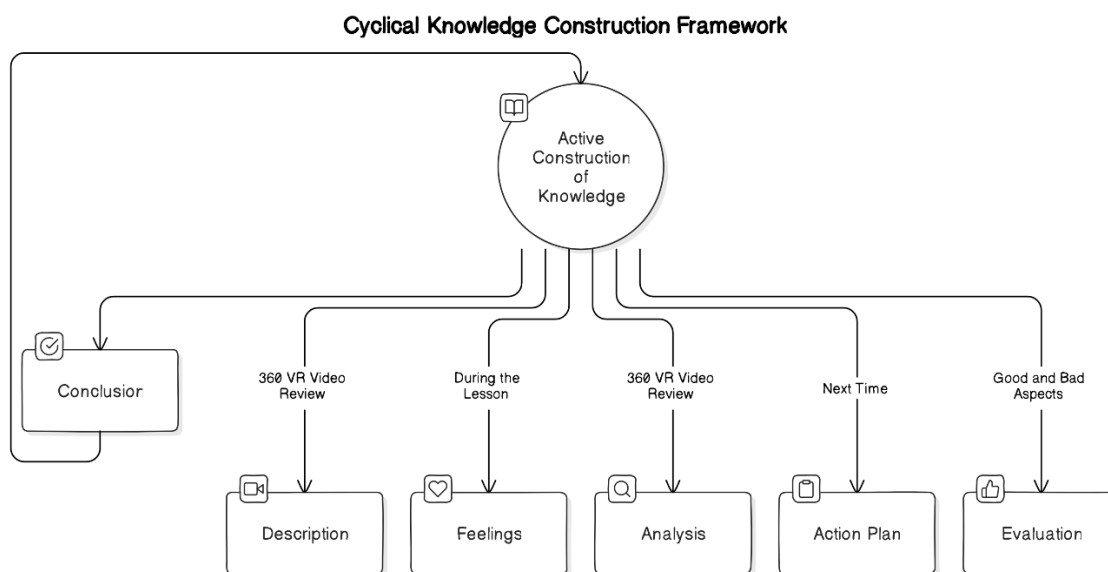

Figure 1. Research Cyclical Knowledge Construction Framework

The use of authentic, real-time scenarios during the PSTs' full internships provided a rich context for reflection and knowledge construction. As PSTs progressed through the semester, they built on their reflections by incorporating feedback from mentors and supervisors, engaging in professional development opportunities, and utilizing recommended resources. These iterative cycles of reflection and feedback allowed PSTs to continuously refine their classroom management skills, aligning with the principles of constructivist active learning.

Through this process, PSTs did not simply receive feedback passively; rather, they actively constructed knowledge by connecting reflective insights to their practical teaching experiences. This iterative learning and reflection cycle reflects the core of active learning, where knowledge is continuously shaped by actions, experiences, and critical thinking.

METHOD

This study employed mixed methods design, utilizing both quantitative and qualitative data collection through survey-style reflection guides and optional participant

narratives. The open-ended narrative option was included to minimize the risk of rushed, superficial responses that can occur with required open-response questions, particularly when participants feel overwhelmed by their research tasks (Martins & Lavradio, 2020). Making the narrative voluntary acknowledged the demands of the PSTs' internships, while still offering an avenue for those who wished to share more detailed insights into their experiences. The central research question guiding this study was: Can a modified Gibbs' Reflective Cycle, combined with 360-degree video and VR headsets, enhance PSTs' ability to objectively self-assess Domain 2: The Classroom Environment?

Participants: The study involved 12 PSTs completing full middle school internships as part of an undergraduate program. Four PSTs participated in Spring 2023, while the remaining eight participated in Spring 2024. These PSTs were placed in local schools, teaching students in grades 4-8 in subjects including English Language Arts, Mathematics, Science, and Social Studies. Two of the participants taught across two grade levels. Table 1 provides a detailed breakdown of participants and their teaching assignments.

Table 1

Participants' Details

Scales	ELA	Math	Science	Social Studies
4th grade		1		
5th grade			2	1
6th grade				2
7th grade	2	3		2
8th grade		1		

Study Design and Procedures: PSTs in the study were observed using a combination of in-person and video-based methods. Per university policy, each PST was observed 2-3 times in person (depending on the distance to the school) and 1-2 times via 2-dimensional video. Feedback following each observation was provided using the Aspiring Teacher Rubric through a Google Form. For two of these observations, lessons were recorded using a 360-degree camera to allow for subsequent VR-based reflection.

