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CONTENTS

CHAPTER 1

EXAMINATION OF SCIENCE TEACHERS' CONCEPTUAL UNDERSTANDING OF SCIENTIFIC LITERACY AND ITS DIMENSIONS

Gülşah GÜRKAN[1]

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1. Introduction

The overarching goal of the reforms in science education is to raise scientifically literate individuals who are equipped to live in a dynamic society by following developments willingly (Flores, 2019). In parallel with developments in science and technology, educational institutions aim to increase the quality of human resources with competencies helping individuals compete globally (Rina, Murtini & Indriayu, 2019). Due to the obvious and undeniable influence of science on countries' development, countries around the world invest in science education and development. The necessary competencies can be obtained through education to possess features that encourage society to produce something with economic return and innovate (Kuncoro & Rusdianto, 2016). It has been observed that efforts and reforms that do not take into account teacher characteristics and participation in order to improve the quality of science education have failed (Altun-Yalcin, Acisli, & Turgut, 2011; Bacanak & Gökdere, 2009). Teachers play a very important role in developing scientific literacy at all levels of the education system. To improve students' scientific literacy, teachers themselves should also have developed scientific literacy (Carter & Norwood, 1997; Cavas, Ozdem, Cavas, Cakiroglu & Ertepinar, 2013). In this respect, preservice teachers and teachers with low scientific literacy cannot be expected to develop scientifically literate students (Flores, 2019).

Since the concept of scientific literacy is context-dependent, it does not have a universally accepted definition (DeBoer 2000; Roberts 2007). While defining scientific literacy, the PISA 2006 evaluation considers it as the knowledge required in the use of processes involved in addressing scientific issues, situations in which these processes can be applied, and mental processes including the attitudinal aspects of students' reactions while using their knowledge and processes. The characteristics that scientifically literate individuals should have can be listed as scientific knowledge and the use of this knowledge to determine their questions, acquiring new knowledge, explaining scientific phenomena, and drawing evidence-based conclusions about science-related issues, understanding the characteristics of science as a form of human knowledge and research, awareness of how science and technology shape our lives in material, intellectual, and cultural environments, and the willingness to participate in science-related issues and science ideas as a thinking citizen (Organisation for Economic Co-operation and Development [OECD], 2006).

Within the PISA framework, the context, situations related to personal, social, and global life in five application areas were addressed in the context of health, natural resources, environment, danger, and limits of science and technology dimensions. These application areas of science are of particular importance for individuals and communities in promoting and maintaining

the quality of life and developing public policies (OECD 2006). When it comes to scientific literacy education, emphasis should be placed on encouraging science knowledge that will help students see the relationship between the science they learn at school and the events and observations they experience in daily life and helping them become conscious users and consumers of information in their daily lives (Sarkar & Corrigan, 2014).

The interest in scientific literacy has increased as the public's attitude toward science has become more important and official support for science has increased due to its economic benefits. In recent years, educators concerned about how well students respond to science courses, instructors concerned about the decreasing number of students choosing science majors, and governments starting to be concerned about the decreasing number of industrialists, skilled scientists and engineers started to be more inclined toward the issue of the influence of all these impacts on economic growth (O'Toole, McKoy, Freestone & Osborn, 2020). In this context, students should be equipped with skills ensuring that they develop in society, think critically, are creative, solve problems, struggle with difficulties, and have an understanding of applying the concept of science in problem-solving. Scientific literacy is an essential skill for solving various problems in both ethical, moral, and global contexts due to rapid changes in science and technology. Literacy means not only measuring the level of understanding science but also understanding various scientific processes and having the ability to apply knowledge and science processes to real situations. Although scientific literacy is included in science curricula, teachers do not have much experience in how to teach scientific literacy to students (Widowati, Widodo, Anjarsari & Setuju, 2017). In this respect, since it is thought that determining teachers' conceptual understanding of scientific literacy will be effective in reflecting this understanding on their students, it is aimed to reveal teachers' conceptual understanding of scientific literacy in the study. The components of the scientific literacy, nature of science, and science-technology-society dimensions are presented appendix 2.

2. Method

2.1. Research Design

The study was planned according to the case study, one of the qualitative research designs. Data were collected using a semi-structured interview form. The data collection tool includes three main questions and four questions within each question.

2.2. Study group

The study was conducted with 17 science teachers. Table 2 contains the demographic information of the study group.

Table 1. Demographic information of the study group

Variables		f	%
Gender	Female	9	52.9
	Male	8	47.1
Branch	Science	17	100
Seniority	1-5 years	1	5.9
	6-10 years	4	23.5
	11-15 years	3	17.6
	16-20 years	3	17.6
	21-25 years	5	29.4
	26-30 years	1	5.9
Total		17	100

2.3. Data Collection Tool

In the study, a semi-structured interview form was created to collect data face-to-face as a data collection tool. This interview protocol consists of three main open-ended questions belonging to the main dimensions (scientific literacy-nature of science-science-technology-society) and four sub-questions corresponding to each of these dimensions. The questions of the interview are given in Appendix 1.

2.4. Data Analysis

Themes and codes were created as a result of semi-structured interviews held with teachers. By adding each data to the code list, themes thought to represent these codes in general were created. Qualitative results were quantified as percentages to make a comparison between the dimensions (Fraenkel et al., 2012; Miles et al., 2014). The data were analyzed by two different science education experts by dividing them into themes. The numbers of "agreement" and "disagreement" in the themes created by the researchers were determined, and the study's reliability was calculated using the formula (Reliability = agreement/agreement + disagreement X 100) proposed by Miles and Huberman (1994). To ensure reliability in a qualitative study, the agreement between researchers should be at least 80% (Creswell, 2013). Another source stated that 90% and higher agreement among researchers in qualitative research provided desirable reliability (Saban, 2009). The reliability coefficient of this study provided 94% agreement. Appropriate tables were created for each research question and presented in the results section below.

Subdivide text into unnumbered sections, using short, meaningful sub-headings. Please do not use numbered headings. Please limit heading use to three levels. Please use 12-point bold for first-level headings, 10-point bold for second-level headings, and 10-point italics for third -level headings with an initial capital letter for any proper nouns. Leave one blank line

after each heading and two blank lines before each heading. (Exception: leave one line between consecutive headings.) Please margin all headings to the left.

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3. Results

This section includes the themes created as a result of the answers given to the questions about scientific literacy and its dimensions and quotations from the interviews regarding these themes.

Table 2. Themes and examples of participant quotations for the scientific literacy dimension

(Have you heard of the concept of scientific literacy? What does scientific literacy mean to you?)

Theme	N	Quotations from interviews
Being able to understand and interpret information	6 (T1, T2, T4, T11, T16, T17)	*"The ability to understand, recognize, and interpret many events in social life according to scientific knowledge (T2)"* *"Interpreting knowledge scientifically, understanding and transferring it to life (T17)"*
Following scientific developments	4 (T3, T6, T7, T8)	*"Following and contributing to scientific developments (T6)"*
Ability to criticize and question	3 (T9, T10, T12)	*"The ability to understand, interpret, and question scientific knowledge (T10)"*
Presenting evidence	2 (T13, T14)	*"Academic and scientific studies need to reach certain evidence as a result of general research (T14)"*
Developing a scientific point of view	2 (T5, T15)	*"Being able to read scientific knowledge and being able to develop a scientific point-of-view (T15)"*

The teachers' answers to the question, "Have you heard of the concept of scientific literacy? What does scientific literacy mean to you?", were gathered under five themes, being able to understand and interpret information, following scientific developments, ability to criticize and

question, presenting evidence, and developing a scientific point of view. The teachers mostly answered the question of what scientific literacy was as being able to understand and interpret information (f=5). It was seen that 64% (N= 11) of science teachers addressed three of the six components (Appendix 1) of scientific literacy.

Table 3. Themes and examples of participant quotations for the scientific literacy dimension

(How would you define a scientifically literate person?)

Theme	N	Quotations from interviews
Having the ability to interpret and question	7 (T1, T4, T10, T11, T12, T15, T16)	*"It is a person who can interpret the problems, concepts, and events he encounters in accordance with scientific realities (T11)"*
Able to look at events from a scientific point of view	3 (T2, T5, T17)	*"It is a person who can look at and evaluate events from a scientific point of view (T2)"*
Interested in science	2 (T3, T14)	*"It is a person who is interested in science (T3)"*
Following scientific developments	2 (T6, T7)	*"They are people who follow scientific innovations and share what they follow with their environment (T7)"*
Using science and technology for beneficial purposes	1 (T8)	*"It is a person who uses science and technology for beneficial purposes (T8)"*
Understanding the nature and functioning of science	1 (T9)	"*Scientifically literate people understand the nature of knowledge and use scientific process skills to solve problems (T9)"*
Shedding light on problems	1 (T13)	*"They are people who can draw meaningful conclusions from raw data and project them on problems (T13)"*

The teachers mostly answered the question, "How would you define a scientifically literate person?" as having the ability to interpret and question (f=7) and able to look at events from a scientific point of view (f=3). Of the science teachers, 47% (N=8) gave answers to this question for two components out of the 6 components of scientific literacy (Appendix 1).

Table 4. Themes and examples of participant quotations for the scientific literacy dimension

(What do you think a scientifically literate person should know and be able to do?)

Theme	N	Quotations from interviews
Must have high foresight	1 (T1)	*"Knowing the past well and being able to envision the future (T1)"*
Must be able to think critically and without prejudice	2 (T2, T5)	*"He must know how to think critically and analytically, must be able to empathize and approach events without prejudice (T2)"*
Must review the literature	2 (T3, T4)	*"I think he must know how to do research and review the literature (T3)"*
Must know the ways of accessing information	4 (T6, T8, T13, T17)	*"He must know the ways of accessing the correct information (T6)"*
Must be able to follow scientific developments	3 (T7, T12, T16)	*"He must be able to follow scientific developments closely (T7)"*
Must have high argumentation skills	3 (T9, T10, T11)	*"He must make observations, question, create arguments, and base arguments on evidence (T9)"*
Must conduct studies with high widespread impact	1 (T14)	*"I think he should enlighten the society about the subjects he has researched and received his expertise in (T14)"*
Must be able to look at events from a scientific point of view	1 (T15)	*"He must be able to read scientific texts and develop ideas from a scientific point of view and approach the issues with scientific explanations (T15)"*

The teachers mostly answered the question, "What do you think a scientifically literate person should know and be able to do?" as "must know the ways of accessing information (f=4)," "must be able to follow scientific developments (f=3)," and "must have high argumentation skills (f=3)." Of the science teachers, 29% (N=5) gave answers to this question for only two of the 6 components of scientific literacy (Appendix 1).

Table 5. Themes and examples of participant quotations for the scientific literacy dimension

(How can a scientifically literate person assess the quality of scientific information from different sources such as TV news, social media, websites, and newspapers?)

Theme	N	Quotations from interviews
Must research the source of information	8 (T1, T2, T3, T4, T6, T7, T9, T10)	*"He must be able to research the source and question what the truth is (T2)"*
Must review the literature	3 (T5, T12, T14)	*"He must research whether there is an exact source and not share information whose source is not certain (T14)"*
Must approach events in a suspicious and critical way	3 (T8, T13, T16)	*"He can evaluate with critical and analytical thinking skills (T13)"*
Must look at provability according to basic scientific principles	3 (T11, T15, T17)	*"He can make decisions by looking at its conformity with basic scientific principles, its level of provability, and its relevance to life (T11)"*

The teachers mostly answered the question, "How can a scientifically literate person assess the quality of scientific information from different sources such as TV news, social media, websites, and newspapers?" as "must research the source of information" (f= 8). Of the science teachers, 35% (N=6) gave answers to this question for only two of the 6 components of scientific literacy (Appendix 1).

Table 6. Themes and examples of participant quotations for the scientific literacy dimension

(How does a scientifically literate person express and position his/her attitude toward specific scientific issues such as climate change, pollution, and genetically modified foods?)

Theme	N	Quotations from interviews
As a life threat	1 (T1)	*"He evaluates them as factors threatening the future of humanity and life (T1)"*
Sensitivity for nature and the future	4 (T2, T6, T9, T16)	*"He displays the necessary sensitivity and acts consciously on these issues that concern all living things (T9)"*
Objective attitude	5 (T3, T10, T11, T13, T15)	*"He approaches events objectively and looks at their positive and negative aspects (T10)"*
Critical attitude toward the change of scientific knowledge	4 (T4, T5, T8, T17)	*"When expressing his attitude on specific issues, he should consider that knowledge changes rapidly on these issues (T4)"*

An attitude stimulating and enlightening people	2 (T7, T14)	*"He must play a role stimulating and enlightening his environment (T7)"*
Solution-oriented attitude	1 (T12)	*"I think he should not make decisions about what the majority says or the media's guidance and he should read and take steps. After all, a scientifically literate person cannot close his eyes after learning things, such as environmental pollution and climate change and will look for solutions. Besides, I think the person is not scientifically literate if what he has learned with full understanding does not motivate him and he does not strive for a solution (T12)"*

The teachers mostly answered the question, "How does a scientifically literate person express and position his/her attitude toward specific scientific issues such as climate change, pollution, and genetically modified foods?" as by displaying an objective attitude (f=5), showing sensitivity for nature and the future (f=4), and displaying a critical attitude toward the change of scientific knowledge (f=4). Of the science teachers, 23% (N=4) gave answers to this question for only one of the 6 components of scientific literacy (Appendix 1).

Table 7. Themes and examples of participant quotations for the nature of science dimension

(Have you heard of the concept of the nature of science? What does the concept of the nature of science mean to you?)

Theme	N	Quotations from interviews
Facts about life	2 (T1, T14)	*"Facts existing in life (T1)"*
The formation and development of science in the process	3 (T4, T5, T9, T17)	*"It is knowing how scientific knowledge is formed, which factors affect it and how it develops (T9)"*
The ontology of science	4 (T2, T11, T13, T15)	*"It is the whole of concepts related to the basic characteristics, methods, philosophy, and origins of science (T11)"*
The result of science	1 (T16)	*"Each event has a proven scientific result, and these results are possible, not a coincidence. Thus, it can be called the result of the nature of science (T16)"*
Rules and principles specific to science	3 (T7, T8, T10)	*"Science also has its own rules and principles (T8)"*

I have heard of it, but I cannot define it completely	3 (T3, T6, T12)	*"I have heard of it, but I cannot define it completely (T12)"*

The teachers mostly answered the question, "Have you heard of the concept of the nature of science? What does the concept of the nature of science mean to you?" as the formation and development of science in the process (f=4) and the ontology of science (f=4). Of the science teachers, 29% (N=5) gave answers to this question only for two of the 8 components of the nature of science dimension (Appendix 1).

Table 8. Themes and examples of participant quotations for the nature of science dimension

(What are the characteristics of scientific knowledge?)

Theme	N	Quotations from interviews
It is universal and objective	9 (T1, T2, T4, T6, T8, T11, T12, T15, T17)	*"It is objective and universal (T15)"*
It is up-to-date	1 (T3)	*"It must be up-to-date (T3)"*
It is based on experimentation and observation	3 (T4, T9, T13)	*"Scientific knowledge is based on experimentation and observation (T4)"*
It is provable	4 (T7, T10, T14, T16)	*"If the scientific validity or accuracy of the information is proven, it is scientific knowledge (T16)"*

The answers to the question, "What are the characteristics of scientific knowledge" were mostly gathered under the themes of universal and objective (f=9) and provable (f=4). Of the science teachers, 41% (N=7) gave answers to this question for only two of the 8 components of the nature of science dimension (Appendix 1).

Table 9. Themes and examples of participant quotations for the nature of science dimension

(How do scientists explain natural phenomena?)

Theme	N	Quotations from interviews
From a scientific point of view	7 (T1, T2, T3, T8, T10, T11, T15)	*"They must use the data to be obtained by applying the steps of scientific study and comparatively with the conducted scientific studies (T11)"*
Through experimentation and observation	6 (T4, T7, T9, T12, T13, T17)	*"Natural phenomena are explained by making observations and experimental studies (T4)"*
By establishing a cause-effect relationship	4 (T5, T6, T14, T16)	*"They explain them according to the cause-effect relationship (T6)"*

The teachers' answers to the question, "How do scientists explain natural phenomena?" were mostly collected under the themes from a scientific point of view (f=7) and through experimentation and observation (f=6). Of the science teachers, 35% (N=6) gave answers to this question only for one of the 8 components of the nature of science dimension (Appendix 1).

Table 10. Themes and examples of participant quotations for the nature of science dimension

(What does the sentence "Science is a method of researching nature and the material world" mean to you?)

Theme	N	Quotations from interviews
Getting to know the universe	5 (T1, T2, T9, T12, T14)	*"Science is a research and investigation. Scientists have researched and enlightened society for centuries. The best way to understand the world and the universe is through research (T14)"*
Importance of science	3 (T3, T8, T13)	*"The importance of science (T3)"*
Scope of scientific thought	3 (T4, T6, T10)	*"It provides an idea about the scope of scientific thought (T4)"*
Discovery of new information	1 (T5)	*"It expresses that undiscovered new information will be revealed (T5)"*
Subjectivity and objectivity of science	1 (T7)	*"They are interested in the visible and provable side of science, but just as science appeals to the brain, concepts such as love, respect, conversation, and more in life appeal to the heart. Hence, science should bring these two concepts together (T7)"*
Importance of the logical approach	1 (T15)	*"It can investigate everything with reason and logic (T15)"*
Examination of concrete events	3 (T11, T16, T17)	*"Science deals with nature and researches concrete events (T16)"*

Most teachers answered the question, "What does the sentence "Science is a method of researching nature and the material world" mean to you?" as getting to know the universe (f=5), importance of science (f=3), scope of scientific thought (f=3), and examination of concrete events (f=3). Of the science teachers, 29% (N=5) gave answers to this question for three of the 8 components of the nature of science dimension (Appendix 1).

Table 11. Themes and examples of participant quotations for the nature of science dimension

(What kind of questions do scientists try to answer?)

Theme	N	Quotations from interviews
Questions that facilitate life	3 (T1, T4, T13)	*"Scientists express their opinions on scientific issues. Any subject that makes people's lives easier can enter this field (T4)"*
All questions in life	4 (T2, T9, T11, T15)	*"All questions in life (T2)"*
Questions that have not been answered	2 (T3, T17)	*"Questions that have not been answered to date (T3)"*
Regarding the causes of events	3 (T5, T6, T16)	*"They search for answers to questions such as why, how, when, and to what (T16)"*
Questions that arouse curiosity	3 (T8, T10, T12)	*"They want to explain everything that people are curious about; space, medicine, the human body, the formation of the universe and human... (T12)"*
Questions without definite results	1 (T7, T14)	*"They search for discovering information for which definite results have not been reached yet and new methods (T14)"*

The teachers' answers to the question, "What kind of questions do scientists try to answer?" were gathered under the themes of all questions in life (f=4), questions that facilitate life (f=3), regarding the causes of events (f=3), and questions that arouse curiosity (f=3). Of the science teachers, 23% (N=4) gave answers to this question for only one of the 8 components of the nature of science dimension (Appendix 1).

Table 12. Themes and examples of participant quotations for the Science-Technology-Society dimension

(Have you heard of the concept of "science, technology, and society"? What are the effects of science and technology on society?)