The reflective process was structured using a modified version of Gibbs' Reflective Cycle, which omitted specific questions related to the participants' feelings and descriptions from the early steps of the cycle. This modification aimed to prevent superficial responses and mitigate the decline in reflection quality that can occur when using long, repetitive survey instruments (Martins & Lavradio, 2020). The PSTs completed the survey-style reflection guide (Appendix B) at three distinct intervals for two observed lessons:

1. Immediately post-teaching (based on memory),
2. After reviewing the 2D video recording, and
3. After viewing the 360-degree video using VR headsets.

This repeated process allowed PSTs to familiarize themselves with the procedures and technology, potentially enhancing their noticing skills—the ability to focus on key classroom events—

which is crucial for grounding reflection in objective evidence. During their internship course, PSTs were introduced to the Aspiring Teacher Rubric, trained to use Oculus Quest 2 VR headsets, and guided through the following study process:

1. Teach the lesson.
2. Provide initial impressions from memory, then: a. Complete the reflection guide based on Domain 2 of the Aspiring Teacher Rubric. b. Identify a solution to improve classroom management.
3. Watch the 2D video and: a. Complete the reflection guide again. b. Determine another solution based on the review.
4. Watch the 360-degree video using VR headsets via YouTube links and: a. Complete the reflection guide based on Domain 2. b. Propose an updated solution.
5. Supervisor feedback: Supervisors provided feedback and scores, with an optional video call for more detailed discussion.
6. Repeat the process for the next lesson using the new strategies identified.

Data Collection: Data were collected using a Google Form reflection guide, which was completed three times for each lesson: immediately after the lesson (based on memory), after reviewing the 2D video, and after reviewing the 360-degree video with a VR headset. To analyze the data, paired samples t-tests were conducted to evaluate whether there were significant differences in the PSTs' self-assessments of Domain 2: The Classroom Environment across the three reflection conditions.

An optional narrative section allowed PSTs to share their experiences with the use of 2D video and 360-degree video in conjunction with VR headsets, particularly in terms of whether they noticed more classroom events or changed their self-assessment scores after viewing the 360-degree video. Only two participants opted to provide a short narrative.

Summary of Procedures

1. PSTs reflected on lessons immediately after teaching (memory-based reflection).
2. They watched the 2D video of the lesson and completed another round of reflection.
3. They reviewed the 360-degree video using VR headsets and reflected again.
4. Supervisor feedback was provided, and the cycle was repeated for the next observation, integrating proposed solutions.

This structured process aimed to improve PSTs' reflective skills and their ability to objectively assess and address classroom management challenges, with particular focus on Domain 2 of the Aspiring Teacher Rubric.

Validity and Reliability: To ensure the validity and reliability of this mixed-methods study, several strategies were employed, drawing on best practices in educational research (Creswell & Miller, 2000; McMillan & Schumacher, 2014). These strategies were designed to enhance the accuracy, consistency, and credibility of the findings.

Detailed Narration and Long Implementation Process: The study was conducted over two semesters, with a long-term implementation process spanning multiple observations and reflections. This extended time frame allowed participants to engage deeply with the study process and become familiar with the reflection tools and technology, enhancing the credibility of their self-assessments.

Triangulation: Data were collected using a combination of survey-style reflection guides, optional participant narratives, and direct observation through 2D and 360-degree video. Triangulating these multiple data sources ensured a more comprehensive understanding of how PSTs reflect on their classroom management practices across different contexts. By comparing results from these various methods, the study was able to cross-check the consistency and validity of the findings.

Direct Quotation of Participants: In the qualitative portion of the study, participants' experiences and insights were captured using open-ended narratives. To maintain authenticity and ensure trustworthiness, participant statements were quoted directly in the analysis. This practice ensured that the voices of the PSTs were accurately represented and that their reflections were grounded in their own experiences.

Intercoder Reliability: During the qualitative data analysis, intercoder reliability was calculated to ensure consistency in coding and interpretation of the narrative data. Two independent coders analyzed the qualitative responses, and the agreement between the coders was assessed using the formula of Miles and Hubermann (1994). The intercoder reliability rate was found to be [Insert Reliability Rate], indicating a high level of agreement and reliability in the coding process.