Theme	N	Quotations from interviews
Continuous change and development	6 (T1, T4, T7, T8, T10, T17)	*"It is like the society's constant change in its adapting to innovations (T1)"*
Positive and negative situations as a result of mutual interaction	5 (T2, T11, T12, T13, T15)	*"Yes, also known as STS, it is the name given to the field of research that examines how science, technology, and society interact with each other with a critical approach. This situation, whose most obvious example we have observed during the pandemic, shows how science manages social perception in the most obvious way. The fact that some scientists have talked about the concept of vaccine positively all the time, while the others have talked in the opposite direction has opened the way to choose the one that is suitable for the benefit of society (T11)"*

Facilitating life	3 (T3, T5, T16)	*"It facilitates our life and sheds light on the future (T5)"*
Increasing the welfare of society	3 (T6, T9, T14)	*"It always takes society to the next level. It ensures the ability to interpret within the framework and logic. It allows the work and situations to be done more practically and comfortably (T14)"*

The teachers' answers to the question, "Have you heard of the concept of "science, technology, and society"? What are the effects of science and technology on society?" were mostly gathered under the themes of continuous change and development (f=6) and positive and negative situations as a result of mutual interaction (f=5). Of the science teachers, 64% (N=11) gave answers to this question for two of the 5 components of the science-technology-society dimension (Appendix 1).

Table 13. Themes and examples of participant quotations for the Science-Technology-Society dimension

(How are man-made products designed and how do the natural world and materials affect this process?)

Theme	N	Quotations from interviews
By destroying nature and creating new problems	1 (T1)	*"With technology development, it becomes easier to design and produce man-made products. It destroys nature more and creates new problem areas (T1)"*
By affecting imagination and creativity	2 (T2, T3, T6, T15)	*"People design using materials, imagination, and creativity skills. Benefiting from resources in our world is part of this process (T2)"*
Nature being an inspiration for prototyping	4 (T4, T5, T11, T13)	*"Prototyping in nature is taken as an example in most studies. For example, like benefiting from the dragonfly while making a helicopter (T5)"*
In line with the wishes and needs of people	6 (T7, T9, T10, T14, T16, T17)	*"Products are designed by blending scientific knowledge with technology. The process advances according to the needs (T9)"*
I have no exact idea about this issue	2 (T8, T12)	*"I need to research this issue completely. It has become a research question for me at the moment (T12)"*

The teachers' answers to the question, "How are man-made products designed and how do the natural world and materials affect this process?" are gathered under the themes of "In line with the wishes and needs of people (f=6)" and "Nature being an inspiration for prototyping (f=4)." Of the science teachers, 58% (N=10) gave answers to this question for two of the 5 components of the science-technology-society dimension (Appendix 1).

Table 14. Themes and examples of participant quotations for the Science-Technology-Society dimension

(How does the acceleration of technological change affect society?)

Theme	N	Quotations from interviews
Positive and negative impact	6 (T1, T2, T12, T14, T16, T17)	*"The acceleration of technology may be good in some areas and bad in the others, depending on how people use it. We will improve society if we take its beneficial aspects. For example, if you spend hours in front of social media on the phone in vain, you will become technology-addicted. But if you use it to access information, it will improve you. Of course, a society that directs technology will develop, but if you are addicted, then I don't think we will develop much (T12)"*
Insatiable impact	1 (T3)	*"It has made us insatiable (T3)"*
Impact on the rapid change of society	3 (T4, T9, T10)	*"It accelerates change in society (T4)"*
Impact that reveals new concepts and professions	1 (T5)	*"New concepts and habits and new professions emerge (T5)"*
Impact that improves living conditions	3 (T6, T7, T8)	*"Technological change can make people lazy. But it literally makes your life easier (T7)"*
Impact reducing historical awareness	1 (T11)	*"While it leads to a decrease especially in historical awareness and the ability to learn from the past in society, it allows the concept of imagination to develop in people and increases openness to innovation (T11)"*
Impact reducing social and emotional skills	1 (T13)	*"While there are rapid developments in various areas, it may have adverse effects on society's social and emotional skills (T13)"*
Impact increasing the need for education in adapting to change	1 (T15)	*"While adapting, society is forced to change. Society can adapt to this change more easily with education (T15)"*

The teachers' answers to the question, "How does the acceleration of technological change affect society?" were mostly gathered under the themes of "positive and negative impact (f=6)", "impact on the rapid change of society (f=3)," and "impact that improves living conditions (f= 3)." Of the science teachers, 17% (N=3) gave answers to this question for only one of the 5 components of the science-technology-society dimension (Appendix 1).

Table 15. Themes and examples of participant quotations for the Science-Technology-Society dimension

(Scientists and engineers make decisions about public issues related to science and technology. How would you explain their contribution to this process?)

Theme	N	Quotations from interviews
Positive contribution	8 (T1, T2, T3, T5, T6, T7, T8, T13)	*"I find it positive. Their efforts and endeavors are admirable (T2)"*
It enables the public to follow scientific developments	1 (T4)	*"They enable the public to adapt to the process. The public must follow scientific developments (T4)"*
With an anthropological approach	2 (T10, T17)	*"I think they will take decisions according to the technology and possibilities of that period, considering the best for people according to scientific data (T10)"*
With an ecocentric approach	1 (T9)	*"The decisions taken to solve the society's problems should not adversely affect the living life and the natural world (T9)"*
Provides an increase in production	1 (T11)	*"This is the basis of the increase in the production of respirators, vaccines, masks, and protective materials during the pandemic and the rapid increase in the number of companies (T11)"*
Positive if they are truly competent in their field	3 (T12, T14, T16)	*"If they are really competent and good in this field, it is positive, but I think most of them are not competent (T12)"*
Reliable because it is approached from a scientific point of view	1 (T15)	*"Solutions will be more reliable because they approach our common problems with reason and logic and scientific data (T15)"*

Answers to the question, "Scientists and engineers make decisions about public issues related to science and technology. How would you explain their contribution to this process?" were mostly included in the theme of "positive contribution (f=8)." Of the science teachers, 11% (N=2) gave answers to this question for two of the 5 components of the science-technology-society dimension (Appendix 1).

Table 16. Themes and examples of participant quotations for the Science-Technology-Society dimension

(How does the introduction of a new technology affect society?)

Theme	N	Quotations from interviews
Positive impact	4 (T1, T8, T15, T16)	*"Our work usually becomes easier with technology. It reduces people's burden in society (T15)"*
Impact arousing interest and curiosity	4 (T2, T3, T14, T17)	*"It arouses interest and curiosity (T2)"*
Mutual interaction and development between producers and consumers	2 (T4, T6)	*"It increases interaction between people who use this technology and people who try to use it. It develops society (T4)"*
Positive and negative impacts according to its benefit	7 (T5, T7, T9, T10, T11, T12, T13)	*"It varies according to the usefulness level. At first, a little distance is left. It is accepted quickly or slowly according to its benefits (T5)"*

The answers to the question, "How does the introduction of a new technology affect society?" were mostly included under the themes of "positive and negative impacts according to its benefit (f=7)," "positive impact (f=4)," and "impact arousing interest and curiosity (f=4)." Of the science teachers, 11% (N=2) gave answers to this question for only one of the 5 components of the science-technology-society dimension (Appendix 1).

4. Discussion

The present study was conducted to determine science teachers' conceptual understanding of scientific literacy within the scope of the three dimensions of scientific literacy: science content knowledge, the nature of science, and science-technology-society. The study showed that teachers' understanding of scientific literacy was weak according to their answers to the semi-structured interview questions. In the study by Göktepe et al. (2022), the "Test of Scientific Literacy Skills (TOSLS)" developed by Gormally et al. (2012) was used, and it was concluded that science teachers' scientific literacy skills were moderate and they did not have scientific literacy skills at the desired level. Again, a study examining teachers' scientific literacy revealed that 65% of teachers had moderate scientific literacy skills (Rubini et al., 2016). In the study investigating primary school teachers' opinions on the nature of science, teachers defined science within the framework of conducting research

and making life easier statements. This result is consistent with the study results (Çakan Akkaş and Memiş, 2022). Studies indicating that teachers have limited knowledge about the nature of science are available (Ayvacı and Muradoğlu, 2021). In the study by Al Sultan, Henson Jr. & Lickteig (2021), more than half of the participants stated that scientific literacy could be achieved by possessing extensive content knowledge and reading different scientific materials. Unlike the findings of this study, there are also studies demonstrating that the scientific literacy levels of preservice teachers are at the desired level (Cavaş, 2013; Chin, 2005).

The study, in which the content analysis of the research performed in Turkey on scientific literacy between 2000-2019 was conducted, showed that the number of articles was insufficient compared to the theses produced and the study group consisted mostly of secondary school and high school students (Arduç and Kahraman, 2021). Teachers constituted the study group in only 4 of the 61 thesis studies examined and only 5 out of the 31 articles. Teachers with low science literacy are not expected to raise scientifically literate students or implement the curriculum reform effectively (Bacanak and Gökdere, 2009; Al Sultan, Henson Jr. & Lickteig, 2021). Although there is no clarity about the semantic complexity of the term scientific literacy due to its nature, what it really means in classroom practice and learning, teachers are at the center of the processes shaping students' scientific literacy (Smith et al., 2011). In this respect, it is thought that understanding teachers and their scientific literacy levels and making progress in this area will significantly influence learning. While the teachers emphasized the ability to understand, interpret, criticize and question information in general for the scientific literacy dimension, they did not mention situations related to the ability to express scientifically and technologically created situations, apply scientific knowledge, create evidence-based arguments, and evaluate these arguments in this dimension. This result is consistent with the study investigating the views of primary school teachers on science literacy (Aldan Karademir, 2012). Scientific literacy means not only understanding science but also various interpretations and also understanding scientific processes (Widowati, Widodo, Anjarsari & Setuju, 2017).

As seen from the statements in the nature of science dimension, the teachers indicated that scientific knowledge was based on experimental evidence, there were rules and principles specific to science, and science addressed all problems about the natural and material world. However, it was observed that the teachers did not mention that various methods were used in scientific research, it was open to revision in light of new pieces of evidence, science was a way of knowing, scientific knowledge assumed there was an order and consistency in natural systems, and science was a

human endeavor. Concerning the nature of science and its dimensions, it can be said that teachers generally have an insufficient conceptual understanding. This result is also supported by the findings of various studies (Kahyaoğlu, 2004; Doğan Bora, 2005; Aslan, Yalçın &Taşar, 2009; Al Sultan, Henson Jr. & Lickteig, 2021).

For the science-technology-society dimension, the teachers generally responded in a way to cover all dimensions. Accordingly, it can be said that teachers' knowledge of how science and technology will affect society is sufficient. However, it is seen that there are many statements that scientists and engineers will only make a positive contribution to existing problems when a new technology is introduced. In parallel with this result, the teachers have adopted the view that developments in science and technology have an impact on people and scientists and engineers make positive contributions in this process. This result is parallel to the result of the study examining the views of preservice teachers on science-technology-society (Dikmentepe, 2012). A study conducted with primary school teachers showed that most teachers expressed that the practices they carried out on the subject of making students comprehend the "Science-Technology-Society" relationship reached their goal (Aldan Karademir, 2012).

5. Conclusion

This study was carried out to determine science teachers' understanding of scientific literacy, nature of science, and science-technology-society concepts. According to the results that emerged from the teachers' answers, it was observed that teachers' understanding of scientific literacy, nature of science, and science-technology-society should be developed.

The teachers expressed scientific literacy more as understanding and interpreting information, and, thus, they expressed a scientifically literate person as a person who understands, interprets, and questions information. Regarding what a scientifically literate person should know and be able to do, the teachers emphasized that he must know the ways of accessing the correct information, must follow scientific developments, and must have high argumentation skills. Moreover, most teachers indicated that a scientifically literate person could evaluate the quality of scientific information from different sources, such as TV news, social media, websites, and newspapers, by researching the source of the information. The teachers stated that a scientifically literate person should mostly position his/her attitude toward specific scientific issues, such as climate change, pollution, and genetically modified foods in an objective, sensitive, and critical way.

Concerning the teachers' answers regarding the nature of science, the nature of science was generally defined as the formation and development of science and the ontology of science. It was stressed that scientific knowledge was mostly based on experimentation and observation and could be proven and scientists explained natural phenomena from a scientific point of view and through experimentation-observation. From the statement "Science is a method of researching nature and the material world," the teachers mostly emphasized getting to know the universe, examination of concrete events, and the scope of science and scientific thought, while they answered the question "What kind of questions do scientists try to answer?" as all questions in life.

The teachers mostly answered the question, "What are the effects of science and technology on society?" asked first within the scope of the science-technology-society dimension, that there might be positive and negative impacts in the form of continuous change and development. They also stated that man-made products were mostly designed in line with the wishes and needs of people and natural world materials created prototyping in this process. To the question of how the acceleration of technological change affected society, the teachers mostly answered that it could affect positively and negatively. The teachers mostly answered the question of how scientists and engineers contributed to public problems related to science and technology as positively. The teachers answered the question, "How does the introduction of a new technology affect society?" as it had positive and negative impacts according to its benefits.

6. Recommendations

Based on the study results, training covering the subjects of scientific literacy, the nature of science, and science-technology-society that will ensure an increase in teachers' awareness and will enable them to understand that science and scientific knowledge are more than just plain facts (Lederman & Abd-El-Khalick, 1998) should be included in in-service programs. According to the study results, activities that will increase argumentation skills should be included in the suggested in-service scope since the teachers answered the questions about scientific literacy and its dimensions with plain facts and judgments without going into details. It can be said that it would be beneficial to include these subjects in the undergraduate programs of teachers in order for them to understand science and raise scientifically literate individuals.

References

Abd-El-Khalick, F., & Lederman, N. G. (2000). Improving science teachers' conceptions of nature of science: A critical review of the literature. *International Journal of Science Education, 22*(7), 665-701. https://doi.org/10.1080/ 09500690050044044.

Akerson, V. L., & Volrich, M. L. (2006). Teaching nature of science explicitly in a first-grade internship setting. *Journal of Research in Science Teaching, 43*(4), 377-394.

Al Sultan, A. Henson, H., & Lickteig, D. (2021). Assessing preservice elementary teachers' conceptual understanding of scientific literacy, *Teaching and Teacher Education, 102*. https://doi.org/10.1016/j.tate.2021.103327.

Aldan Karademir, Ç. (2012). Sınıf Öğretmenlerinin Fen ve Teknoloji Okuryazarlığına İlişkin Görüşleri. *Bartın* Üniversitesi *Eğitim Fakültesi Dergisi. 1* (1), 236-251.

Altun Yalçın, S., Açışlı, S., & Turgut, Ü. (2011). Determining the levels of pre-service science teachers' scientific literacy and investigating effectuality of the education faculties about developing scientific literacy. *Procedia Social and Behavioral Sciences*, 15, 783-787.

Arduç, M. A. & Kahraman, S. (2021). Türkiye'de Bilimsel Okuryazarlık Alanında Yapılan Araştırmaların İçerik Analizi. *İnönü Üniversitesi Eğitim Bilimleri Enstitüsü Dergisi, 8*(16), 16-43.

Aslan, O., Yalçın, N. & Taşar, F. (2009). fen ve teknoloji öğretmenlerinin bilimin doğası hakkındaki görüşleri. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi, 10*(3), 0-2.

Ayvacı, H. Ş. ve Muradoğlu, B. (2021). "Fen Bilimleri Öğretmenlerinin Bilimin Doğası ve Bilim Tarihine Yönelik Görüşleri - Opinions of Science Teachers on Nature of Science and History of Science". *Ondokuz Mayıs Üniversitesi Eğitim Fakültesi Dergisi, 40*(2), 519-550.

Bacanak, A. ve Gökdere, M. (2009). Investigating level of the scientific literacy of primary school teacher candidates. *Asia-Pacific Forum on Science Learning and Teaching, 10*(1), Article 7, p.1.

Carter G, Norwood KS (1997). The relationship between teacher and student beliefs about mathematics. *School Science and Mathematics 97*(2), 62-67.

Cavas, P., Ozdem, Y., Cavas, B., Cakiroglu, J., & Ertepinar, H. (2013). Turkish pre-service elementary science teachers' scientific literacy level and attitudes toward science. *Science Education International, 24*(4), 383-401.

Çakan Akkaş, B. N. & Kabataş Memiş, E. (2022). Sınıf Öğretmenlerinin Bilimin Doğasına Yönelik Düşüncelerinin İncelenmesi. *Uluslararası Bilim ve Eğitim Dergisi, 5*(1), 16-33.

DeBoer, G. (2000). Scientific Literacy: Another look at its historical and contemporary meanings and its relationship to science education reform. *Journal of Research in Science Teaching, 37*(6), 582-601.

Dikmentepe, E. (2012). Öğretmen Adaylarının Fen-Teknoloji-Topluma Yönelik Görüşlerinin Sınıflar Bazında İncelenmesi. Pamukkale Üniversitesi Eğitim Bilimleri Enstitüsü Yüksek Lisans Tezi.

Doğan Bora, N. (2005). Türkiye Genelinde Ortaöğretim Fen Branşı Öğretmen ve Öğrencilerinin Bilimin Doğası Üzerine Görüşlerinin Araştırılması. Yayınlanmamış Doktora Tezi. Gazi Üniversitesi, Ankara.

Flores, J. E. (2019). LNU Pre-service Secondary Science Teachers' Scientific Literacy and Science Teaching Self-Efficacy. *Journal of Physics: Conference Series*, 1254.

Gormally, K., Brickman, P., & Lutz, M. (2012). Developing a test of scientific literacy skills (TOSLS): Measuring undergraduates' evaluation of scientific information and arguments. *CBE–Life Sciences Education, 1*(4), 264-377.

Göktepe D., Eroğlu Doğan, E., ve Doğan, D. (2022). Fen bilimleri öğretmenlerinin bilimsel okuryazarlık beceri düzeylerinin farklı değişkenler açısından değerlendirilmesi, *E-Uluslararası Eğitim Araştırmaları Dergisi, 13*(1), 233-253.

Kahyaoğlu, E. (2004). Turkish Preservice Science Teachers' Views on STS: Characteristics of Scientists' Work. Unpublished Master's Thesis. Ankara: Middle East Technical University.

Smith, K. V., Loughran, J., Berry, A., & Dimitrakopoulos, C. (2012) Developing Scientific Literacy in a Primary School, *International Journal of Science Education, 34*(1), 127-152.

Kuncoro, A., & Rusdianto, H. (2016). the ınfluence of entrepreneurship subject on students? ınterest in entrepreneurship by hidden curriculum as ıntervening variable. Dinamika Pendidikan, 11(1), 7. https://doi.org/10.15294/dp.v11i1.8700

Lederman, N. G. (2007). *Nature of science: Past, present, and future*. In S. K. Abell & N. G. Lederman (Eds.), Handbook of research on science education (pp.831-879). Mahwah, NJ: Erlbaum

Lederman, N. G., & Abd-El-Khalick, F. (1998). *Avoiding de-natured science: Activities that promoteunderstandings of the nature of science.* In W. McComas (Ed.), The nature of science in scienceeducation: Rationales and strategies (pp. 83–126). Dordrecht, the Netherlands: Kluwer.

Lederman, N., Abd-El-Khalick, F., Bell, R., & Schwartz, R. (2002). Views of nature of science questionnaire: toward valid and meaningful assessment of learners' conceptions of nature of science. *Journal of Research in Science Teaching, 39*(6). 497-521.

Lederman, N., Lederman, J., & Antink, A. (2013). Nature of science and scientific inquiry as contexts for the learning of science and achievement of scientific literacy. *International Journal of Education in Mathematics, Science and Technology, 1*(3), 138-147.

NRC. (1996). *National science education standards.* National Academic Press.

O'Toole JM, McKoy K, Freestone M, Osborn J-A. (2020). 'Scientific Literacy': An Exercise in Model Building. *Education Sciences. 10*(8), 204. https://doi.org/10.3390/educsci10080204

OECD (Organisation for Economic Co-operation and Development). (2006). Assessing scientific, reading and mathematical literacy: A framework for PISA 2006. Paris: Author.