Validity of Quantitative Data: For the quantitative portion of the study, paired samples t-tests were conducted to assess changes in participants' self-assessment scores. Assumptions for t-tests, such as normality and dependence, were carefully considered, and data were reviewed to ensure they met the necessary criteria for valid statistical analysis. The use of multiple observation cycles also contributed to the reliability of the quantitative data by allowing participants to refine their reflective practices over time.

The investigators combined detailed narration, triangulation, direct quotations, and intercoder reliability. Therefore, this study ensured the rigor and reliability of its findings. The methodological rigor employed in both the qualitative and quantitative components enhances the overall trustworthiness of the research and ensures that the results accurately reflect the impact of 360-degree video and VR headsets on PSTs' ability to reflect on classroom management.

Ethical Considerations

This study adhered to strict ethical guidelines to ensure the protection and well-being of all participants. Approval for the research was obtained from the Institutional Review Board (IRB) at Arkansas Tech University, under approval number E-2022-16. Participation in the study was entirely voluntary, and all participants provided informed consent prior to data collection. They were informed about the purpose of the study, the use of 360-degree video and VR technology, and the reflection processes involved. Participants were assured that their responses and self-assessments would remain confidential, and that no identifying information would be used in any published findings. Additionally, participants were given the option to withdraw from the study at any time without penalty. Careful measures were taken to protect the privacy and data of all individuals involved, ensuring that the research complied with the ethical standards set forth by the IRB and adhered to the principles of respect, beneficence, and justice.

RESULTS

This study utilized paired samples t-tests to compare the average self-assessment scores of the 12 participants across different stages of the reflection process: immediately after teaching, after reviewing the 2D video, and after reviewing the 360-degree video. Prior to conducting the t-tests, several assumptions were evaluated to ensure the validity of the results:

- Normality: Although the sample size was small (N = 12), normality of the difference scores was assumed based on the Central Limit Theorem.
- Dependence: The study design inherently assumed dependence, as the same participants were measured under different conditions.
- Scale of Measurement: The data were treated as interval or ratio scales, making them appropriate for mean comparisons using t-tests.

Descriptive Statistics: Descriptive statistics were calculated for each condition, revealing the following mean and standard deviation values in table 2:

Table 2

Descriptive Statistics for Each Condition

Condition	Mean (M)	Standard Deviation (SD)
Immediate post-teaching	35.63	6.97
Post 2D Video Review	38.50	7.23
Post 360-Degree Video Review	39.13	5.82

These descriptive statistics indicate that participants' self-assessment scores increased as they progressed through each reflective stage, with the highest scores observed after reviewing the 360-degree video.

Inferential Statistics: The paired samples t-tests revealed the following results in table 3 and 4:

Table 3

Paired Sample Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Reflection after teaching 01	35.63	12	6.968	2.464
	Reflection after teaching 02	38.50	12	7.231	2.557
Pair 2	Reflection after watching flat video 01	35.00	12	6.698	2.368
	Reflection after watching flat video 02	40.13	12	5.540	1.959
Pair 3	Reflection after watching 360 videos 01	35.38	12	4.340	1.535
	Reflection after watching 360 videos 02	39.13	12	5.817	2.057

Table 4

Summary of Paired Samples t-Tests Results

	Comparison Pair	t(11)	p-value	Result
Pair 1	Immediate Post-Teaching vs. Post 2D Video Review	-2.081	.076	Not statistically significant
Pair 2	Post 2D Video Review vs. Post 360-Degree Video Review	-4.621	.002	Statistically significant
Pair 3	Immediate Post-Teaching vs. Post 360-Degree Video Review	-3.035	.019	Statistically significant

Correlation: Correlation analysis further revealed strong positive relationships between the scores across the different reflection stages in table 5:

Table 5

Correlations Between Scores Across Different Reflection Stages

	Comparison Pair	Correlation (r)	p-value
Pair 1	Immediate Post-Teaching vs. Post 2D Video Review	.849	.008
Pair 2	Post 2D Video Review vs. Post 360-Degree Video Review	.885	.003
Pair 3	Immediate Post-Teaching vs. Post 360-Degree Video Review	.801	.017

These strong correlations indicate that while individual differences in self-assessment existed, there was a consistent trend toward improvement in self-assessment scores across the stages. This

suggests that the reflective process, particularly when enhanced by 360-degree video, led to more positive evaluations of classroom management practices.