Rina, L., Murtini, W., & Indriayu, M. (2019). Entrepreneurship education: Is it important for middle school students? *Dinamika Pendidikan, 14*(1), 47-59. https://doi.org/10.15294/dp.v14i1.15126

Roberts, D. A. (2007). *Scientific Literacy/science literacy*. In S.K. Abell & N.G. Lederman (Eds.) Handbook of Research in Science Education (pp. 729-80). Mahwah: Lawrence Erlbaum.

Rubini, B., Ardianto, D., Pursitasari, I. D., & Permana, I. (2016). Identify scientific literacy from the science teachers' perspective. *Jurnal Pendidikan IPA Indonesia, 5*(2), 299-303.

Sarkar, Mahbub & Corrigan, Deborah. (2014). Promotion of scientific literacy: Bangladeshi teachers' perspectives and practices. *Research in Science & Technological Education. 32*(2), 162-181. 10.1080/02635143.2014.905462.

Widowati, A., Widodo, E., Anjarsari, P., & Setuju, S. (2017). *The Development of Scientific Literacy through Nature of Science (NoS) within Inquiry Based Learning Approach*. Journal of Physics: Conference Series. 909. 012067. 10.1088/1742-6596/909/1/012067.

Appendix 1. Semi-structured interview questions

Have you heard of the concept of scientific literacy?

1. What does scientific literacy mean to you?
2. How would you define a scientifically literate person?
3. What do you think a scientifically literate person should know and be able to do?
4. How can a scientifically literate person assess the quality of scientific information from different sources such as TV news, social media, websites, and newspapers?
5. How does a scientifically literate person express and position his/her attitude toward specific scientific issues such as climate change, pollution, and genetically modified foods?,

Have you heard of the concept of the nature of science?

1. What does the concept of the nature of science mean to you?
2. What are the characteristics of scientific knowledge?
3. How do scientists explain natural phenomena?
4. What does the sentence science is a method of researching nature and the material world mean to you?
5. What kind of questions do scientists try to answer?

Have you heard of the concept of "science, technology, and society"?

1. What are the effects of science and technology on society?
2. How are man-made products designed and how do the natural world and materials affect this process?
3. How does the acceleration of technological change affect society?
4. Scientists and engineers make decisions about public issues related to science and technology. How would you explain their contribution to this process?
5. How does the introduction of a new technology affect society?

Appendix 2. Components of the scientific literacy, nature of science, and science-technology-society dimensions (NRC, 1996)

Component		Definition of the component
Scientific literacy	1	Has the ability to question everyday experiences and natural phenomena.
	2	Has the ability to understand scientific materials from different sources.
	3	Can express scientifically and technologically created situations.
	4	Has the ability to evaluate the quality of scientific information from different sources.
	5	Has the ability to present and evaluate arguments based on evidence.
	6	Has the ability to apply scientific knowledge.
Nature of science	1	Scientific research uses various methods.
	2	Scientific knowledge is based on empirical evidence.
	3	Scientific knowledge is open to revision in light of new pieces of evidence.
	4	Scientific models, laws, mechanisms, and theories explain natural phenomena.
	5	Science is a way of knowing.
	6	Scientific knowledge makes an assumption that there is an order and consistency in natural systems.
	7	Science is a human endeavor.
	8	Science addresses questions about the natural and material world.

Science-technology-society	1	Every man-made product is designed by applying some knowledge of the natural world and is made using natural materials.
	2	Using natural materials to make things affects the environment.
	3	People's needs and wishes change over time, like their demands for new and advanced technologies.
	4	Engineers improve the existing technologies or develop new ones to increase their benefits, reduce the known risks, and meet social demands.
	5	As new technologies become available, they can bring about changes in the way people live and interact with each another.

CHAPTER 2

THE RELATIONSHIP BETWEEN SCHOOL ALIENATION AND COMMITMENT: A STUDY ON PRESERVICE TEACHERS

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INTRODUCTION

School alienation has recently attracted attention in the field of educational sciences. The relationship between school alienation and organizational variables such as school burnout (Polat, 2018), attitudes towards the teaching profession (Çağlar, 2013), and peer bullying (Haskaya, 2016) has been investigated. School commitment has also been researched by scholars. On the other hand, no study which investigates commitment and alienation together has been found in the literature. In this study, the relationship between school alienation and school commitment was investigated.

Alienation/ School Alienation

The word *alienation* derives its meaning from the words "belonging to someone else" or "being related to someone else". It means personality division in psychology and weakening of the bond between the individual and society in sociology (Han, 2020). At the same time, the concept has prepared a critical ground for the technocratic conception of civilization that mechanizes human beings. As a matter of fact, Charlie Chaplin's movie Modern Times which was made in 1936, with its serious references to alienation, maintains its importance today as a masterpiece.

It can be said that the concept of alienation was established by Marx. According to Marx, with the alienation created by the system, the alienation from his own labor, the product, other employees, human existence, and ultimately his own nature occurs (Terzi, 2021). Marx combined alienation as both a social phenomenon and an individual situation and introduced a new definition as "the alienation of labor". (Öztürk and Çipe, 2020). In capitalism, people are alienated not only from their own labor, but also from their own potential to act, and in this sense, they dehumanize (Aydın, 2010). The process of alienation in Marx and dehumanization, which is highlighted as the "iron cage" in Weber, can be defined as the dissolution of not only the economic functioning of capitalism but also its social fabric and institutional structure (Aydın, 2010).

School alienation, on the other hand, is described as the student's weak commitment to school, negative attitudes, considering the social and academic dimension of the school meaningless, and emotional disconnection from the school and the learning process (Ünsal, 2017). In the study of Ataş and Ayık (2013) on pre-service teachers, gender, decision to choose the department, level of relationship with lecturers and classmates, and the frequency of participation in social activities emerged as factors that affect the sense of alienation from school.

Classifying the factors that increase school alienation as internal

and external factors, Parsıl (2007) defines elements such as bureaucratic structure, family, mass media, and peer groups as external factors, teacher's classroom management approach, the physical structure of the classroom, and communication as internal factors. It is noteworthy that the communication structure took place in both factors.

Regarding the subject, in studies of alienation from school in the field of higher education, it is seen that the ones carried out abroad have focused more on racism, while studies in Turkey have emphasized loneliness, attitude, and social events more (Ataş and Ayık 2013).

Organizational Commitment / School Commitment

In the organizational sense, the concept of commitment is defined as acting in a way that protects the interests of the organization and expresses the commitment to the whole of the organization, not to its parts. Organizational commitment is discussed under three headings as affective, continuance, and normative commitment (Meyer & Allen, 1997; cited by Terzi, 2015). Although organizational commitment is examined under three headings, affective commitment comes to the fore when organizational commitment is mentioned. Organizational commitment is the individual's commitment to the social system, desire to be included in the social system, and tendency to social relations within the system. Commitment includes at least three basic factors: First, strong belief and acceptance in the goals and values of the organization, second, voluntary effort for the benefit of the organization, and third, being a permanent member of the organization (Demirel, 1998). On the other hand, commitment to school should be evaluated by considering the school as an organization and considering its aims, inputs, and processes, especially in terms of the people on whom it works. School commitment, which has emotional, behavioral, and cognitive dimensions, is defined as the student's feeling of belonging to the school, believing that he/she is valuable as a member of the school, and adopting the goals of the school (Ünsal, 2017).

From this point of view, Finn's (1993) definition of the student's feeling of belonging to the school and adopting the goals of the school stands as a better definition (Cited by Arastaman, 2009). While making this definition, it is necessary to emphasize the existence of the "belonging" variable in the definition. Similar to commitment, belonging also evokes convergence to the organization. Meyer and Allen (1997) state that organizational belonging is a psychological state, and this situation leads to the employee's decision to continue membership in the organization (Cited by Terzi, 2015).

The Relationship between School Alienation and Commitment

Although the relationship between school alienation and commitment has been examined separately in the literature as organizational variables, no study that deals with both variables together has been found in the literature. It can be argued that this is due to the fact that the concept of alienation has only recently been studied.

In the research conducted by Atila (2019), which is indirectly related to this research, among university students on psychological capital, class commitment, and alienation, it has been determined that the students experienced a moderate level of class commitment and alienation, and there was a significantly negative relationship between students' class commitment and their perceptions of school alienation.

In this study, the relationship between school alienation and commitment was investigated and answers were sought to the following questions.

1) What is the level of school alienation and school commitment of preservice teachers?

2) Is there a significant difference between school alienation and school commitment attitudes of preservice teachers?

a) According to their gender

b) According to their departments

3) Is there a relationship between school alienation and school commitment?

4) Does school engagement predict the tendency to school alienation?

METHOD

This study, which deals with the relationship between preservice teachers' tendency to alienate from school and their attitudes towards school commitment, was carried out in the relational screening model. Relational screening is a research model that aims to determine the existence and/or degree of co-variance between two or more variables (Karasar, 2004).

Study Group

The study group consisted of preservice teachers who took the Sociology of Education as well as Turkish Educational System and School Management courses at Necatibey Faculty of Education in the spring semester of 2021-2022. In the aforementioned group, there were 556 pre-service teachers, 290 of whom were in the first grade and 266 were in the third grade.

The data collection tools were sent online to all of the preservice teachers, and at the end of the data collection process, 409 pre-service teachers responded to the questionnaires. The representation ratio of the collected data to the study group was 73.5%. Of the pre-service teachers in the study group, 210 (51.3%) were in the 1st grade, and 199 (42.1%) were in the 3rd grade. In the analysis of the data, the study group was grouped under two headings, namely the science-related departments and social departments. The social departments included 7 branches, namely Turkish, Social Studies, English, Preschool, Classroom, Turkish Language and Literature, and Music, while the science-related departments covered 5 branches as Science, Primary Mathematics, Mathematics, Biology, and Chemistry. There were 291 (71.1%) pre-service teachers in social departments and 118 (28.9%) in science-related departments.

Data Collection Tools

In the study, the "University Alienation Scale" and "Student Commitment to Higher Education Scale" were used as data collection tools.

The University Alienation Scale was developed by Kurtulmuş, Kaçire, Karabıyık, and Yiğit (2015). When the scale is considered structurally, it is seen that it is one-dimensional, 5-point Likert-type, and has 9 items. The items in the scale are scored between "Strongly Agree (5)" and "Strongly Disagree (1)". There is no reverse-coded item in the scale. While the Cronbach Alpha value of the scale reported by the researchers was a=85, it was a=91 in the reliability analysis performed within the scope of this study.

The Student Commitment to Higher Education Scale, which is the other data collection tool of the research, was developed by Çınkır, Kurum, and Yıldız (2021). It is one-dimensional, 5-point Likert-type, and has 14 items. The items in the scale are scored between "Strongly Agree (5)" and "Strongly Disagree (1)". There is no reverse-coded item in the scale. While the Cronbach Alpha value of the scale reported by the researchers was a=93, it was calculated as a=96 in the reliability analysis within the scope of this study.

FINDINGS

Findings Related to the First Sub-Dimension

The findings regarding preservice teachers' alienation tendencies and school commitment are given in Table 1.

Table 1. Mean Scores of Tendency to School Alienation and Attitudes to School Commitment

Sub-Dimensions	N	$\bar{X}$	ss
School Alienation	409	2.48	.97
School Commitment	409	3.53	1.02

According to Table 1, the mean alienation of preservice teachers ($\bar{X}$=2.48, sd=.97) was "*low*", while the mean school commitment ($\bar{X}$=3.53, sd=1.02) was found to be "*high*".

Findings Related to the Second Sub-Dimension

Table 2 and Table 3 show the findings on whether there was a difference between preservice teachers' alienation tendencies and school commitment attitudes according to gender and department.

Table 2. T-test for School Alienation Tendency and School Commitment Attitudes by Gender

Sub-Dimensions	Gender	N	$\bar{X}$	sd	t	p
School Alienation	Female	307	2.40	.95	-2.801	.005*
	Male	102	2.71	.97		
School Commitment	Female	307	3.62	.97	2.939	.003*
	Male	102	3.28	1.11		

*p<.01

In Table 2, it is seen that preservice teachers' school alienation tendencies (p=.005) and school commitment attitudes (p=.003) differed at p<.01 level according to gender. The difference was in favor of male preservice teachers in the school alienation dimension ($\bar{X}$=2.71, sd=.97), and female preservice teachers in the school commitment dimension ($\bar{X}$=3.62, sd=.97).

Table 3. T-test for School Alienation Tendency and School Commitment Attitudes by Department

Sub-Dimensions	Department	N	$\bar{X}$	ss	t	p
School Alienation	Social	291	2.53	.97	1.782	.075
	Science	118	2.34	.96		
School Commitment	Social	291	3.46	1.03	-2.307	.022*
	Science	118	3.71	.96		

*p<.05

When Table 3 is considered, it is seen that the preservice teachers' school alienation tendencies (p=.075) were similar according to the department studied. On the other hand, pre-service teachers' school commitment attitudes (p=.022) differed at p<.05 level according to the department, and the difference was in favor of the science-related department ($\bar{X}$=3.71, sd=.96).

No difference was found in the preservice teachers' alienation tendencies and their school commitment attitudes according to grade levels.

Findings Regarding the Third Sub-Dimension

The results of the correlation analysis conducted to determine whether there was a relationship between school alienation tendencies and school commitment attitudes are given in Table 4.

Table 4. Correlation Analysis of the Relationship between School Alienation Tendency and School Commitment Attitudes

	School Commitment
School Alienation	-.71**

N=409 **p<.01

Table 4 shows the relationship between preservice teachers' school alienation tendencies and their school commitment attitudes. Accordingly, it is seen that there was a negative and moderate relationship at the level of r=-.71 (p.01) between school alienation and school commitment.

Findings Regarding the Fourth Sub-Dimension

The findings of the regression analysis regarding the prediction of school alienation tendencies are given in Table 5.

Table 5. Regression Analysis for the Prediction of School Alienation Tendencies

Variable	B	R	R^2	β	t	F	p
Constant	4.878	-	-	-	39.879	-	.000**
School Alienation	-.678	.71	.51	.711	-20.396	416.009	.000**

**p<.01

When Table 5 is examined, it is seen that school commitment explained 51% of the total variance in the school alienation tendency (R=.71, R2=.51, p=.000). In other words, school commitment significantly explained 51% of the school alienation. The total effect of school commitment on school alienation was (β= .711). The findings show that school commitment is a significant predictor of the tendency to school alienation.

DISCUSSION AND CONCLUSION

In the results of the study in the context of ***arithmetic means***, it is seen that the mean score of preservice teachers' school alienation tendencies is "*low*", while the mean score of school commitment is "*high*". These findings are compatible with studies on school alienation (Külekçi Akyavuz, 2020; Polat, 2018; Polat & Özdemir, 2018; Şimşek & Katıtaş, 2014) and school commitment (Güner Demir, Erdemli, & Kurum, 2021; Ceylan, 2020) in the literature.

In the ***gender-related*** results of the study, it was determined that male preservice teachers experienced a higher level of alienation than females, whereas female preservice teachers had a higher level of commitment than males. This finding is supported by the results of various studies in the literature including school alienation (Ülker Dörttepe, 2016; Atli, Keldal, & Sonar, 2015; Şimşek & Ataş Akdemir, 2015) and school commitment (Bilir, 2020; Sağlam & İkiz, 2017; İhtiyaroğlu & Demir, 2015).

As a result of the study related to the ***department***, it was concluded that preservice teachers' school alienation tendencies were similar according to the department they studied. In the context of school commitment, the pre-service teachers who received education in the science-related departments had a stronger commitment level than their peers who continued their education in the social departments. While the result of the research in terms of alienation is equivalent to the findings of the study carried out by Özer and Akay (2020), it has been determined that the department that teacher candidates attend mades a difference in their school alienation scores in the studies of Ataş and Ayık (2013). Unlike the findings of the research in the dimension of commitment, in his study on students at the faculty of sports sciences, Direk (2020) concluded that the commitment levels of the students in different departments were similar.

As a result of the research related to the ***grade levels***, no difference was found between the preservice teachers' school alienation tendencies and school commitment attitudes. This finding is consistent with the results of various studies in the dimension of alienation (Sağun & Akbuğa, 2019; Uslu, 2018; Çelik & Babaoğlan, 2017) and in the dimension of commitment (Dönmez, 2016).

In the study, it is concluded that there is a negative and moderate relationship between school alienation and school commitment. Atila (2019) found a moderate and negative relationship between class commitment and school alienation in his study on university students. In a study conducted by Köz and Seçilmiş (2021), it was determined that there is a moderate negative relationship between organizational alienation and organizational commitment. Korkmaz (2014) concluded that there is a negative significant correlation between work alienation and organizational commitment. Yıldız (2017) mentioned the negative and significant effect of work alienation on organizational commitment in his study conducted in hotel businesses. In his research with teachers, Akar (2017) concluded that there is a negative significant relationship between school alienation and affective commitment.

In relation to the result of the study that school engagement is a significant predictor of alienation from school, Alireza and Alborz (2021) reported that organizational commitment has an effect on work alienation.

REFERENCES

Akar, H. (2017). The relationship between quality of work life, school alienation, burnout, affective commitment and organizational citizenship: a study on teacher. *European Journal of Education Research, 7*(2), 169-180.

Alireza, D. & Alborz, G. (2021). The role of organizational commitment, islamic work ethics and job alienation in relationship between job satisfaction and organizational with the probability of employee breach. *Supervision and Inspection, 15*(55), 101-132.

Arastaman, G. (2009). Lise birinci sınıf öğrencilerinin okula bağlılık (school engagement) durumlarına ilişkin öğrenci, öğretmen ve yöneticilerin görüşleri. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi, 26*, 102-112.

Ataş, Ö. & Ayık, A. (2013). Öğretmen adaylarında okula yabancılaşma, *Turkish Studies*, 8(8),103-122.

Atila, F. (2019). Üniversite öğrencilerinin psikolojik sermaye sınıf bağlılığı, okula yabancılaşma algıları arasındaki ilişkilerin analizi. Yayımlanmamış doktora tezi. İnönü Üniversitesi, Malatya.

Atli, A., Keldal, G. & Sonar, O. (2015). Üniversite öğrencilerinin yabancılaşma ile yalnızlık düzeyleri arasındaki ilişki. *Mustafa Kemal Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 12*(29), 149-160.

Aydın, D. G. (2010). Kapitalizmde bireyin sorgulanması: yabancılaşma ve demir kafes. *Amme idaresi Dergisi, 43*(2),17-32.

Bilir, B. (2020). *Yükseköğretimde öğrenci bağlılığının araştırılması*. Yayımlanmamış doktora tezi, Osmangazi Üniversitesi, Eskişehir.

Ceylan, H. (2020). *Ortaokul öğrencilerinin okula bağlılıklarında önemli bir faktör: okul kültürü.* (Yayımlanmamış yüksek lisans tezi). Sabahattin Zaim Üniversitesi, İstanbul.

Çelik, E., & Babaoğlan, E. (2017). Üniversite öğrencilerinin yabancılaşma düzeyi. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi (KEFAD), 18*(1), 405-427.

Demirel, Y. (1998). Örgütsel güvenin örgütsel bağlılık üzerine etkisi: tekstil sektörü çalışanlarına yönelik bir araştırma, *Yönetim ve Ekonomi,15(2),* 179-194.

Direk, O. (2020). *Spor bilimleri fakültesinde öğrenim gören öğrencilerin örgütsel bağlılık ve liderlik yönelimlerinin incelenmesi.* (Yayımlanmamış yüksek lisans tezi). Akdeniz Üniversitesi, Antalya.

Dönmez, Ş. (2016). *Ortaokul öğrencilerinde okul iklimi, okula bağlılık ve okul yaşam kalitesi algısının çeşitli değişkenler açısından incelenmesi.* (Yayımlanmamış yüksek lisans tezi). Sıtkı Koçman Üniversitesi, Muğla.

Güner Demir, T., Erdemli, Ö., ve Kurum, G. (2021). Üniversite türü açısından öğrencilerin eğitim-öğretim etiği ile bağlılık düzeylerinin incelenmesi. *YYÜ Eğitim Fakültesi Dergisi, 18*(2), 246-274.

Han, F. (2020). *Geleneksel veya siber zorbalığa maruz kalmanın okula yabancılaşmayla ilişkisinin incelenmesi.* Yayımlanmamış Doktora Tezi. Malatya, İnönü Üniversitesi.

Haskaya, S. (2016). *Ortaokul öğrencilerinde akran zorbalığı ile okula yabancılaşma arasındaki ilişkinin incelenmesi*. Yayımlanmamış yüksek lisans tezi. Çağ Üniversitesi, Mersin.

İhtiyaroğlu, N. & Demir, E. (2015). Farklı denetim odağına sahip öğrencilerin okul bağlılık düzeylerinin incelenmesi. *KSBD Hüseyin Hüsnü Tekışık Özek Sayısı 1*, 281-295.

Karasar, N. (2004). *Bilimsel Araştırma Yöntemi*. Ankara: Nobel Yayın Dağıtım.

Korkmaz, H. (2014). *Ortaöğretimde devlet okullarında görev yapan öğretmenlerin yabancılaşma düzeyleri ile örgütsel bağlılıkları arasındaki ilişkinin incelenmesi.* Yayımlanmamış yüksek lisans tezi. Bahçeşehir Üniversitesi, İstanbul.

Köz, E. N. & Seçilmiş, C. (2021). Yabancılaşma ve öncüllerinin örgütsel bağlılığa etkisi. *Eskişehir Osmangazi Üniversitesi Sosyal Bilimler Dergisi, 22*(2), 727-748.

Kurtulmuş, M., Kaçire, I., Karabıyık, H., ve Yiğit, B. (2015). Üniversiteye Yabancılaşma Ölçeği Geçerlik ve Güvenirlik Çalışması. *Elektronik Eğitim Bilimleri Dergisi, 4*(7), 100-110.

Külekçi Akyavuz, E. (2020). Ortaöğretim öğrencilerinin okul tükenmişliği ve okula yabancılaşma algıları arasındaki ilişkinin incelenmesi. *Kastamonu Eğitim Dergisi, 28*(2), 847-857.

Özer, S. & Akay, C. (2020). Öğretmen adaylarının akademik erteleme ve yabancılaşma düzeylerinin incelenmesi. *Journal of Social and Humanities Sciences Research (JSHSR), 7*(62), 3528-3542.

Öztürk, S. & Çipe, B.(2020). Kafka, metamorfoz ve emeğin yabancılaşması. Dokuz *Eylül Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 22*(1),105-121.

Parsil, A. M. (2007). *Sınıf örgütünde yabancılaşma.* Yayımlanmamış yüksek lisans tezi. Cumhuriyet Üniversitesi, Sivas.

Polat, Ş. (2018). Ortaokul öğrencilerinde okula yabancılaşma ve okul tükenmişliği ilişkisinin incelenmesi. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi, 31*(1), 257-277.

Polat, Ş., ve Özdemir, M. (2018). Ortaokul öğrencilerindeki eğitim stresi, okul tükenmişliği ve okula yabancılaşma arasındaki ilişkilerin incelenmesi. *Kastamonu Education Journal, 26*(5), 1395-1406.

Sağın, A. E. & Akbuğa, T. (2019). Lisanslı spor yapan öğrencilerin okula yabancılaşma düzeyleri. ÇOMÜ Spor Bilimleri Dergisi, 2(1), 44-55.

Sağlam, A. & İkiz, F. E. (2017). Ortaokul öğrencilerinin şiddet eğilimleri ile okula bağlılık düzeyleri arasındaki ilişkinin incelenmesi. İlköğretim Online, 16(3), 1235-1246.

Şakir, Ç., Kurum, G., ve Yıldız, S. (2021). Yükseköğretimde Öğrenci Bağlılığı Ölçeği: Geçerlik ve Güvenirlik Çalışması. *Cumhuriyet Uluslararası Eğitim Dergisi,* 10, 273-298.

Şimşek, H. & Ataş Akdemir, Ö. (2015). Üniversite öğrencilerinde okula yabancılaşma. *Curr Res Educ, 1*(1), 1-12.

Şimşek, H. & Katıtaş, S. (2014). İlköğretim ikinci kademe öğrencilerinde okula yabancılaşmanın çeşitli değişkenler açısından incelenmesi. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi (KEFAD), 15*(1), 81-99.

Terzi, A. R. (2021). Eğitim Sosyolojisi (Geliştirilmiş 2.Baskı). Ankara. Detay Yayıncılık

Terzi, A. R. (2015). Organizational commitment and citizenship behaviors among teachers, *Anthropologist*, *21*(1–2), 350–360.

Uslu, T. (2018). Üniversite öğrencilerinin liderlik, akademik özyeterlik *ve okula yabancılaşma algıları (Erzincan üniversitesi örneği).* Yayımlanmamış doktora tezi. İnönü Üniversitesi, Malatya.

Ülker Dörttpe, Z. (2016). Üniversite yaşamına uyum sürecinde yabancılaşmanın etkisi. Yayınlanmamış yüksek lisans tezi, Akdeniz Üniversitesi, Antalya.

Ünsal, S. (2017). Ortaöğretim öğrencilerinin okula yabancılaşmaları ve okula yabacılaşmalarına neden olan faktörler. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi,18*(3), 435-455.

Yıldız, O. Ş. (2017). *Otel işletmelerinde iş özellikleri ve örgütsel bağlılık ilişkisinde işe yabancılaşmanın rolü.* Yayımlanmamış doktora tezi. Hacı Bektaş Veli Üniversitesi, Nevşehir.

CHAPTER 3

EXAMINATION OF LEARNING-BASED PHYSICAL ACTIVITIES IN PLANS USED IN PRE-SCHOOL EDUCATION INSTITUTIONS[1]

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1 This study was held on November 24/26, 2021, 7. It is an extended version of the oral declaration presented at the International Preschool Education Congress (IECEC-UOEK-2021).

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1. Introduction

Movement is an integral part of human nature. People continue their lives with reflexes and complex physical activities (Tomporowski at al., 2011). Movements beginning with reflexes in the fetal period change in terms of density, time and shape in the process ahead. The highest period of change is early childhood. Given the negative correlation between the active lifestyle and the growing age, regular physical activities in the early years of life support the physical and cognitive development of children in their present and future lives (Lubans, Morgan, Cliff, Barnet and Okely, 2010). So supporting physical activity in early childhood is important for individuals to develop positive attitude toward such activities (Salmon and et al, 2005; Fisher, Reilly and Kelly, 2005; Cliff, Okely, Smith and McKeen, 2009; Donnelly and et al. 2016).

It has been stated that children who do not participate adequately in exercise movements in early childhood may have difficulty in skills such as balance, jumping, throwing, running, bouncing, etc. for an active life (Stodden, 2008). In a study performed by Fang et al (2017), there was a meaningful relationship between the regular presence of exercise movements in early childhood education environments and the learning levels of children. In this context, it is thought that integrating physical activity into educational environments will contribute positively to the development of children both physically and mentally. Physical activity plays a role in the development of many high-level cognitive skills. Chaddock-Heyman et al (2018) say that the brain cannot be focused on just by ignoring the body during the learning process. It can be said that traditional lessons put students in a cognitive and physically passive and immobile role. Vorkapic-Ferreira et al (2017) point out that regular physical activity and movement activities are required for the brain to function efficiently. Children in active learning positions with physical activity and movement activities are more effective in configuring and using knowledge, skills or experience learned. According to Olsson (2009), active learning occurs as a result of children interacting with the problem or experience. Children who learn by doing and living use their bodies for learning through play and movement. In this framework, it is stated that physical activity has a direct effect on learning processes (Hidayatullah, 2013; from Wujiati and at al., 2019). It is also expressed that physical activities provide motivation for learning. There is an increase in attention levels and cognitive skills when children are motivated enough (Lu at al, 2015; Hyndman at al., 2018; Zimmer, 2014; from Orhan, 2019; Diken, 2010). Children spend an important part of their days outside the house and in more school environments since the pre-school period. In terms of time spent in a school environment, children develop and maintain their

physical activity habits are closely related to educational environments (Hyndman and Mahony, 2018). McGowan at al (2021) say that children are not active enough in their education environment and that there is no positive behavior for learning activities can be developed in classroom environments where adequate movement is not achieved.

The Ministry of National Education 2013 program has designed organizations that provide early childhood education, while it has been stated that individuals should be organized in such a way that they can take into account the interests and needs of children and enable active learning. In closed-class environments of physical activity, studies that emphasize positive impact on learning, early childhood educators include physical activity in learning activities, show that children have made more permanent learning and enjoy school environments where they spend most of their days (Vanderloo at al., 2015). On the other hand, the inclusion of physical activity in classroom activities as well as out-of-class activities is a key issue for learning situations and creativity. Children learn at the rate they experience (Pate, R., at al., 2004).Less structured out door activities stimulate the sense of curiosity in the nature of children, leading children to research and learning (Pate, R.. R., McIver, K., at al, 2008). Research shows that schools must set outdoor strategies alongside classroom programs to enable students to achieve their learning and training program goals in school areas (Dobbins, Husson, DeCorby and LaRocca, 2013; Hyndman, Mahony, Te Ava, Smith and Nutton, 2017). Hyndman and Mahony (2018) have studied the effects of physical activities in mobile equipment and fixed equipment school outdoor environments, and in their studies, they have indicated that mobile equipment allows more creative activities, such as manipulating, designing, developing and relocating moving equipment due to the modular nature of mobile equipment. It has also been concluded that moving equipment may be more suitable for developing cognitive and social skills in children. Howie at al (2015), in an intervention study, planned activities in a structured and unstructured manner, tour the playground, capture, basketball, running, etc. utilizes motion activities. This practice has shown that children provide better learning outcomes, that the school is becoming more attractive to children, and that it supports the development of children's brain functions physiologically.Drollette at al (2014), examined how brain functions change with physical movements and how the sechanges are reflected in learning processes. The study found that the brain functions are more active and busy, according to a group running on a 20-minute walk band and a group performing a sit-in action during the same time period. The studies prove that cognitive processes and concepts of learning are related to physical experiences and are related to physical movements in many ways.

When the literature is examined, physical activity is included in educational environments with different applications (Erwin at al., 2021; Kelly, 2016). In recent years, kinesthetic classes have started to be created in which activities such as warming up activities (icebreaking), brain breaks, sitting on balance balls instead of rows or pilates balls are integrated into classroom or classroom activities such as creating curiosity, building group trust, reducing stress, and engaging in activities that keep the body active and active in students. In the study of kinesthetic class applications developed in the United States, the work includes regulations in-class environment to alert children to movement or stability. Kinesthetic Classroom applications enable children participating in activities and studies planned in educational environments to use their bodies during work and aim to minimize environmental constraints for children to learn (NepeanTutoring ,25 June 2021). In case of decreased concentration times in students at different times of the day Kinesthetic classrooms use funny storiesor 5-10-minute breaks, free roaming in the classroom, finger games, jumping, etc. To make children more focused. The sepractices contribute positively to the learning process by providing motivation and focus again for disoriented students (Pallotat al, 2017). The study, taken as a whole, shows that kinesthetic class practices increase motivation, support learning processes, prepare the brain and body for learning, increase levels of attention and participation (Kuczala, 2015; Peiris at al., 2021; Schiling, Washington, Billingsley and Deitz, 2003; Kilborn, 2009; Jovanova and Popeska, 2019; Hajar at al., 2020; Wiebelhaus and Fryer 2016; Dinkel at al. 2017)

These above-mentioned studies, physical activity has a positive impact on the development of high-level cognitive skills such as effective learning, creative thinking and critical thinking. In this context, it is considered important that early childhood educators include learning-based physical activity when creating their training plans. Pre-school education institutions, which can be accessed publicly on the Internet, are widely known to be using monthly education plans. In this study, to see how learning-based physical activities are included in the training flows used, the learning-based physical activity activities in the pre-school education institutions are examined.

2. Method

Research Model: A document study of qualitative research patterns was used in this study to examine the learning-based physical activity activities in the pre-school education institutions. The document review covers the analysis of written materials that contain information about the case and facts that are intended to be investigated. The document review can be used in conjunction with other data collection methods (Yıldırım ve

Şimşek, 2005, p. 187), as well as a single data collection method. There are some steps in the document analysis. These are the way to identify and access documents, check and understand the authenticity of the data, analyze data and use the data where necessary (Yıldırım ve Şimşek, 2005). The document to be analyzed in this study is a two-month training plan that includes daily training flows from 2020-2021 educational years, which are widely used in pre-school education institutions, and is explored in the context of the " Activity Involving Learning-Based Physical Activity ". The two separate monthly training plans, comprised of daily training flows, were determined based on the availability of public platforms on the internet. In this context, the activities planned using physical activity to reach the concepts contained in the Ministry of National Education Preschool Program (2013) or the concepts contained in the gain and indicators were evaluated as "Event with Learning-based physical Activity".

Data collection and Analysis

In activities involving a Learning-based physical Activity, the main objective is not to conduct physical activity, but to use physical activity as a tool when reaching gains and indicators. In this context, all activities under large group events, small group events, individual events and integrated events are evaluated except for the free activities included in the training plans. The data obtained in this way has been analyzed using the content analysis technique. Content analysis is a "scientific approach that explores social truth through objective and systematic classification, conversion to numbers and deduction of the message, meaning and/or grammar contained in verbal, written or other materials" (Tavşancıl and Aslan, 2001, s. 22). The training plans were analyzed by three researchers and identified activities that contain learning-based physical activity, the application locations of activities, the concepts used and the types of activities. The activities of the two plans reviewed in the content analysis are covered individually, while the activities planned to be integrated are calculated as one event. For the internal consistency of the study, the analysis of researchers has been compared and the activities with consensus have been determined. Miles and Huberman's (1994) reliability formula has been used for the reliability of the work. The reliability of the work was found to be 97%, as a result of the calculation of the reliability = consensus / (contingency + disagreement). Over 70% of the calculation according to miles and Huberman (1994) is considered reliable for research. For the purpose of the study, for what purpose/purposes is physical activity included in the training plans used in the pre-school education institutions? What are the methods used for activities involving learning-based physical activity? In which areas are activities involving physical activity included in the training plans implemented indoors/outdoors? What concepts are included

in the activities that include physical activity in the training plans and what types of activities have been carried out? Questions are answered.

3. Findings

In this part of the study, the findings are addressed to answer the work questions. How many activities were carried out during the year of the training, how much space was included in the learning-based physical activities, what types of activities included in the learning-based physical activity, the concepts and methods used and internal/external use cases for learning-based physical activities are presented in activities that include learning-based physical activity.

Table 1. Activity numbers in Training Plans

	Document One		Document Two	
	Number of Events	**Activity Involving Learning-Based Physical Activity**	**number of activity**	**Activity with Learning-based physical Activity**
September	59	8	8	-
October	56	8	28	6
November	48	6	41	7
December	23	2	47	3
January	15	1	31	4
February	45	2	20	1
March	57	8	66	2
April	50	3	85	4
May	55	1	36	5
June	29	_	47	4
Total	437	39	409	36

Table 1 shows the number of activities implemented in the training plans by months. The documents examined identified first document 437 activities, second document 409 activities. In education plans, play, maths, art, science, action, A total of 846 events including drama, music, readiness to read and writing and Turkish language activities have been reviewed. When reviewing the events, the integrated activities are considered as one event. Since second document has included more integrated events, the total number of events varies by 1.plandan in some months, although the monthly workday is the same. From a point of view of learning based physical activity, activities were found to contain in the first document 39, in the second document 36 learning based physical activities. 75 of the total 846 activities carried out in the training plans are activities that include learning-based physical activity (table 1). Activities involving learning-based physical activity account for 9% of both plan total activities (846)

Table 2. Activity types with Learning-based physical Activity

	Play	Mathematics	Art	Science	Motion	Drama	Music	Readiness to Read and Write	Turkish Language Activity	Total
Plan 1	32	2	1	3	2	1	1	3	1	46
Plan 2	25	13	1	7	3	2	--	3	--	54
Toplam	57	15	2	10	5	3	1	6	1	100

Table 2 shows the distribution of activities that include learning based physical activity by species. 1.planda 46, in the second document 54 activities total 100 activities include learning based physical activities. The training plans examined show that the learning based physical activity is at the most game activity (First Document 32, Second Document 25), at least music and language activity in Turkish (First Document 1, Second Document 1). When integrated activities are divided into activity type, the number of learning-based physical activities (Table 1) within the overall activity numbers of the plans and the number of activity types with learning-based physical activity (Table 2) differ. This is due to the fact that when reviewing the overall activity numbers, integrated activities are treated as single events.

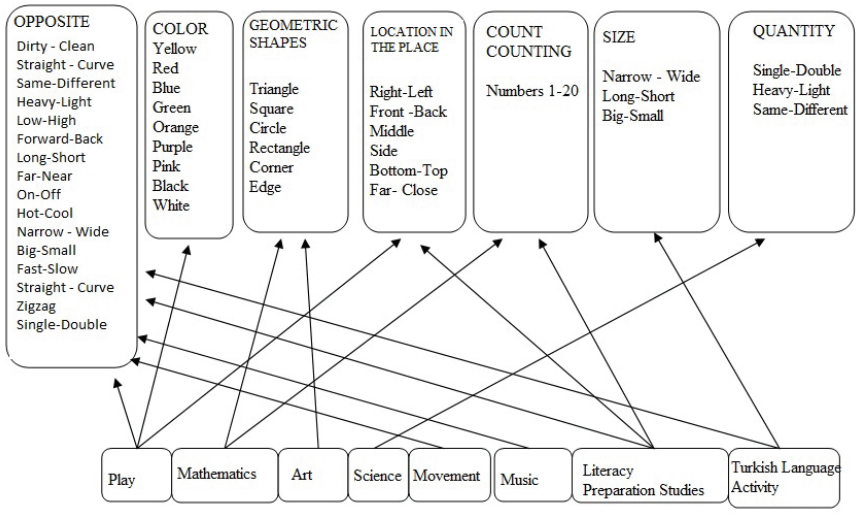

Figure 1. Concepts involved in activities involving Learning-based physical Activity

Figure 1. shows the concepts involved in activities that include learning-based physical activity in the plans. The target concepts in the activities are classified according to the concept categories in the month Training Plans in the National Ministry of Education Pre-School Program (2013) (Figure 1). According to this, Figure 1. Opposite concepts, Color,

Geometric shapes, Location at Site, Number/Count when examined, It appears to be in the Size and Quantity categories. The learning basis in the prepared plans includes the concepts that are in the most opposing categories of activities that include physical activity. In terms of the types of activities planned to reach the concepts in Figure 1, activity plans have been prepared in the types of Play, Motion, Music, Read and Preparation literacy to reach the concepts in the category of opposites. To reach the concepts within the color category, Gaming activities, Mathematics and Art activities for concepts in the Geometric shapes category, Reading Preparation Literacy Studies for concepts in Location category in the Site, and Game activities, Preparation to literacy and Mathematics activities for concepts in the Number/Count category, To reach the concepts in the category of size, Turkish Language activities and the concepts in the category of Quantity, activities with learning-based physical activity of the type of science activity were determined to be planned.