Interpretation of Results: The results of this study demonstrate that preservice teachers' self-assessment of Domain 2: The Classroom Environment improved significantly after reviewing their teaching practices using 360-degree video recordings. This indicates the potential of immersive video technologies to enhance reflective practices and self-assessment in teacher education. The significant increase in scores after viewing 360-degree videos highlights the advantages of using immersive tools to capture a fuller, more comprehensive view of classroom dynamics, allowing PSTs to notice and reflect on key elements they may have missed in memory-based or 2D video reflections.

Additionally, the strong correlations between the stages suggest that while PSTs' self-assessment evolved over time, there was a consistent and positive trend toward deeper reflection and improved perceptions of their classroom management skills. These findings underscore the value of combining immersive technology with structured reflection frameworks, such as Gibbs' Reflective Cycle, to foster meaningful professional growth in teacher education. Table 6 summarizes the paired sample correlations.

Table 6

Paired Sample Correlations

		N	Correlation	Sig.
Pair 1	**Reflection after teaching 01 & Reflection after teaching 02**	12	.849	.008
Pair 2	**Reflection after watching flat video 01 & Reflection after watching flat video 02**	12	.885	.003
Pair 3	**Reflection after watching 360 videos 01 & Reflection after watching 360 videos 02**	12	.801	.017

Table 7

Paired Sample Test Results for Reflections at Different Stages

Comparison	Mean Difference	Std. Deviation	t-value	df	Sig. (2-tailed)
Pair 1 **Reflection after teaching 01-02**	-2.875	3.907	-2.081	11	.076
Pair 2 **Reflection after watching flat video 01 - 02**	-5.125	3.137	-4.621	11	.002
Pair 3 **Reflection after watching 360 videos 01 - 02**	-3.750	3.495	-3.035	11	.019

Only two participants provided a short narrative. Their responses are below:

Pre-service Teacher 1:

First off, I just want to say that using the VR headset was one of the coolest experiences that I ever had. I did not realize how useful it could be in terms of reflecting on my own teaching. On both of my surveys, I changed certain ratings from highly effective to effective after watching the 360 videos. Although I felt like my teaching was effective, I saw some room for improvement with little details from the 360 videos that I would have never noticed without the 360 camera. In both observations, especially my second observation, I noticed a few classroom management issues. Specifically, I noticed a few students who had been talking about off-topic things and distracting others, and I noticed some students who were staring off into space instead of paying attention, which I had not paid much attention to while teaching and even during the flat video. I also noticed how the materials and supplies could have been better arranged and organized. There were more traffic jams and off-topic conversations than I realized while the students were getting/putting away supplies/materials. These traffic jams and off-topic conversations resulted in loss of instructional time. I believe the 360 experience was a success, as it provided us with a view as if we were standing in the classroom in the moment of the lesson. It allows us to look in all directions of the classroom and see things that we cannot see while we are teaching or from a camera positioned in one spot of the room and from one camera angle. The most important things that I noticed were how the classroom and supplies were arranged and how many off-topic conversations/distractions were occurring when my back was turned or while I was helping another student. I am really glad I got the opportunity to be a part of this experience with the 360 cameras.

Pre-service Teacher 2:

Anytime I watch myself teach it is a little unnerving, but I feel that with the headset I was able to focus on the students far more than with the flat video. Often watching myself on the flat video I cringe but I knew going into this 360-video platform I would be more focused on the students. I think that by watching the 360 after watching the flat I was a able to garner more about how the students were engaging/not engaging with the overall lesson. I did end up changing a couple of the ratings I gave myself. I do not remember which ones but I feel that I was more forgiving the third time I completed the survey. I think the reason I was more forgiving after watching the headset because I felt that I was able to catch the students attention better than I thought I had.

While only two narratives were provided, they offer valuable insights into how participants' perspectives shifted when using 360-degree VR compared to traditional 2D video. Pre-Service Teacher 1 lowered their self-assessment ratings after noticing off-task student behaviors and classroom organization issues that had previously gone unnoticed. This highlights the potential of 360-degree video to reveal overlooked classroom dynamics, such as distractions or ineffective space management. Conversely, Pre-Service Teacher 2 increased their ratings after observing greater student engagement through the

360-degree video, which shifted their focus away from personal discomfort in the 2D video and toward student interactions.