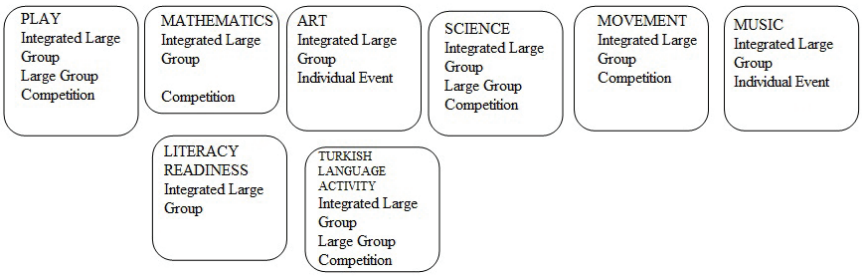

Figure 2. Types and methods of activities involving Learning-based physical Activity

Figure 2 shows the types and methods of application of learning-based physical activities. Activities that include learning based physical activity in the pre-prepared plans reviewed Game, Mathematics, Art, Science, Motion, Prepared in the types of Music, Read and Literacy Preparation and Turkish Language Activity. It is seen that activities are planned mainly as integrated large group event and large group event, and only Art activities and Music activities are prepared as a combined large group event and large group event as well as as as as as as individual events. Apart from the arts activities, Music activities and Preparatory to Writing to Read, it has been seen that the activities of Play, Mathematics, Science, Motion and Turkish Language are prepared in competition.

Table 3. Indoor/Outdoor Distribution of Activities in Plans by Months

	Document One		Two Document	
	Indoor	**Outdoor**	**Indoor**	**Outdoor**
September	58	1	8	__
October	53	3	22	6
November	47	1	37	4
December	21	2	46	1
January	13	2	29	2
February	44	1	18	2
March	55	2	64	2
April	50	__	81	4
May	53	2	36	__
June	26	3	43	4
Toplam	420	17	384	25
	437*		**409***	

*** Number of events applied throughout the year in plans**

Table 3 shows the outdoor use of activities in the plans. Table 3 it was determined that the use of a non-classroom outdoor space was recommended in 17 of the 437 first-class activities, while the second plan suggested using a non-classroom outdoor space in 25 of 409 activities. The decrease in the planned plans under review is remarkable, as the weather heats up in the events, according to the months.

Table 4. Indoor/Outdoor Distribution of Activities Involving Learning-Based Physical Activity

	Indoor	**Outdoor**
Plan 1	38	1
Plan 2	34	2

Table 4 shows the use of open space in activities involving learning-based physical activity implemented in the plans. When Table 4 is examined, it is determined that outdoor use is recommended in 1 of the 39 activities involving learning-based physical activity in the first plan, and outdoor use is recommended in 2 out of 36 activities involving learning-based physical activity in the second plan.

4. Results and Discussion

A total of 846 activities included in the two separate annual training plans were reviewed in this study, aimed at examining the learning-based physical activity activities in the pre-school education institutions. The activities reviewed have been evaluated for learning-based physical

activities, types of activities involving learning-based physical activity, concepts and methods of use that are desired in activities involving learning-based physical activity, areas of application (indoor/outdoor).

Based on activities involving learning-based physical activity, 75 (9%) of the total 846 activities in the training plans constitute an activity that includes learning-based physical activity (Table 1). In a study that tucker and his friends (2011) have reported that 96% of the educators in pre-school institutions know the importance of physical activity and movement training. However, it is seen that educators who train in the institutions in which the research is conducted do not participate in planning as much as they care about physical activity. According to Trost at al (2010), educators are more likely to prefer static activities in institutions that teach early childhood. This is similar to the results of the work carried out. In addition, Mavilidi and her friends (2016) have integrated physical activity into pre-school children's geography learning, demonstrating that children with physical activities perform more learning than traditional learning methods in classroom environments. Again, Mavilidi at al (2017) stated that in their study, they integrate physical activity into the science class, they have the highest learning output in cases where children integrate physical activities and embody them. Toumpaniari at al (2015) have found that physical activity and gestures have been studying the impact of children learning foreign languages, while physical activity supported by gestures provides more permanent learning than static and traditional learning, and children enjoy this learning method more. When evaluated in the context of these studies, implementation of the pre-training plans commonly used in our country shows that the proposed activities are inadequate to include learning-based physical activity (9%). Güler and Demir (2016) concluded that in their early childhood educators' study of the views and perceptions of risky games, teachers saw physical activity-related games as risky and were cautious against risky games. It may be considered that, in the case of less room for activities involving physical activity, teachers see moving activities as risky, find desk-side activities more secure, as well as the idea that classroom management is easier at inactive activities, and this is reflected in the process of preparing an event plan.

When looking at the distribution of activities that contain learning-based physical activity based on activity types, in the first document 46, in the two document 54 shows that the activity contains learning-based physical activity (Table 2). The learning-based physical activity in the training plans examined was included in the most game activity (First Document 32, Second Document 25), the least music and language activity in Turkish (Plan 1, Plan 1, Plan 2, Plan 1). Derschied at al (2010) worked on early childhood educators' views on integrating certain physical

activities in the classroom into activities, and concluded that educators often included physical activity during the day, free play, out and music. This result is similar to the work done and the use of physical activities in more gaming activities. According to Reilly (2010), the reason why physical activity is not prioritized in early childhood education is because early childhood educators and parents tend to choose other learning areas such as literacy, arithmetic and readiness to write for formal education instead of physical activity. In this context, the education plans prepared in our country may also be considered to have an impact on this trend. In other words, early childhood educators have no academic concern of the game activity type and they use physical activity as a tool for fun time rather than as a learning tool, so they can conclude that they include more physical activity content in the game activity type. However, in a study by Dewar (2016) aimed at integrating new concept teaching into one-on-one experience, the intervention group was allowed to do the action one-on-one, while the work done in the control group was only performed through demonstration. As a result of the study, when learning is integrated into physical experience, it has been found that the language development of its participants is better than the traditional methods of using the time and concepts to memorize new concepts learned.

From a point of view of the concepts intended to achieve the training plans, these concepts are opposing, Color, Geometric shapes, Location in Site, Number/Count, It appears to be in the Size and Quantity categories (Figure 1). The learning basis in the prepared plans includes the concepts that are in the most opposing categories of activities that include physical activity. The types of activities prepared to reach concepts in the plans are in the category of Game, Motion, Music, readiness to Read, and Turkish Language Activity types, Play activities in the Color category, Mathematics and Art activities in the Geometric shapes category, reading preparation to literacy in Location Category and Play activities, In the Number/Count category, the reading Preparation to Literacy Studies and Mathematics activities, Turkish Language activities in the Size category, and learning-based physical activities in the Quantity category of the Fen activity type were planned (Figure 1). When preparing training plans, it was determined that activities involving learning-based physical activity were more involved in opposing concepts and examples of practice in different types of activities. There was no study in the literature regarding the use of opposites in activities. However, it may be thought that the training plans used in pre-school education institutions are more likely to have opposite concepts in activities that include learning-based physical activity, because it is easy to plan as a competition and adapt opposites for competitor events. From the perspective of the types and methods of

applying learning-based physical activities to training plans, activities that include learning-based physical activity in the pre-examined plans Game, Mathematics, Art, Science, Motion, It was observed that the activities were prepared in the types of Music, Literature Preparation Studies and Turkish Language Activity and were planned mainly as integrated large group event and large group event, and that only Art activities and Music activities were prepared as an individual event in addition to them (Figure 2). In addition, other than the Art activities, Music activities and Preparatory to Write to Read Studies, it has been determined that the activities of Play, Mathematics, Science, Motion and Turkish Language are prepared in competition with another expression suggested to be applied in the form of competition (Fig. 2). Sönmez (2016) in the study of preschool children to determine how they perceive their own performance in competitive and non-competitive environments and to determine their satisfaction levels of performance, in the competition environment, he reported that children are performing more than the competition environment, but that close to all children in non-competition environments feel happy, while less feel happy in the competition. It is important to experience feelings such as sadness, breakage, happiness during early childhood. However, the surplus of the competition may adversely affect the condition of children being good (Sönmez, 2016). Therefore, it is important to ensure that competitive and non-competitive activities are balanced when preparing activities in pre-school education institutions. However, it has been found that while preparing activities involving learning-based physical activity in the surveyed plans, the balance of competitive and uncompetitive activity is not noticed.

Given the use of space in the training plans, 3 of the 75 activities that contain learning-based physical activity have been implemented outdoors and 72 activities have been implemented within the classroom (Table 4). To learn about concepts such as numbers, colors, shapes, etc., these activities are jumping, rolling, running etc. it is determined to contain activities. In terms of space usage, the activities in the training plans showed that 42 activities from 846 events carried out throughout the year were carried out outdoors and 804 activities were carried out in the classroom (Table 3). According to Vanderloo (2015), the effectiveness of the physical activities of children in institutions varies depending on the quality of the institution, whether trainers receive physical activity training, material and field suitability. Vanderloo (2015) concluded in his study that children in early childhood were less physically active than children in the institution with an outdoor playground, which served full-day and continued an institution without an outdoor playground. In this respect, it may be considered that early childhood educators in our country do not plan adequately for the

use of outdoor spaces in their education plans because of the physical conditions of schools.

As a result, this study was conducted to examine the learning-based physical activity in pre-school education plans commonly used in pre-school education institutions and found that there was not enough room for physical activity in the training plans used, but also insufficient activities recommended for out-of-class use. However, research on physical activity, learning and cognitive indicates that physical activity supports learning and cognitive processes. In addition to traditional teaching methods in schools, warming up activities (IceBreaking), brain breaks (Brain-Breaks), as well as new approaches to using balance balls instead of chairs, show that incorporating physical activity into educational environments increases learning permanence (Donnelly and Lambourne, 2011). In this context, early childhood educators should take care to include physical activity in their activities and training plans and educational institutions into their institution policies. In many educational institutions around the world, from pre-school schools to university levels, this change has been implemented and positive learning outcomes have been received as a result of the practice. In order to increase the daily physical activation times of children, as well as in-class applications and physical regulations, and to make a habit of that, children should be supported for their access to educational institutions by bicycle or by foot. In addition, early childhood educators should be encouraged to prepare their own event plans, taking into account the needs, availability levels, facilities of their institutions, and the needs of the group they train instead of ready plans. Action activities should be as important as activities that support other development areas and movement activities should be more involved in training flows. Early childhood educators and parents should be raised to be aware of this, and they should be supported to gain healthier and more active living habits in order for children to gain holistic learning experiences.

5. References

Akbaba, S. (2006). Eğitimde motivasyon. *Atatürk Üniversitesi Kazım Karabekir Eğitim Fakültesi Dergisi*, (13), 343-361.

Bagatell, N., Mirigliani, G., Patterson, C., Reyes, Y., & Test, L. (2010). Effectiveness of therapy ballchairs on classroom participation in children with autism spectrum disorders. AmericanJournal of Occupational Therapy, 64(6), 895-903.

Batt, K. (2009). *The Implementation of kinesthetic learning activities to identify geometrics hapes with preschool students.* (Electronic Thesisor Dissertation). Retrieved from https://etd.ohiolink.edu/

Benham, E., Ciotto, C., &Fede, M. (2014). Learn to move, move to learn: Motivate students to learn through school-based physical activity. Principal Leadership, 15(4), 40.

Chow, B. C., McKenzie, T. L., &Louie, L. (2015). Children's physical activity and associated variables during preschool physical education. Advances in Physical Education, 5(01), 39.

Chaddock-Heyman, L. (2012). The Effects of Physical Activity on the Brain and Cognition During Childhood. dissertation, Urbana IL: University of Illinois at Urbana-Champaign.

Cliff, D. P., Okely, A. D., Smith, L. M., &McKeen, K. (2009). Relation ships between fundamental movement skills and objective lymeasured physicalactivity in preschool children. Pediatric exercise science, 21(4), 436-449.

Derschied, L. E., Umoren, J., Kim, S., Henry, B.W., &Zittel, L. L. (2010). Early childhood teachers' and staffmembers' perceptions of nutrition and physical activity practices for preschoolers. Journal of Research in Childhood Education, 24, 248–265.

Dewar, G. (2016, October). *Featurestory.* Natural Start. https://naturalstart.org/feature-stories/learning-doing-how-outdoor-play-prepares-kids-achievement-stem

Diken, İ. H. (Ed.). (2010). Erken çocukluk eğitimi.

Dinkel, D., Schaffer, C., Snyder, K., & Lee, J. M. (2017). They just need to move: Teachers' perception of class room physical activity breaks. *Teaching and Teacher Education*, *63*, 186–195. https://doi.org/10.1016/j.tate.2016.12.020

Dobbins, M., Husson, H., DeCorby, K., &LaRocca, R. L. (2013). School-based physical activity programs for promoting physical activity and fitness in children and adolescent saged 6 to 18. The Cochrane Database of Systematic Reviews, 2(2), Cd007651.

Donnelly, J. E., Hillman, C. H., Castelli, D., Etnier, J. L., Lee, S., Tomporowski, P., ... & Szabo-Reed, A. N. (2016). Physical activity, fitness, cognitive

function, and academic achievement in children: a systematic review. Medicine and science in sports and exercise, 48(6), 1197.

Dolu, N., Bahür, S., Demirer, S., Kulak, E., Çam, A. (2016).The effect of physical activity on cognitive function. İzmir Üniversitesi Tıp Dergisi, R5

Drollette, E. S., Scudder, M. R., Raine, L. B., Moore, R. D., Saliba, B. J., Pontifex, M. B., &Hillman, C. H. (2014). A cute exercise facilitates brain function and cognition in children who need it most: an ERP study of individual differences in inhibitory control capacity. Develop mentalc ognitiveneuro science, 7, 53-64.

Erwin, H., Weight, E. and Harry, M. (2021), "Happy, Healthy, and Smart": Student Responses to the Walking Classroom Education Program Aimed to Enhance Physical Activity. J School Health, 91: 195-203. https://doi.org/10.1111/josh.12990

Fang, H., Quan, M., Zhou, T., Sun, S., Zhang, J., Zhang, H., &Chen, P. (2017). Relationship between physical activity and physical fitness in preschool children: a cross-sectionalstudy. *BioMedresearchinternational*, *2017*.

Fedwa, A. L., &Erwin, H. E. (2011). Stability balls and students with attention and hyperactivity concerns: Implications for on-task and in-seat behavior. *American Journal of Occupational Therapy, 65*(4), 393-399.

Ferreira-Vorkapic, C., Feitoza, J.M., Marchioro, M., Simões, J., Kozasa, E. and Telles, S. (2015) Are There Benefits from Teaching Yoga at Schools? A Systematic Review of Randomized Control Trials of Yoga-Based Interventions. Evidence-Based Complementary and Alternative Medicine, 2015, Article ID: 345835. https://doi.org/10.1155/2015/345835

Flippin, M., Clapham, E., ve Tutwiler, M.. (2021). Effects of Using a Variety of Kinesthetic Classroom Equipment on Elementary Students' On-Task Behavior: A Pilot Study. Learning Environments Research. 10.1007/s10984-020-09321-2.

Fisher, A., Reilly, J. J., Kelly, L. A., Montgomery, C. E., Williamson, A., Paton, J. Y., & Grant, S. (2005). Fundamental movement skills and habitual physicalactivity in young children. Med Sci Sports Exerc, 37(4), 684-688.

Güler, B. İ. & Demir, E. (2016). Okul Öncesi Öğretmenlerinin Riskli Oyunlara Yönelik Görüş ve Algıları . Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi , 17 (02) , 97-118 . DOI: 10.21565/ozelegitimdergisi.246484

Haan, M. (2015). "Stability Balls and Hand writing Proficiency in a Kindergarten Classroom" Master of Education Program Theses. 86. https://digitalcollections.dordt.edu/med_theses/86

Hajar M.S., Rizal H., Muhamad A.S., Kuan G. (2020) The Effects of Brain-Breaks on Short-Term Memory Among Primary School Children in Malaysia. In: Hassan M. et al. (eds) Enhancing Healthand Sports Performance by

Design. MoHE 2019. Lecture Notes in Bio engineering. Springer, Singapore. https://doi.org/10.1007/978-981-15-3270-2_50

Howie, E. K., Schatz, J., & Pate, R. R. (2015). Acute Effects of Classroom Exercise Breaks on Executive Function and Math Performance: A Dose-Response Study. *Research quarterly for exercise and sport*, *86*(3), 217–224. https://doi.org/10.1080/02701367.2015.1039892

Hyndman, B.,&Mahony, L. (2018). Developing creativity through out door physical activities: a qualitative exploration of contrasting school equipment provisions. Journal of Adventure Education and Outdoor Learning, 18(3), 242-256.

Jovanova S., Jovanova M., ve Popeska, B. (2019). Brain Breaks Active Break in Macedonian Schools –Qualitative Study. *Activities in PhysicalEducationandSport, International Journal of Scientificand Professional Issues in PhysicalEducationandSport*, *9*(1–2), 34–37.

Kafka, N., ve Limberg, R., (2013). "Surveying Teachers about the Use of Stability Balls as an Intervention," *Journal of Under graduate Research at Minnesota State University, Mankato*: Vol. 13 ,Article 3.

Kelly Mancini Becker (2016) The Walking Classroom: Active Learning Is Just Steps Away!, Journal of Physical Education, Recreation & Dance, 87:2, 20-26, DOI: 10.1080/07303084.2015.1119073

Kercood, S., Banda, D.R. (2012). Theeffects of added physicalactivity on performance during a listening comprehension task for students with and without attention problems. International Journal of Applied Educational Studies, 13(1), 19-32.

Kilbourne, J. (2009) Sharpening the mind through movement: using exercise balls as chairs in a university class. *Chronicle of Kinesiology&Physical Educationin Higher Education, 20*(1), 10-15.

Kim, J. (2015). Physical activity benefits creativity: Squeezing a ball for enhancing creativity. Creativity Research Journal, 27(4), 328–333. https://doi.org/10.1080/10400419.2015.1087258

Köyceğiz, M., ve Özbey, S. (2019). Okul öncesi eğitim kurumlarına devam eden çocukların motivasyon düzeylerinin problem çözme becerileri ve öğretmenlerine ilişkin bazı değişkenler açısından incelenmesi. Folklor/Edebiyat, 25(97), 554-574.

Malina, R. M. (2001)."Physical activity and fitness: Path ways from childhood to adulthood," American Journal of Human Biology, vol. 13, no. 2, pp. 162–172.

Lu, C., &Montague, B. (2016). Movetolearn, learn to move: Prioritizing physical activity in early childhood education programming. Early Childhood Education Journal, 44(5), 409-417.

Lubans, D. R., Morgan, P. J., Cliff, D. P., Barnett, L. M., &Okely, A. D. (2010). Fundamental movement skills in children and adolescents. Sports medicine, 40(12), 1019-1035.

Mavilidi, M. F., Okely, A. D., Chandler, P., &Paas, F. (2016). Infusing Physical Activities In to the Classroom: Effects on Preschool Children's Geography Learning. Mind, Brain, and Education, 10(4), 256–263. https://doi.org/10.1111/mbe.12131

Mavilidi, M. F., Okely, A. D., Chandler, P., &Paas, F. (2017). Effects of Integrating Physical Activities Into a Science Lesson on Preschool Children's Learning and Enjoyment. Applied Cognitive Psychology, 31(3), 281–290. https://doi.org/10.1002/acp.3325

McGowan, A. L., Gerde, H. K., Pfeiffer, K. A., &Pontifex, M. B. (2021). Physically active learning in preschoolers: Improved self-regulation, comparable quantity estimation. *Trends in Neuro science and Education*, 100150. Pallot, M., Christmann, O., Richir, S., Dupont, L., Boly, V., &Morel, L. (2017). ICE Breaking. 11, 1–7. https://doi.org/10.1145/3110292.3110316

Miles, B.M. ve Huberman, A.M.(1994). Qualitative data analysis: An expanded source book. Retrieved from http://books.google.com.tr/ books/about/Qualitative_Data_Analysis.html

Niederer, I., Kriemler, S., Gut, J., et al. (2011). "Relationship of aerobic fitness and motor skills with memory and attention in preschoolers (Ballabeina): A cross-sectional and longitudinal study," BMC Pediatrics, vol. 11, articleno. 34

NepeanTutoring, (25 Haziran 2021). *Benefits of kinesthetic learning*. Nepean Tutoring https://nepeantutoring.com.au/benefits-of-kinesthetic-learning

Olsson, L.M. (2009). Movement and Experimentation in Young Children's Learning: Deleuze and Guattari in Early Childhood Education (1st ed.). Routledge. https://doi.org/10.4324/9780203881231

Pallot, M., Christmann, O., Richir, S., Dupont, L., Boly, V., &Morel, L. (2017). *ICE Breaking*. *11*, 1–7. https://doi.org/10.1145/3110292.3110316

Pate, R. R., McIver, K., Dowda, M., Brown, W. H., &Addy, C. (2008). Directly observed physical activity levels in preschoolchildren. Journal of schoolhealth, 78(8), 438-444.

Peiris, C. L., O'Donoghue, G., Rippon, L., Meyers, D., Hahne, A., De Noronha, M., &Hanson, L. C. (2021). Classroom Movement Breaks Reduce Sedentary Behavior and Increase Concentration, Alertnessand Enjoymentduring University Classes: A Mixed-Methods Feasibility Study. *International journal of environmental research and public health*, *18*(11), 5589.

Reilly, J. (2010). Low levels of objectively measured physicalactivity in preschoolers in childcare. Medicine and Science in Sports and Exercise, 42(3), 502–507.

Salmon, J., Timperio, A., Cleland, V., &Venn, A. (2005). Trends in children's physical activity and weight status in high and low socio-economic status areas of Melbourne, Victoria, 1985-2001. Australian and New Zealand journal of public health, 29(4), 337–342. https://doi.org/10.1111/j.1467-842x.2005.tb00204.x

Sibley, B. A., &Etnier, J. L. (2003). The relationship between physical activity and cognition in children: A meta-analysis. Pediatric Exercise Science, 15, 243–256.

Schilling, D. L., Washington, K., Billingsley, F. F., &Deitz, J. (2003). Classroom seating for children with attention deficit hyperactivity disorder: Therapy balls versuschairs. *American Journal of Occupational Therapy, 57*(5), 534-541.

Schilling, D. L., &Schwartz, I. S. (2004). Alternative seating for young children with autism spectrum disorder: Effects on classroom behavior. *Journal of AutismandDevelopmentalDisorders, 34*(4), 423-432.

Schwart, K. (2015, Mart 16). *Why kids need to move, touch and experience to learn. KQED.* https://www.kqed.org/mindshift/39684/why-kids-need-to-move-touch-and-experience-to-learn

Sönmez, Sibel. (2016). *Erken Çocukluk Döneminde Bireysel Ve İkili Grup Etkinlik Performans Algıları: Karşılaştırmalı Deneysel Bir İnceleme* Ss, 323-333 *Perceptıon Of Indıvıdual And Pairs Actıvıtıes Performance In Early Chıldhood: A Comperatıve Experımental Study.*Jounal of Academic Social Science Studies. Autumm III. 323-333.

Spalding, A., Kelly, L., Santo Pietro, J. E., &Posner-Mayer, J. (1999). *Kids on the ball: Using Swiss balls in a complete fitness program*. Champaign, IL: Human Kinetics.

Stodden DFF, Goodway JDD, Langendorfer SJJ, Roberton MAA, Rudisill MEE, Garcia C, et al. (2008). A develop mental perspective on the role of motor skill competence in physical activity: An emergent relationship. Quest. 2008;60:290–306.

The New York Times. (2017, Mart 24). *Do you learn better after moving around?.* The New York Times. https://www.nytimes.com/2017/03/24/learning/do-you-learn-better-after-moving-around.html

Tomporowski, P. D., Davis, C. L., Miller, P. H., &Naglieri, J. A. (2008). Exercise and children's intelligence, cognition, and academic achievement. Educational Psychology Review, 20, 111–131.

Trost, S. G., Ward, D. S., &Senso, M. (2010). Effects of child care policy and environment on physical activity. Medicine and science in sports and exercise, 42(3), 520-525.

Tucker, J. M., Welk, G. J., & Beyler, N. K. (2011). Physical activity in US adults: compliance with the physical activity guidelines for Americans. American journal of preventive medicine, 40(4), 454-461.

Vanderloo, L. M., Tucker, P., Johnson, A. M., Burke, S. M., &Irwin, J. D. (2015). Environmental in fluences on Preschoolers' physical activity levels in various early-learning facilities. Research Quarterly for Exercise and Sport, 86(4), 360-370.

Wiebelhaus, S., &FryerHanson, M. (2016). Effects of Classroom-Based Physical Activities on Off-Task Behaviors and Attention: Kindergarten Case Study. *The Qualitative Report*, *21*(8), 1380-1393. https://doi.org/10.46743/2160-3715/2016.2448

Wujiati&TohoCholikMutohir&Nining W. Kusnanik&Zukhairina & Sri Hidayati & Emosda & Ekawarna & Yennizar & Amirul Mukminin*, 2019. "Critical Thinking Skills Based "Physical Activities Learning Model for Early Childhood," The Journal of Social Sciences Research, Academic Research Publishing Group, vol. 5(3), pages 738-755, 03-2019

CHAPTER 4

PROBLEM POSING ACTIVITIES IN GASE CONCEPT IN CHEMISTRY COURSE

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INTRODUCTION

Considering the current primary, secondary, and high school mathematics and science curricula, there is a general statement of the Ministry of National Education on the curricula in all of them, which is the same in all curricula. The said statement is as follows;

"*The rapid change in science and technology, the changing needs of individuals and society, and innovations and developments in learning and teaching theories and approaches have also directly affected the roles expected from individuals. This change describes an individual who produces knowledge and can use it functionally in life, can solve problems, thinks critically, is entrepreneurial and determined, has communication skills, can empathize, and contributes to society and culture*." (Ministry of National Education [MoNE] 2018a, b, c, d).

As can be understood from this statement, the primary aim of education is to raise individuals who can produce knowledge, have developed high-level thinking skills such as problem-solving and critical thinking, and can use these skills functionally in daily life. The emphasis on the importance of interdisciplinary studies in the statement,

"*A total of curricula that direct the use of metacognitive skills, provide meaningful and permanent learning, are associated with solid and previous learning and integrated with values, skills, and competences with other disciplines and daily life have been created*"

is remarkable. (MoNE 2018a, b, c, d).

Furthermore, in all of the curricula, it is indicated that the education system aims "to raise individuals of character with integrated knowledge, skills, and behaviors in competencies," and eight key competencies are defined in the Turkish Qualifications Framework. "Mathematical competency and basic competency in science/technology" are among these competencies. In this competency, mathematical competency is defined as

"*the ability and desire to develop and apply mathematical thinking to solve a number of problems encountered in daily life and to use mathematical modes of thinking (logical and spatial thinking) and presentation (formulae, models, constructs, graphs, and tables) to varying degrees."*

Within the same competency,

"Competency in Science" is expressed as "referring to the presence of knowledge and the ability and desire to utilize methodology for the explanation of the natural world to define questions and produce evidence-based conclusions." (MoNE 2018a, b, c, d).

Considering this information within the curricula, it can be said that there are common views in teaching mathematics and science courses, and in this regard, it is aimed to raise individuals with developed high-level thinking skills by adopting the interdisciplinary approach.

Considering the adoption of the interdisciplinary approach, it is observed that this view is actually not new and the importance of common practices has been frequently mentioned in the curricula developed by emphasizing the close relationship between science and mathematics disciplines since 1989 (National Research Council [NRC] 1996; National Council of Teachers of Mathematics [NCTM] 2000; The Next Generation Science Standards [NGSS] 2013). Furthermore, particular attention is also drawn to the relationship between science and mathematics disciplines in STEM programs developed in recent years, the importance of the common practices of disciplines is emphasized (National Research Council [NRC] 2012; Next Generation Science Standards [NGSS], 2013), and it is indicated that mathematics and science course contents at primary-high school levels include common processes such as problem-solving and reaching numerical results (NRC, 2011, 2012; NGSS, 2013). Additionally, both disciplines aim to raise individuals with skills to solve daily life problems and are based on problem-solving process and thinking skills (National Council of Teachers of Mathematics [NCTM], 2000; NRC, 2012; NGSS, 2013; MoNE 2018a, b, c, d). In the vision of the program created for mathematics education at K-12 levels in the USA and Canada, it is emphasized that students should understand how mathematical concepts relate to both other mathematical concepts and concepts in other disciplines, especially science, and they should be integrated into school curricula in such a way that they establish a chain of connections at each grade level (Morlier, 2012). Concerning the relationship between the two disciplines, the first common issue that comes to mind is numerical problems and their solutions. In both mathematics and science courses, students try to solve problems and reach the correct result by applying the knowledge they have acquired in courses to the equations they have learned. However, even mathematics courses in which numerical problems are mostly solved are not considered a stack of formulae to be applied by memorizing, and it is ignored that they should have a structure that includes questioning, critical thinking, and analysis, in other words, using high-level cognitive skills (Işık ve Kar, 2012; İymen, Duatepe-Paksu, 2015; Karabey, Tunalı, Olkun, Ergut; 2019). As a result of this application, it is seen that students who have solved problems usually cannot interpret the results they have found and remain incapable of explaining their solutions (Işık ve Kar, 2012). Based on this information, it can be clearly indicated that applications to be performed with memorized formulae will not be sufficient in "raising individuals with developed high-level thinking

skills," which is the common goal of mathematics and science courses. Therefore, it is believed that more productive individuals will be raised by preparing active learning environments that allow students to reason by giving up memorization and the mechanical application of certain rules (Singh, Hoon, Md Nasir, Han, Md Rasid & BZH. J. (2020). Based on these views, considering the types of problems in mathematics and science courses and their solution steps, the following information attempted to be briefly explained below was reached.

When the types of problems in science courses are first considered, it is seen that they are divided into two groups as *numerical* (algorithmic) and *conceptual* (Nakiboğlu ve Kalın, 2003). *Numerical problems* are the types of problems in which students do not need to think much and make comments (Lin, Chiu ve Chou, 2004; Nakhleh ve Mitchell, 1993), and can reach the result by solving the formulae they have memorized. *Conceptual questions* are the types of questions in which students' knowledge and understanding of concepts are measured (Watkins ve Hattie, 1985). The inability of students who are successful in solving numerical problems to achieve the same success in solving conceptual problems (Nakhleh ve Mitchell, 1993) indicates that conceptual questions require more in-depth understanding compared to algorithmic questions. In this case, it would not be very realistic to assume that students who solve algorithmic questions by memorizing formulae also learn concepts. However, students who have learned concepts in depth can be successful in solving algorithmic problems (Nakhleh ve Mitchell 1993, Boujaoude, Salloum, ve Abd-El-Khalick, 2004).

Types of mathematical problems are generally classified as *closed-ended, open-ended,* and *research-project* types. Concerning closed-ended and open-ended problem types within the scope of the study, it is observed that *closed-ended problems* are divided into two groups as routine and non-routine problems. *Routine problems* are types of problems that can be frequently encountered in daily life and can be solved by four operations (Altun, 2008). *Non-routine problems* are the types of problems that require more thinking compared to routine problems, organizing data, and seeing the relationships. Non-routine problems are divided into two as "real life problems" and "process problems." Real life problems should include a real life situation in addition to having the characteristics of non-routine problems. Therefore, real life conditions, as well as mathematical thinking and operations, should be considered in solving these questions (Greer 1993). Such problems may have more than one solution or no correct answer, which may cause students to have uncertainties in their minds and experience cognitive conflicts (Nesher and Hershkovitz 1997). Mathematical thinking processes used to achieve results in solving

problems are important in process problems. *Open-ended problems* are problems that do not have a single answer, involve problems in daily life, and contain incomplete information and assumptions. There is no single method for the solution of these problems, and problems can be solved in various ways and have many possible answers. They are helpful for the development of students' creativity and imagination (Akay 2006).

Considering the above-described types of problems for mathematics and science courses, it is seen that numerical problems, which are frequently used in science disciplines, and closed-ended problems, which are also frequently used in mathematics courses, have common characteristics, which suggests the idea that the steps of problem-solving in these disciplines should also be compared.

Problem-solving provided by Polya (1957, 1973) as four steps, including "understanding the problem," "devising a plan," "carrying out the plan," and "looking back," for mathematical problems was increased to five steps in 1994 with the addition of Gonzales' "expansion" step (Yıldız, 2008). Concerning the steps of problem-solving in science courses, it is observed that four steps consisting of understanding the problem, identifying the problem, carrying out a plan for the solution, and validation were provided by Herron (1996) (Akben, 2020). Problem posing, which is defined as creating a new problem or producing new problems (English, 1997; Silver,1994) by making changes to the existing ones, can be carried out using various methods. Stoyanova and Ellerton (1996) classified these methods as structured, semi-structured, and free problem-posing techniques. In the *structured problem-posing* method, students create a new problem by changing the information given to them. The problems created by the method "What if? … what if not?" developed by Brown and Walter (1993) are considered structured problem posing (Kaba ve Şengül 2016). In semi-structured problem-posing situations, an open-ended situation is given to students, and they are asked to pose a problem using their knowledge, skills, and experience. In the *free problem-posing* method, students are asked to produce a problem depending on a situation without giving any problem. For example, situations such as "Create a problem related to…..?" or "Produce a problem about…" are used for this method (Stoyanova, 2003).

Research Aim

Based on the above-mentioned statements, it can be clearly indicated that problem types and problem-solving steps in mathematics and science disciplines are highly similar and these two disciplines are closely associated with each other. Furthermore, it is a striking shortcoming that the problem-posing approach, which is crucially emphasized and frequently

applied in mathematics teaching, is not included in science courses. In this research, problem-posing studies on gases were conducted in a high school level chemistry course, and it was attempted to evaluate the problems posed by candidates in order to draw attention to this shortcoming and the importance of interdisciplinary studies. In line with this aim, in the present study, 11th-grade students who received education on gas laws were asked to pose a problem on this subject, and answers to the following research questions were sought.

1.What is 11th-grade students' problem-posing performance on gases at different levels?

2.What are the general problem-posing skills of 11th-grade students on gases?

1. METHOD

1.1. Research Design

In this study, the descriptive research approach was used since it was aimed to reveal an existing situation (Gay et al., 2006). Using this approach, it was attempted to determine the qualities of the problems developed by 11th-grade students on gases. Different levels of problem-posing situations were given to students, the ratios of the problems they developed to meet the qualities were investigated, and the frequency percentage values for each quality were calculated.

1.2. Participants

The study was conducted with 19 students studying in the 11th grade of a public school in Ankara province. Although there were actually 21 students in this classroom, 2 students did not want to participate because participation in the intervention was voluntary, and the study was conducted with 19 students. The participants consisted of 10 female and 9 male students.

1.3. Data-Collecting Tools

In this study, the 5-question Problem-Posing Test (PPT) including two structured, two semi-structured, and one free problem-posing situation developed by the researcher was used as the data collection tool, as it had also been applied by different researchers previously (Işık ve Kar, 2012; Kılıç, 2013; Silver & Cai, 1996). This test was applied to 27 students for the first time in the 2018-2019 academic year, and both the course teacher and an expert in chemistry education were asked for their opinions on the content validity of the scale. After receiving expert opinions and carrying out the pilot study, the PPT was made ready for this study. The preparation of the PPT was based on achievements on gases in the 11th Grade Chemistry

Curriculum, expressions in course books, and questions in workbooks. The first question of the test was at the level of structured problem posing and contained missing data. A problem was given in this question, which was asked to students to predict their knowledge about gases and realize that there might be questions apart from the classic question format, and it was asked whether there were missing data and, if any, what they were. The second question of the test was also at the level of structured problem posing and was a fill in the blank question. In this question, the volume of He gas at a certain temperature was given, and students were asked to complete the question provided that the amount of gas and the pressure were constant. In the third question, semi-structured questions were initiated, and a picture of two balloons of equal volume was given. While it was written that there was helium gas on one of the balloons, it was written that there was oxygen gas on the other one. The molar masses of helium and oxygen gases were given, and students were asked to write a problem. The fourth question was also of the semi-structured type and was an illustrated question. In the figures in the question, it was shown that the volume of a gas-filled container with a piston was halved at a constant temperature, and it was asked to produce questions suitable for these figures. The fifth question was of the free problem-posing type, and students were asked to write a question about gases. Finally, students were asked to indicate their opinions about the application.

1.4. Data-Collecting Process

The test, which was organized in accordance with the pilot study and expert opinions, was applied in February of the spring semester of the 2021-2022 academic year by obtaining the necessary permissions from the institution and based on the participants' voluntariness (The time difference between the pilot study and the application was due to the inability to carry out face-to-face education during the pandemic period.). Before the application, students were provided with the necessary explanations and informed that confidentiality would be preserved. To this end, the students' names were not used, and each student was assigned a number in the results section, and the data obtained were presented with codes in the form of S1, S2…..

During the study process, various rubrics were found in the studies in the literature on data analysis (Ergün, Gürel ve Çorlu, 2011; Kaba ve Şengül, 2016; Özgen, Geçici, Aydın ve Bayram, 2019). As a result of the review, it was concluded that they were largely similar and some items would not be suitable for this study. Therefore, in evaluating the data in this study, each problem was examined by classifying it within itself, as in the study by Işık and Kar (2012), and frequency and percentage values were calculated. The data were analyzed separately by the researcher and a

domain expert, and criteria were determined for each question. An agreement of 87.5% was achieved in the opinions of the researcher and expert.

The possible situations of the problems to be created were first revealed for the data analysis (Kılıç, 2013). A coding key was created based on these possible situations. This coding key was arranged in line with the opinions of an expert chemistry educator. Since it was asked to find the missing information in question 1, this question was coded as "Finding the given information sufficient," "Inability to identify the missing data although the given information is found insufficient," "Identifying the unnecessary data along with the given missing data," and "Identifying the missing data correctly." The codes "Data in the question were not considered," "Inappropriate for the principles of chemistry," "Appropriate for the principles of chemistry, missing data," "Appropriate for the principles of chemistry, solvable," and "No problem created-Blank" were created for the problems developed in questions 2, 3, and 4. The 5th question, a free problem-posing question, was coded as "Error in data," "Inappropriate for the principles of chemistry," "Blank," "Missing data," and "Appropriate for the principles of chemistry, solvable." The data obtained at the end of the application were evaluated according to these codes, and their frequency and percentage distributions were determined.

2. FINDINGS

The results obtained by examining the problems created by the students and evaluating them using the criteria determined according to their structures are presented in the tables below. In these tables, the number of the student who responded in accordance with this criterion is also given just beside the frequency value of each criterion.

Table 1 presents the frequency and percentage values of the criteria created with the codes determined for Question 1, which is at the level of structured problem posing.

Table 1. *PPT 1. Frequency and Percentage Values of the Question Criteria*

Criteria	*f*		%
Finding the given information sufficient.	**11**	(1,3,4,5,8,10,11,14,15,16,17)	57.896
Identifying the missing data incorrectly.	**4**	(7,9,18,19)	21,052
Finding the unnecessary data along with the missing data.	**2**	(2,6)	10.526
Identifying the missing data correctly.	**2**	(12,13)	10.526
Total	19		100.00

As seen in Table 1, more than half of the students (57.896%) found the given information sufficient. However, the type of gases in containers or the information about non-reactive gases should also be given to solve

this problem. Of the students, 10.526% noticed the missing data and stated that the data that were not missing were also missing. The statement of S6, who expressed his opinion in this regard, is as follows, "*We need the type of gases. Furthermore, is it asking the first partition, the second partition, or both*?"