These differing perspectives underscore the potential of 360-degree VR technology to enhance reflective practices by providing a fuller, more immersive view of classroom dynamics. This finding aligns with prior research suggesting that 360-degree video can offer a more comprehensive understanding of classroom interactions, allowing teachers to notice and reflect on aspects of their teaching that might otherwise be missed (Kosko et al., 2021).

DISCUSSION

Despite the relatively small sample size of 12 PSTs, this study's findings provide compelling evidence of significant improvements in their self-assessment ratings for Domain 2: The Classroom Environment after using 360-degree video and VR headsets for reflective practice. These improvements, particularly in comparison to post-teaching and post-2D video reflection, suggest that immersive technologies offer distinct advantages for enhancing PSTs' ability to objectively assess their classroom management. While this study offers a promising step forward, further research with larger samples over multiple semesters is needed to validate these findings and confirm the broader applicability of 360 VR in teacher education.

The optional narratives, though insightful, were limited in number. The two PSTs who provided detailed feedback highlighted valuable shifts in their perceptions of classroom dynamics, suggesting that the 360 VR experience prompted deeper reflection than the traditional 2D video. However, future research should explore ways to encourage more participants to contribute qualitative insights. Incentives or structured prompts might be employed to increase narrative participation, thus allowing for a richer qualitative data set that complements the quantitative findings. Gathering more qualitative reflections could deepen our understanding of how PSTs experience 360 VR technology and how it influences their reflective processes.

Some technical challenges were encountered during the study, particularly with the use of VR headsets and 360-degree cameras. Several PSTs reported difficulties with viewing the 360 videos via VR headsets, pointing to the need for additional training and technical support in future studies. Furthermore, the tendency of 360 cameras to overheat and turn off after 30-45 minutes—depending on the room temperature—limited the duration of recorded lessons. Additionally, the time required to process and upload 360 videos to YouTube in multiple short segments for VR viewing was considerable, often taking upwards of 1.5 hours per video. While this may pose logistical challenges, YouTube's view counts can verify whether PSTs watched all segments, offering some accountability in the reflection process. Despite these technological hurdles, the benefits of 360 VR in promoting reflective practice appear to justify the investment of time and resources.

One unexpected result was the non-significant difference between post-teaching and post-2D video reflection scores. This suggests that PSTs may have effectively recalled key moments from memory as accurately as they did when prompted by the 2D video. The limited scope of 2D video, which often captures only part of the classroom, may not have provided PSTs with new insights beyond what they had already noticed during teaching. In contrast, the 360-degree VR video offered a more comprehensive view, allowing PSTs to notice details that were missed both in the moment of teaching and when reviewing the 2D video. This expansive view allowed PSTs to identify off-task student behavior, classroom management issues, and organizational inefficiencies that they would not have otherwise detected.

From a theoretical standpoint, the findings align with constructivist active learning theory, which emphasizes the active construction of knowledge through meaningful engagement and reflection. The 360 VR experience created an immersive environment that helped PSTs situate themselves back in the classroom, enabling them to critically observe salient details and analyze their teaching from a more objective perspective. This focused reflection allowed PSTs to construct new understandings of classroom dynamics, leading to more informed pedagogical decisions in future lessons. By linking their reflections to concrete evidence from the 360 video, PSTs exemplified the principles of active learning by actively building on prior knowledge and experiences to improve their teaching practices.

The use of 360 VR technology thus served as a scaffold for PSTs' knowledge construction, offering a holistic view of their classrooms that traditional reflection tools like 2D video or memory-based reflection could not provide. The ability to virtually navigate the classroom and observe interactions from different angles helped PSTs engage more deeply in reflection, leading to more nuanced insights about classroom management and student behavior. This scaffolding effect is essential for novice teachers, who often struggle to objectively assess their own performance. By offering a more comprehensive view of their teaching environment, 360 VR technology helps bridge the gap between reflection-in-action and reflection-on-action, allowing PSTs to gain a more accurate and complete picture of their teaching.

In conclusion, this study underscores the potential of 360 VR technology to enhance reflective practice in teacher education by providing a richer, more immersive perspective on classroom dynamics. Future research should build on these findings by exploring larger samples, addressing technical challenges, and expanding the use of qualitative methods to capture the depth of PSTs' reflective experiences. By integrating 360 VR into reflective cycles, educator preparation programs may better equip PSTs with the tools to critically reflect, self-assess, and improve their teaching practices in meaningful ways.

LIMITATIONS AND RECOMONDATIONS

This study has several key limitations that should be acknowledged. First, the small sample size (N = 12) and the short implementation period limit the generalizability of the

findings. With such a small cohort, the results may not fully represent the broader population of preservice teachers (PSTs). Future research should aim to recruit larger samples and collect data over multiple internship cycles to assess the reliability and broader applicability of these findings. A longitudinal approach would also be valuable, allowing researchers to track PSTs' reflective growth and performance in Domain 2: The Classroom Environment over time as they gain more experience with 360-degree video analysis.

Another limitation of this study was the brevity of the reflection guide, which omitted some components of Gibbs' Reflective Cycle to prevent participant fatigue. While the modified guide served the study's purpose, it may have reduced the depth of reflection in some areas. Future studies should consider using the full model, incorporating all stages of Gibbs' Reflective Cycle, to explore how each stage impacts PSTs' self-assessment and professional growth. Additionally, integrating semi-structured interviews alongside the reflection guide could provide richer qualitative data, allowing for deeper insights into PSTs' experiences with 360-degree video and VR reflection.

This study also relied on self-report data, which, while essential for fostering reflective practice, carries the risk of PSTs either overestimating or underestimating their performance. To address this, future research could triangulate self-assessment data with mentor teacher and university supervisor observations, offering a more comprehensive and objective picture of PSTs' proficiency in Domain 2. This would provide a more balanced evaluation of their classroom management and environmental awareness, helping to ensure that PSTs' reflective growth aligns with external observations and assessments.

In conclusion, this study provides evidence that integrating 360-degree video and VR technology into teacher education, combined with a modified version of Gibbs' Reflective Cycle, can significantly enhance PSTs' ability to reflect on and objectively assess their classroom management. Immersive video technology enables PSTs to develop a more nuanced, evidence-based understanding of their teaching practice, allowing them to identify key areas for improvement. As teacher educators seek innovative ways to foster reflective practitioners, the use of 360-degree VR video offers an exciting opportunity to provide authentic, detailed portrayals of classroom dynamics. Despite the technological challenges, the potential for this approach to enrich PSTs' professional knowledge and catalyze meaningful growth is well worth further exploration and refinement.

CONCLUSION

This study explored the potential of integrating 360-degree video and virtual reality (VR) technology with a modified version of Gibbs' Reflective Cycle to enhance preservice teachers' (PSTs) ability to objectively assess their classroom management practices, specifically in Domain 2: The Classroom Environment. The findings indicate that using immersive 360-degree video can significantly improve PSTs' reflective practices by offering a more comprehensive and detailed view of classroom interactions compared to traditional 2D video or memory-based reflection. PSTs were able to notice key elements of student

behavior, classroom organization, and engagement that they might have otherwise missed, thereby facilitating deeper, more critical reflection on their teaching performance. Future research will focus on increasing the sample size and addressing the technological challenges.

While the study was limited by its small sample size and technical challenges, the results suggest that immersive technologies like 360-degree video and VR hold significant promise in teacher education. By situating PSTs in an environment that closely mirrors their real-world teaching experiences, these tools enable them to engage in more meaningful reflection, leading to better-informed pedagogical decisions and an enhanced understanding of classroom dynamics. The integration of these technologies supports a constructivist approach to learning, where PSTs actively build knowledge from their teaching experiences and reflection, ultimately leading to professional growth.

The potential benefits of 360-degree video and VR technology in fostering reflective practitioners warrant further investigation, particularly with larger samples and longer study durations. As teacher educators seek new and innovative methods to support PSTs in becoming effective, reflective teachers, the incorporation of immersive technologies offers a valuable tool for scaffolding PSTs' reflective abilities and enhancing their professional development.

In conclusion, while the adoption of 360-degree video and VR technology in teacher education presents certain challenges, its ability to transform the reflective process and enrich PSTs' learning experience makes it a powerful addition to teacher preparation programs. By continuing to explore and refine these methods, teacher educators can better prepare PSTs to navigate the complexities of classroom management and become reflective, adaptive, and effective educators.