Question 2 of the PPT was also at the level of structured problem posing, and it was asked to complete the question by giving some data. Table 2 presents the performance criteria and frequency and percentage values determined for evaluating the questions created by the students.

Table 2. *PPT 2. Frequency and Percentage Values of the Question Criteria*

Criteria	*f*		%
Ignoring what is given in the question.	**7**	(1, 4, 5, 7, 15, 16, 19)	36,842
Appropriate for the principles of chemistry, missing data for solution.	**5**	(2, 10, 11, 13, 18)	26,316
Appropriate for the principles of chemistry and solvable.	**6**	(6, 8, 9, 12, 14, 17)	31,577
Blank	**1**	(3)	5,265
Total	19		100,000

As seen in Table 2, more than 1/3 of the students (36.842%) attempted to complete the question without even considering the data in the question sentence. For example, the student coded S7 never took into account the condition "provided that the pressure is kept constant" in the problem sentence and created the problem, "*How many atm is the pressure*?".

Another criterion created for Question 2 in the PPT was that the problems posed were appropriate for the principles of chemistry, but the data were insufficient to solve them. The problem posed by five out of 19 students participating in the study had this quality. The problem posed by the student coded S2 is an example of this situation. In this problem posed by the student, he asks about the change that may occur with the increasing temperature. Although the problem posed was appropriate for the principles of chemistry, the extent of the change could not be calculated since how much the temperature would be increased was not given. Moreover, a more appropriate problem could be posed by clearly stating the extent of the change in volume in the problem since the amount of gas and pressure were constant.

The third criterion created for this problem-posing situation was being appropriate for the principles of chemistry and solvable, i.e., posing a correct problem. Considering the percentage value in Table 2, approximately 1/3 of the class succeeded in posing this problem. The student coded S6, who met this criterion, completed the question with the statement "....*how many* ^{o}*C degrees should the temperature be increased to increase the volume 5*

times?", gave the increase in volume value numerically and clearly stated that the value that should be found was the temperature increase.

Problem-posing question 3 of the PPT was at the semi-structured level. In this question, it was stated that there were different gases in two balloons under equal conditions and of equal volumes, and students were asked to pose a problem appropriate to this situation. Table 3 presents the criteria and frequency and percentage values determined for this problem-posing situation.

Table 3. *PPT 3. Frequency and Percentage Values of the Question Criteria*

Criteria	*f*		%
Ignoring what is given in the question.	**8**	(1, 3, 5, 10, 12, 14, 17 18)	42,105
Inappropriate for the principles of chemistry.	**2**	(9, 11)	10,526
Appropriate for the principles of chemistry, missing data for solution.	**4**	(4, 6, 15, 19)	21,052
Appropriate for the principles of chemistry and solvable.	**1**	(8)	5,265
Blank	**4**	(2, 7, 13, 16)	21,052
Total		19	100,000

In the third problem-posing situation of the PPT, it was observed that many students (42.105%) did not take into account the conditions given for problem posing, as in the previous question. For example, considering the problem posed by student number 17, it was seen that the student talked about different volumes and posed a problem to find the pressure value although the same conditions and equal volumes were given in the question. This student created a question with the following statement, "*The volume of the balloon filled with He gas at 20 °C is 2 L. The volume of* O_2 *gas is 3 L. How many atm is the pressure of He gas*?"

The problems posed by two of the 19 students participating in the study were not compatible with the principles of chemistry. The problem developed by S11 is an example of this, and this student wrote the question, "*After a while, the volume of the balloon filled with He increases by 2 L, and the volume of the balloon filled with* O_2 *increases by 4 L. Accordingly, how many atp will the volume of the balloons increase*?" Upon examining this problem, it was observed that the student gave the volume value and asked the volume again and used the abbreviation "atp" as the volume unit. The posed problem showed that the student had misconceptions about the concepts of volume and pressure and their units.

Another criterion determined by analyzing the problems posed by the students in relation to the 3rd question in the PPT was that the problems posed were in accordance with the principles of chemistry, but the data were insufficient for the solution. A problem that may be an example of this

was posed as follows, "*According to the equation $P_1.V_1 = P_2.V_2$, if these two balloons are intended to be combined in a container, how many moles of gas will be obtained in total?"* In this problem posed by the student coded S4, the situation of equality of conditions was expressed by the given equation, and the total number of moles of the two gases was asked. While this problem was appropriate for the principles of chemistry, the total number of moles of gases could not be calculated since the quantitative value of the number of moles of each gas was unknown.

The final criterion in the 3rd question of the PPT was to create a solvable question in accordance with the principles of chemistry. Only the problem posed by student S8 met this condition. The problem posed by this student was as follows, "*A hole is opened in two balloons of an equal volume containing He and O_2 gases. If the balloon with He gas is completely emptied in 4 seconds, in how many seconds will the balloon with O_2 be emptied?"* In this problem-posing situation, S8 wrote a problem that was appropriate for Graham's law of diffusion and included solvable quantitative data.

With the 4th question of the PPT, the problem-posing situation requested from the students was at the semi-structured level. Two figures were given in this question. In the first figure, a thermometer and manometer were placed in a gas-filled container with a piston. In the second figure, pressure was applied to this container. It was observed that the volume decreased due to the applied pressure, the pressure increased in the manometer gauge, and the temperature remained constant in the thermometer. Table 4 presents the frequency and percentage values of the criteria determined for this problem-posing situation.

Table 4. *PPT 4. Frequency and Percentage Values of the Question Criteria*

Criteria	*f*		%
Ignoring the images.	**3**	(2, 9, 3)	15,789
Just asking for the description of the figure.	**4**	(4, 5,6,14)	21,052
Inappropriate for the principles of chemistry.	**7**	(10, 11,12, 15, 17, 18, 19)	36,842
Appropriate for the principles of chemistry, missing data for solution.	**1**	(16)	5,265
Blank	**4**	(1, 7, 8,13)	21,052
Appropriate for the principles of chemistry and solvable.	**0**		0
Total	19		100,000

In this problem-posing question, 3 of 19 students created a question without considering the given figures. The question, "*As can be seen in the figure, some gas is filled into the pressured container. Will there be a change in temperature when we increase the pressure in this container? If*

so, how would it change?", which was written by the student coded S9 who met this criterion, can be given as an example. Considering the problem posed by S9, it was observed that a question about temperature change was asked. However, in the thermometer in the figures, it was seen that the temperature remained constant and the pressure and volume changed.

As seen in Table 4, 21.052 % of the students who participated in the study wrote a question in which only a verbal explanation of the figure was requested, and they did not pose a numerical problem. The question of the student coded S14 can be given as an example of this criterion. This student wrote a question, "*As can be seen in the figure, what is the pressure to volume ratio and the name of the law?"*

In the semi-structured problem situation, which was the 4th question of problem-posing studies, the highest percentage was composed of the problems not prepared in accordance with the principles of chemistry. A student with significant misconceptions about the concepts of pressure, volume, and temperature in gases and their units posed the question, "*There is He gas in the container with a movable piston in the figure. The temperature of this gas is 20 ^{o}C. Since the pressure increases as the piston is pushed down, how many atm/^{0}C is the temperature and pressure of the gas in the final state?"* (S11).

In this problem-posing situation, a student could pose a problem in accordance with the principles of chemistry, assuming that numerical data were given. This problem posed by S16 was as follows, "*By what % did the pressure of this gas with constant temperature in both situations increase at the end of the applied force? (I wrote a question assuming that the number values were given*)".

For the problem-posing situation in question 4, there was no problem that was appropriate for the principles of chemistry and solvable.

Free problem posing was the final problem-posing situation of the PPT. In this question, students were asked to write a problem about the gas laws. The criteria given in Table 5 were reached by analyzing the problems posed by the students.

Table 5. *PPT 5. Frequency and Percentage Values of the Question Criteria*

Criteria	*f*		%
Not related to gas laws	**1**	(9)	5,265
Inappropriate for the principles of chemistry.	**8**	(2, 3, 4, 5, 7, 12, 14, 18)	42,105
Appropriate for the principles of chemistry, missing data for solution.	**4**	(1,10,15, 17)	21,052
Appropriate for the principles of chemistry, solvable.	3	(6, 8, 19)	15,789
Blank	3	(11, 13, 16)	15,789
Total	19		100,000

As a result of analyzing the problem-posing situations developed for this question, it was observed that a student posed a problem related to the number of mole-particles, which is not directly related to the gas laws. In this question written by S9, the atomic number of a certain amount of gas was asked with the statement, "*What is the number of atoms in 2.5 moles of CO_2 gas?"*

In the problems posed for this question, types of problems that were inappropriate for the principles of chemistry constituted the highest percentage (42.15%). One of the two problems in this criterion was as follows, "*The volume of a container filled with 32 g of O_2 gas at 0 °C is 2 L. What is the volume of this container?"* (S4), and the other was, "*Since 3 moles of CO_2 gas is 50 grams, what is the weight of 2 moles of element C?"* (S18). In the problem posed by student S4, he both gave the volume value and asked the volume value again under the same conditions (without creating a second condition within the framework of chemistry principles). The student coded S18 also indicated that the mass of 3 moles of CO_2 gas was 50 grams and presented information inappropriate for the principles of chemistry.

In the free problem-posing situation, 4 of 19 students (21.052%) who participated in the study posed problems that were appropriate for the principles of chemistry but contained missing data. A question evaluated in this criterion was created by S1. S1 presented his question in the following way, "*The volume of a balloon filled with H_2 gas at 40 ^oC is 4L. How many atm is the pressure provided that the amount of gas is kept constant*?" In this problem, it was seen that the temperature and volume values of the gas were given. Although it was indicated that the amount of gas was kept constant in the problem, it would not be possible to calculate the desired pressure value in the question since there was no numerical value or information that could be found by calculation.

The problems that were appropriate for the principles of chemistry and solvable were mostly (15.789%) posed in the 5th question. The visual of the problem that met this criterion and was posed by the student coded S8 is presented in figure 1.

The figure of the problem posed for the 5th question by S8.

The student drew this figure and posed the question, "*In the figure given, the distance between A and B is divided into 10 equal parts. Gases A and B are sent simultaneously from both ends. Accordingly, at what point do these gases meet? (A: 4g/mol, B:16g /mol)",* and he also solved it. This problem is related to the diffusion of gases. While posing the problem, the student provided the necessary information to solve the problem and made the solution after writing it.

In the results section of the study, after giving the frequency and percentage values obtained as a result of examining the problems posed by the students for each problem-posing situation in the PPT in accordance with the determined criteria, the general analysis of the problems was performed, and the results are presented in Table 6. To this end, the problems posed were divided into four groups as "correct," "partially correct," "incorrect," and "blank," as in the study by Çetinkaya and Soybaş (2018) in which they examined the problem-posing skills of 8th-grade primary school students. In this study, the problems that were appropriate for the principles of chemistry but had no sufficient data were also considered partially correct, and a general analysis of the problems was conducted.

Table 6. *General Analysis of the Problems Posed by the Students*

Question	Correct		Partially Correct		Wrong		Blank	
	f	%	*f*	%	*f*	%	*f*	%
1st question	2	2,105	6	6,315	11	11,578	0	0,000
2nd question	6	6,315	5	5,261	7	7,383	1	1,052
3rd question	1-2	1,052	4-3	4,210	10	10,526	4	4,210
4th question	0	0,000	5	5,261	10	10,526	4	4,210
5ht question	3	3,157	5	5,261	8	8,421	3	3,157
TOTAL	12	12,629	25	26,308	46	48,434	12	12,629

The percentage values given in Table 6 showed that approximately half of the problems (48.434%) posed by the students were incorrect. While 12 of the 95 problems that needed to be posed were correct, the same number of problems were left blank without posing.

The scores of the exam on gases within the scope of the course were reached to compare students' problem-posing skills and school achievement scores. The students' scores were grouped based on the "High School Grading System" as in Table 7, and the number of students was determined.

Table 7. *Students' school achievement scores on gases*

Point range	0-49	50-59	60-69	70-84	85-100
Achievement Status	Fail	Passing	Average	Good	Very good
Number of Student	3	5	5	3	3

As seen in Table 7, students' school achievement scores are quite high, there are no failing students, 10 of 19 students were successful on the subject of gases at the passing and average level, and 6 students were successful at the good and very good level. This result indicated that the students who successfully solved the given numerical problems did not have enough conceptual knowledge to create a very basic question on the same subject and could not even find the missing information in a simple problem.

3. CONCLUSION

Based on the statements, since there is scarcely any application of the problem-posing approach, which is emphasized and frequently used in mathematics teaching, in science courses, and with the importance attached to interdisciplinary studies, problem-posing studies were carried out on gases in the high school chemistry course, and the problems posed by the candidates were evaluated in this study.

The fact that mathematics and science disciplines are closely related to each other and the increasing importance attached to interdisciplinary studies in recent years constituted the starting point of this study. From this point of view, primary, secondary, and high school mathematics curricula and then 3-8 grade science and high school physics and chemistry curricula were analyzed separately. The analysis determined that the common goal of all curricula was to raise individuals with developed problem-solving and high-level thinking skills. Furthermore, all of the curricula aimed to raise individuals of character with integrated knowledge, skills, and behaviors in "mathematical competency and basic competency in science/technology" within the scope of the Turkish Qualifications Framework (TQF).

Due to the consideration of the common objectives in the curricula analyzed and the frequent inclusion of solution to numerical problems in science and mathematics courses, it was needed to compare the problem-solving steps used in these two disciplines. As a result of the comparison, it was observed that problem-posing practices, which were started to be used in mathematics courses at the primary school level and considered a step of problem-solving, were not included in science courses.

As a result of the reviews in the literature on problem posing, the view that these practices should also be integrated into science courses emerged, and based on this view, applications were performed on gas laws with 11^{th}-grade high school students. The results obtained from the applications showed that the students who received education on gases for 30 course hours as required by the curriculum had difficulty posing problems even though they solved dozens of problems.

In the study, a total of 5 questions at the levels of structured, semi-structured, and free problem posing were given, and students were asked to pose problems. In the first question, which was at the level of structured problem posing, the students were asked whether there were missing data in the given problem and, if any, what they were. Only two students could answer this question correctly. Although six students indicated that there was a deficiency in the data, they could not correctly identify this deficiency. However, the question is based on basic knowledge of gases (in fact, knowledge of chemical reactions) and the knowledge that the sum

of the moles of the product/products formed as a result of the reaction of different gases may not be equal to the sum of the moles of the reactants. The results revealed that students solved the question using the equation $(P_1.V_1) + (P_2.V_2)$= PsVs they memorized, which thus suggested that the examples of non-reactive gases were usually included in this type of question. The presence of students who indicated that the final volume value should also be given showed that some students could not internalize even the most basic information, such as the diffusion of gases into their environment and their covering the entire volume in closed containers.

The highest number of (6) correct problems were posed in question 2. This question was a structured problem-posing exercise in the form of completion based on Charles' law, one of the most basic gas laws related to the temperature-volume change of a gas at constant amount and pressure. In this question based on the equation $V_1/T_1=V_2/T_2$, students were given the initial temperature and volume values of a gas and were asked to pose a problem in accordance with the condition of keeping the amount and pressure constant. In this problem-posing study in which the temperature or pressure value of the second state is simply given and the other unknown can be asked, more than the number of students who posed the problem correctly (7) attempted to complete the problem without considering their data. The students who noticed the temperature and volume values given numerically in the question generally posed problems by completing the question as "how many atm is the pressure." This result suggested that the students posed problems based on the idea that pressure should be asked since the temperature and volume values were given based on the problems that the students had solved widely (based on their knowledge of the factors affecting the gases) without reading the question completely. A similar result was also found in the third question. In this question, although the students were given two different gas samples under equal conditions and of equal volume, 8 students posed problems asking the pressure value by giving different volume values to the gases without considering these data. Considering the data in this question, the most typical information that immediately attracts attention is the information that the number of particles/moles of gases is equal. It was revealed that 4-3 students who attempted to pose problems based on this information posed problems in which the volume value was asked. In these problems, if mass ratios were asked instead of mass values, it would be possible to reach a numerical result.

Considering the problem-posing exercises asked for the 4th question, students were observed to be more unsuccessful in this problem-posing situation. In fact, this question is a simple question based on the pressure-volume relationship of gases (Boyle-Mariotte's law); however, not verbal

statements but a visual was used to pose a problem here. Based on this visual, 4 of the students found it sufficient to write a question sentence based on explaining the figure without posing a problem. Nevertheless, 3 students wrote sentences asking about the situations related to increasing or decreasing the temperature without considering the figure, or what kind of change would occur in the temperature in case of pressure change. These results revealed that students did not sufficiently consider the given figures or did not have enough experience in interpreting them. In their study, Ergin, Cömert, and Sarı (2012) investigated the effects of different question presentation formats on students' academic achievement in the physics course and concluded that the questions with figures were effective in the correct solution of questions by students. However, the results obtained in this study indicated that students did not adequately focus on the figures in such questions and could not use the data correctly. These results suggested that while solving questions with figures, students considered only the data that would lead to the desired result in the question, not the whole figure, and therefore they could not develop their skills in reading and evaluating the figures. Based on this view, it can be said that students should be asked questions with figures that draw more attention to concept, data, and result relationships so that students can focus on the whole figure and develop their correct understanding and interpretation skills.

In the free problem-posing situation, the fifth and final question of the study, students were asked to write a problem about gases. Upon examining the problems posed for this question, it was determined that the problems attempted to be written by 8 students (approximately half of the students who participated in the study) were not appropriate for the principles of chemistry. This result demonstrated that students could not write even a simple problem with gas laws even when no restrictions were imposed. Unfortunately, this showed that although students could solve questions by memorizing the pattern formulae, they did not pose a very simple problem suitable for one of these formulae. One of the three students who posed a correct and solvable problem wanted to check the question he wrote by performing the solution. However, he made a wrong representation in the figure he had drawn for the solution of the problem. This result supports the conclusion reached in the paragraph above for question 4. In other words, students cannot adequately focus on drawing and reading, and they can make significant mistakes.

In conclusion, based on the study results, it can be clearly stated that the students who were successful in solving numerical problems with the formulae they memorized in the chemistry course about gases were not successful in completing the missing questions or writing problems on the same subject, which shows that algorithmic questions can be solved without

understanding subjects. However, if we make our students comprehend concepts in depth, we can contribute to both their being good problem solvers and the development of high-level thinking skills. In this context, it can be indicated that it is important to use the problem-posing approach in science teaching. Based on this idea, it can be said that conducting problem-posing activities in science courses may contribute to students' meaningful and permanent learning of science concepts, and with this view, problem-posing studies should be included in science courses curricula.

REFERENCES

Akay, H. (2006). *The examination of the effect of mathematics instruction with problem posing approach on students' academic achievement, problem solving ability and creativity*. (Doctoral dissertation). Gazi University, Institute of Educational Sciences, Ankara.

Akben, N. (2020). Effects of the problem-posing approach on students' problem solving skills and metacognitive awareness in science education. *Research in Science Education*, 50 (3), 1143-1165.

Altun M. (2008). *Matematik Öğretimi (İlköğretim İkinci Kademe*), Alfa Aktüel Yayınları, Ankara,

Boujaoude, S., Salloum, S., & Abd-El-Khalick, F. (2004). Relationships between selective cognitive variables and students' ability to solve chemistry problems. *International Journal of Science Education, 26,* 63 –84.

English,L. D. (1997). The development of fifth grade children's problem posing abilities. *EducationalStudies in Mathematics, 34*, 183-217.

Ergün, H., Gürel, Z., & Çorlu, M. A. (2011). Problem tasarlama performansının değerlendirilmesinde kullanılabilecek bir rubriğin geliştirilmesine ilişkin bir araştırma. *Milli Eğitim Dergisi, 41(191*), 39-55.