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Data Availability Declaration

Data Availability Upon Formal Request:

While the primary datasets utilized in this study are not publicly accessible due to certain constraints, they are available to researchers upon a formal request. The authors have emphasized maintaining the integrity of the data and its analytical rigor. To access the datasets or seek further clarifications, kindly reach out to the corresponding author. Our aim is to foster collaborative academic efforts while upholding the highest standards of research integrity.

Author Contributions

Multiple Authors with Equal Contribution:

Author Contributions:

All authors, Heather Stefanski, and Mohamed Ibrahim, contributed equally to this work. They collaboratively handled conceptualization, methodology design, data acquisition, and analysis. Each author played a significant role in drafting and revising the manuscript, ensuring its intellectual depth and coherence. All authors have thoroughly reviewed, provided critical feedback, and approved the final version of the manuscript. They jointly take responsibility for the accuracy and integrity of the research.

Biographical notes:

Heather Stefanski 1[3]: Dr. Heather Stefanski, Ed.D. is the Director/Advisor Middle Level Education and Assistant Professor, Teaching and Educational Leadership at Arkansas Tech University. Russellville, Arkansas 72801, USA.

SC Scopus Author Identifier Number: None

Web of Science Researcher ID: None

Google Scholar Researcher ID: None

Mohamed Ibrahim 2: Dr. Mohamed Ibrahim is a Professor and Graduate Program Director at Arkansas Tech University. His research and teaching focus on integrating educational technology, multimedia design, and innovative pedagogies to enhance student motivation and learning outcomes..

SC Scopus Author Identifier Number : None

Web of Science Researcher ID: IWD-6564-2023

Google Scholar Researcher ID: Fd6opoIAAAAJ

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[3] Corresponding Author

Appendix A

Domain 2: The Classroom Environment

Standard	Effective Look Fors
2a: Creating an Environment of Respect and Rapport	- ensures that talk between the teacher candidate and students and among students is consistently respectful. - appropriately responds to disrespectful behavior among students. - makes general connections with individual students. - creates a learning environment that enables students to exhibit respect for the teacher candidate and other students.
2b: Establishing a Culture for Learning	- demonstrates that grade level learning expectations exist for all students. - ensures students can articulate the learning expectation(s) and/or connection to previous learning. - ensures most students are engaged with the learning goals and appear to be on task with assigned content or tasks. - ensures most students are engaged with class or group discussion around content. - is explicit in communicating expectations (e.g., what students will be doing - 1st, next, etc.) that are aligned to class learning objectives. - ensures students are doing what the teacher has asked based upon the objective of the lesson. - monitors students' work and provides just-in-time feedback to support students' ability to meet the objectives.
2c: Managing Classroom Procedures	- ensures that students move from one place to another in the classroom with efficiency. - has structures and procedures in place and uses those structures for students to efficiently get supplies, move from place to place, etc. - ensures transitions are smooth and takes minimal time. - ensures classroom jobs or responsibilities are in place. - ensures students know the transition routines and follow them. - ensures routines and procedures, whether developed by the teacher candidate or adopted from the mentor teacher, for things like bathroom breaks, getting/putting away supplies, lining up, attendance, lunch count, etc. are clear to the observer and students appear aware of them.
2d: Managing Student Behavior	- uses an established set of objective classroom expectations - preferably visible to the students and others in the classroom. - is consistent and equitable with enforcing classroom expectations with all students. - ensures that students know and follow the class expectations.

	- calmly corrects inappropriate behavior in a manner that is respectful and appropriate for the situation. - may have nonverbal cues/signals to help correct behavior with students. - may use callbacks or some other group attention signal to get the whole class's attention. - may use classroom management structure/strategy to recognize positive behavior as a way to get the whole group to follow instructions.
2e: Organizing Physical Space	- ensures the classroom is safe, clean, and orderly. - sets up or uses the physical space established by the mentor teacher in a way that adjusts for any special needs of students in the classroom. - ensures the classroom is set up in such a way that it supports collaborative as well as individual work. - organizes all students to interact, practice, or complete learning tasks. - ensures materials are easily accessible to the students, students can readily see/hear instruction, etc. - ensures that it is clear that people's feelings are honored and valued. - ensures the physical arrangement contributes productively to the learning activities.

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