Gay, L. R., Mills, G. E. & Airasian, P. (2006). *Educational Research: Competencies For Analysis And Applications*.(8th Ed.). New Jersey: Pearson Prentice Hall.

Greer, B. (1993). The mathematical modelling perspective on world problems. *Journal of Mathematical Behavior, 12,* 239–250.

Işık, C., & Kar, T. (2012). Sınıf öğretmeni adaylarının problem kurma becerileri. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi. 12 (23*), 190-214.

İymen, E., & Duatepe-Paksu, A. (2015). Analysis of 8th Grade Students' Number Sense Related to the Exponents in Terms of Number Sense Components. *Education and Science 40(177).*109-125.

Kaba, Y. ve Şengül, S. (2016). Developing the Rubric for Evaluating Problem Posing (REPP). *International Online Journal of Educational Sciences, 8 (1),* 8-25.

Karabey, B., Tunalı, C., Olkun, S. & Ergut, G. (2019). Ortaokul matematik öğretim programlarının sayı duyusu bileşenlerine göre karşılaştırılması. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 19(4*), 1760-1774.

Kılıç, Ç. (2013). İlköğretim öğrencilerinin doğal sayılarla dört işlem gerektiren problem kurma etkinliklerindeki performanslarının belirlenmesi. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi, 20,* 256-274.

Lin, H., Chiu H. & Chou, C. (2004). Student understanding of the nature of science and their problem-solving strategies. *International Journal of Science Education. 26 (1*), 101-112.

Ministry of National Education (MoNE) (2018a). *Primary and Secondry Science Education Curriculum*. T.C. Ministry of National Education, Board of Education. http://ttkb.MoNE.gov.tr/.

Ministry of National Education (MoNE) (2018b). *Primary and Secondary Mathematics Education Curriculum.* T.C. Ministry of National Education, Board of Education. http://ttkb.MoNE.gov.tr.

Ministry of National Education (MoNE) (2018 c). *High School Mathematics Education Curriculum.* T.C. Ministry of National Education, Board of Education. http://ttkb.MoNE.gov.tr.

Ministry of National Education (MoNE) (2018 d). *High School Chemistry Education Curriculum* T.C. Ministry of National Education, Board of Education. http://ttkb.MoNE.gov.tr.

Morlier, R. (2012). *Evaluation of the correlated science and mathematics professional development model* (Master dissertation). http://files.eric.ed.gov/fulltext/ED531891.pdf.

Nakhleh, M. B., & Mitchell, R. C. (1993). Concept learning versus problem solving: there is a difference. *Journal of Chemical Education, 70(3*), 190–192.

Nakiboğlu, C., & Kalın,Ş. (2003). High school students' difficulties about problem solving in chemistry courses I: according to experienced chemistry teachers. Kastamonu Education Journal, 11(2), 305–316.

National Council of Teachers of Mathematics [NCTM] (2000). *The principles and standards for school mathematics.* Retrieved from http://www.nctm.org/Standards-and-Positions/Principles-and-Standards/..

National Research Council (NRC) (1996). *National science education standards*. Washington, DC: National Academies Press. https://www.nap.edu/read/4962.

National Research Council. (NRC) (2011). *National science education standards*. Washington, DC: The National Academies Press; http://www.nap.edu/catalog.php?record id=13128

National Research Council. (NRC) (2012). *National science education standards.* Washington, DC: National Academies Press.

Nesher, P., & Hershkovitz, S. (1997). *Real-world knowledge and mathematical knowledge*. In E. Pehkonen (Eds.), Proceedings of 21st Conference on the International Group for the Psychology of Mathematics Education, 3, 280–287.

Next Generation Science Standards (NGSS) (2013). *Conceptual Shifts in the*. htpp://www.nextgenscience.org/next-generation-science- standards.

Özgen, K., Geçici, M. E., Aydın, M., & Bayram, B. (2019). An Investigation of Eighth Grade Students› Skills in Problem-Posing. *International Journal for Mathematics Teaching & Learning, 20(1),* 106-130.

Silver, E. A. (1994). On mathematical problem posing. *For the Learning of Mathematics, 14(1),* 19–28.

Silver, E. A. & Cai, J. (1996). An analysis of arithmetic problem posing by middle school students. *Journal for Research in Mathematics Education, 27,* 521–539.

Singh, P., Hoon, T, S., Md Nasir, N, A., Han, C. T., Md Rasid, N. S. & BZH. J. (2020). An Analysis of Students' Mathematical Reasoning and Mental Computation Proficiencies. *Universal Journal of Educational Research 8(11),* 5628-5636.

Stoyanova, E. (2003). Extending students' understanding of mathematics via problem posing. *The Australian Mathematics Teacher, 59(2*), 32–40.

Stoyanova, E., & Ellerton, N. F. (1996). *A framework for research into students' problem posing in school mathematics.* In P. Clarkson (Ed.), Technology in mathematics education 518–525. Melbourne: Mathematics Education Research Group of Australasia

Watkins, D., & Hattie, J. (1985). A longitudinal study of the approaches to learning of Australian tertiary students. *Human Learning, 4,* 127–141.

Yıldız, V. (2008). *Investigation of The Change İn 6th Grade Students' Problem Solving Abilities, Attitudes Towards Problem Solving and Attitudes Towards Mathematics After Mathematics Instruction Based On Polya's Steps*. Unpublished master thesiss. Middle East Technical University, Ankara.

CHAPTER 5

A REWIEV OF PIANO ALBUMS TO ENRICH THE PIANO REPERTOIRE OF MUSIC TEACHER CANDIDATES

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INTRODUCTION

The piano is the most important part of instrument training due to its extensive literature, its use as a main instrument and a secondary instrument in professional music education, and its place in polyphony and world music. Therefore, piano training is one of the indispensable dimensions of professional music education.

The content of piano training gradually covers the technical exercises and etudes, examples of works by Turkish and world composers, and examples of educational music, piano literature and learning-teaching techniques in music education at school (Tufan & Güdek, 2008).

In Turkey, piano training, which was previously included in the curriculum of the music teaching departments of faculties, is a compulsory course for 6 semesters and as an elective course in the last 2 semesters. The courses are named Piano Education 1 and Piano Education 2.

The Council of Higher Education (2018) defined the achievements of the Piano Education 1 course as recognizing the piano instrument and the position of the hands on the keyboard, examining the usage areas and reviewing the literature of the piano, correct positioning of the body, wrist and arm, recognizing the treble and bass clefs and carrying out single-handed and double-handed exercises for this, making finger exercises around the middle C on the keyboard, and performing the exercises suitable for the level from the Burkard method. The achievements of the Piano Education 2 course are as follows: scale studies starting from one octave in C major and A minor tones up to four octaves, recognizing major and minor tones, scale studies in other major-minor tones, cadence studies and their application, examining staccato and legato techniques on short works by application, performing etudes and exercises to help strengthen the fingers and wrists, performing accompaniment school songs, phrasing and sight-reading exercises in piano works, and studies on musicality.

In music teaching programs that provide vocational music education, offering piano lessons for only 2 semesters is insufficient for teacher candidates to develop themselves in this instrument, since the piano is the instrument that music teacher candidates will most benefit from during the study and implementation of all music lessons. Furthermore, this creates great difficulties for students who want to improve themselves in the field of piano professionally and academically in the future. It has been observed that the aforementioned students continue to choose the piano as an individual instrument aside from the compulsory 2-semester piano training and after the compulsory education.

The Council of Higher Education (2018) included Individual Instrument Training in the Music Teaching Undergraduate Program for

7 semesters. Achievements for piano instrument in Individual Instrument Training 1 were determined as exercises for gaining correct posture and basic behaviors; exercises on the scale and cadence, duate, staccato, and legato technique; sight-reading; exercises for 5 fingers with opposite direction and parallel scale; methods to be followed in the study of etudes and works; applying the terms of loudness, phrasing, and applied studies; and playing etudes and works at the suitable level. The achievements of Individual Instrument Training 2 are as follows: Scale and cadence exercises at the suitable level; sight-reading and finger change exercises; portato technique, pedal and arpeggio exercises; playing national and universal works of different periods and etudes at the suitable level; examining the harmonic structures of the works and the accompaniment figures; and doing exercises to accompany school music.

Achievements in Individual Instrument Training 3 were determined as: scale, arpeggio and cadence exercises within 4 octaves at the suitable level; right pedal use in short works in this range; practicing nuances with pedal applications; studying the etudes and exercises of the composers such as Czerny, Duvernoy, Burgmüller, Loeschhorn, Gedike, etc.; studying the short works selected from the baroque and classical periods; and examining the characteristics of the period. The achievements in Individual Instrument Training 4 were determined as: consolidating consolidate the baroque, classical, romantic, and contemporary works by analyzing them according to the characteristics of the period in order to reinforce the basic skills and techniques learned on the piano; sight-reading the works suitable for left pedal use, especially on classical period works and perceiving and applying the mechanical differences of the left pedal between console piano and grand piano; understanding the concept of tonality together with appropriate etudes and works that improve sight-reading in piano playing; studies that improve the skill of accompanying piano for solo or small instrument groups; and making sight-reading studies of Turkish music examples.

Works on Baroque and Classical period tirades and understanding the standard finger numbers to be used in them; sight-reading the works of the period suitable for middle pedal use in order to comprehend the characteristics of the Baroque period bass pedal; playing scale and arpeggio works that improve technique; sight-reading and touch speed together with end-of-scale cadences; and recognizing Turkish composers and understanding the chord finger number variability of harmonic differences in works written with the harmony of contemporary Turkish music are the achievements of Individual Instrument Training 5. The following achievements were included In Individual Instrument Training 6: being able to perform works in forms such as preludes, suites, and inventions from the Baroque period polyphonic works according to the characteristics of the period; distinguishing the stylistic differences

between the works of this period and the works of the classical period; understanding the structural features of the classical period sonata form and making sample works, and participating in activities by accompanying instruments and school music; sight-reading to recognize the different arrangements of the national anthem accompaniment; and giving place to scale and arpeggio works in tones that improve the concept of tonality in every course. And finally, the following achievements were determined for Individual Instrument Education 7: listening to works from different performers from all periods and playing works at suitable level in order to improve piano literature, including scale, arpeggio and cadence works in every tone; examining the harmonic and form analyzes of the studied works on the edition; examining and playing examples of 4-hand piano works; performing chromatic exercises to improve tone grasp in the touch; analyzing contemporary works in harmonic and formal terms, studying examples from contemporary Turkish composers; analyzing and playing jazz pieces at the suitable level; and participating in concert organizations in solo and accompaniment positions in order to improve the stage experience. All of these achievements reveal the fact that piano students receive training with many and various methods.

The most suitable and useful instrument to be used as a tool in teaching music is the piano. The method applied in piano training should help the student to play all piano literature (Pamir, 1995).

According to the Turkish Language Association (2019), a method is the way or technique to be followed while doing a job. On the other hand, Say (2002) defined the method in the field of music as educational books with musical notes, which are used in instrument teaching by starting from the beginning, and progressing gradually from easy to difficult.

According to Çimen (1995), a piano method should have the following features:

a) It should be parallel to contemporary general teaching principles and prepared according to the latest methods developed in piano training.

b) It should be suitable for the physical and psychological structure of the age for which it is prepared.

c) The exercises, etudes, and pieces covered by the method should arouse the interest of the students and direct them to systematic study.

d) The outer appearance of the book, the design of the inner pages, pictures, and drawings should be as attractive as the content and notation must be legible.

e) There should be a balance between the theoretical information and musical pieces included in the method.

f) Piano harmony, music theory, improvisation, and creative work should be included.

Camp (1992) stated that the repertoire selections in which the student will gain experience should be made in accordance with the techniques and behaviors to be taught. Teaching material in an appropriate and balanced order is key. The student can be successful with the help of a repertoire prepared in this way. The Turkish Language Association (2019) has declared the repertoire in music as "repertoire".

Students who have completed the beginner level should be familiar with the piano literature at the intermediate and advanced levels and expand their repertoire. At this point, they are expected to recognize different styles as soon as they see them and behave in accordance with the style. "For example, when faced with a figured bass notation, they should be able to anticipate that it belongs to the baroque period and predict the ornaments that can be added and tempo slack (rubato) that can occur. It is also suggested that romantic and impressionist period works, which contain more difficult pieces, should be added to the repertoire. The students should not be unfamiliar with works of the modern period, and it is recommended that they should test their own limits and strike a balance accordingly in order to achieve the effect desired by the composer" (İlkay & Sarı, 2020).

While the number of piano methods available for the beginner and intermediate level is sufficient in vocational music education institutions, it was observed that it is partially more difficult to find works, practice books, and methods, especially in the transition from intermediate level to advanced level, in a certain repertoire preparation stage.

In the literature review that was performed, it was seen that the beginning piano methods and etudes were mostly examined. On the other hand, Işkın and Güdek (2019), examined the piano practice books used in adult music education. According to them, piano practice books that are not named as a method are books for learning piano that are chosen according to the skill level, age, experience, and purpose of the student.

The literature review revealed that the albums, methods, and books containing the repertoire for both students who show a variable level in the compulsory two-semester piano training and those who choose the piano in the individual instrument training course and want to progress in this instrument are limited in institutions that provide vocational music education.

Based on this knowledge and thought, it is important to introduce albums that include works for piano students who have reached a certain

level can play. For this purpose, the problem statement of the study was determined as: Does Nevhiz Ercan - Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Books 1 and 2 contribute to enriching the piano repertoire of music teacher candidates? Depending on this main problem, answers to the following sub-problems were sought:

1. How many works are there in the Nevhiz Ercan - Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Books 1 and 2?

2. What are the titles of the works in the Nevhiz Ercan - Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Books 1 and 2?

3. How many different composers are included in the Nevhiz Ercan - Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Books 1 and 2?

4. What are the periods of the works in the Nevhiz Ercan - Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Books 1 and 2?

5. Do the Nevhiz Ercan - Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Books 1 and 2 contain information regarding whether the work is a section in a major work or included in a method/album?

METHODS

In this part of the study, there are definitions about the study model, universe and sample, data collection, analysis, and limitations.

Study Model

In this qualitative study, a descriptive research model was used. In the study, the literature was reviewed through document analysis and printed piano albums and books were reached. “Document analysis is the process of providing data by analyzing written documents containing information about facts and events related to the subject examined within the scope of the study. A lot of information about the study area can be obtained through document analysis without the need for interviews and observations” (Karataş, 2015).

Universe and Sample

The universe of the study consisted of piano albums. The sample group of the study was the Nevhiz Ercan-Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Books 1 and 2. The 2 books selected as samples are shown in Table 1.

Table 1. *Piano Albums Examined Within the Scope of Study*

Title of the Work	Compiled by	Publication Year	Publisher	Number of pages
Piano Classics from the Baroque Period to the 20th Century Book 1	Nevhiz Ercan - Belir Tecimer	2017	Arkadaş Publishing	161
Piano Classics from the Baroque Period to the 20th Century Book 2	Nevhiz Ercan - Belir Tecimer	2017	Arkadaş Publishing	165

Limitations

The study was limited to all of the works included in the Nevhiz Ercan - Belir Tecimer Piano Classics Books 1 and 2.

Data Collection and Analysis

The content analysis method was used to analyze the data obtained from the books that constitute the scope of the study. The main purpose of content analysis is to collect similar data within the framework of certain concepts and themes and present these data to the reader in an understandable way (Yıldırım & Şimşek, 2008).

During the examination of the books, a "Work Review Form" was created by the researcher. In this form, the categories of the "Number of Works", "Title of the Work", "Name of the Composer", "Period of the Work" and "Reference Status of the Work", which includes information about whether the work is the section of a major work or included in a method/album, were created. The created form was presented to the opinion of 3 field experts.

FINDINGS

In this part of the study, findings related to sub-problems are included.

Table 2. Nevhiz Ercan - Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Book 1.

Number of Works	Name of the Composer	Title of the Work	Period of the Work	Reference Status of the Work
1	Arne, T.	Sonata, No.VI	Baroque	Section II
2	Bach, J. S	Prelude, BWV 934	Baroque	(From Little Preludes and Fugues)
3	Bach, J.S.	Allemande	Baroque	(From First Book for Pianists)
4	Bach, J.S.	Prelude, BWV 933	Baroque	(From Little Preludes and Fugues)
5	Bach, J.S.	Invention (2-part), BWV 777	Baroque	
6	Galuppi, B.	Allegro	Baroque	
7	Handel, G.F.	Prelude HWV 453	Baroque	
8	Handel, G.F.	Aria	Baroque	(From XIV. Suit)
9	Handel, G.F.	Minuet	Baroque	

10	Paradisi, P. D	Toccata	Baroque	(From A Major Sonata)
11	Pescetti, G.B.	Sonata No. 6	Baroque	Section III
12	Scarlatti, D.	Sonata K.73b	Baroque	
13	Scarlatti, D.	Aria K32	Baroque	
14	Scarlatti, D.	Sonata K. 63	Baroque	
15	Telemann, G.P.	Fantasia No. 5	Baroque	
16	Bach, W.F.	Allegro	Classical	
17	Beethoven, L. van	Waltz,WoO 84	Classical	
18	Beethoven, L. van	Allemanden WoO 42, No. 6	Classical	
19	Beethoven, L. van	Bagatelle, Op.119, No. 3	Classical	
20	Benda, G.A.	Sonatina No. 3	Classical	
21	Benda, G.A.	Sonatina No. 17	Classical	
22	Cimarosa, D.	Sonata	Classical	Section I
23	Diabelli, A.	Bagatelle	Classical	(10 Light Pieces)
24	Diabelli, A.	Sonatina Op. 151, No.2	Classical	Section I
25	Haydn, F.J.	Allegro Scherzando Hob. III:75/4	Classical	
26	Haydn, F.J.	Sonata Hob.XVI:8	Classical	Section I
27	Hook, J.	Rondo	Classical	
28	Hook, J.	Sonatina Op. 12, No. 6	Classical	Section I
29	Kuhlau, Fr.	Sonatina Op. 88, No. 2	Classical	Section I
30	Mozart, W.A.	Allegro KV. 9a	Classical	
31	Mozart, W.A.	Sonatina	Classical	Section I
32	Beaumont, P.	Tarantella	Romantic	
33	Brahms, J.	Waltz Op. 39, No. 11	Romantic	
34	Burgmüller, J.F.	L'adieu Op. 100 No. 12	Romantic	
35	Burgmüller, J.F.	Berceuse Op. 109, No. 7	Romantic	

Table 3. Nevhiz Ercan - Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Book 1 (Continued).

Number of Works	Name of the Composer	Title of the Work	Period of the Work	Reference Status of the Work
36	Burgmüller	Tarantella Op. 100, No. 20	Romantic	
37	Chopin, F.	Waltz	Romantic	
38	Chopin, F.	Mazurka Op. 67, No. 4 (Posthumous)	Romantic	
39	Ellmenreich, A.	Spinnerlied Op. 14, No. 4	Romantic	
40	Grieg, E.	Waltz Op. 38, No. 7	Romantic	
41	Gurlitt, C.	Music Box Op. 140, No. 8	Romantic	
42	Gurlitt, C	Schlummerlied Op. 101, No. 6	Romantic	
43	Gurlitt, C	Bright Sky Op. 140, No. 3	Romantic	
44	Gurlitt, C	Etude Op. 82, No. 99	Romantic	
45	Heller, S.	Etude Op. 47, No. 1	Romantic	
46	Heller, S.	The Tolling Bell Op. 125, No. 8	Romantic	
47	Heller, S.	Avalanche Op. 45, No. 2	Romantic	
48	Kirchner, T.F.	Miniatures Op. 62, No. 9	Romantic	
49	MacDowell, E.	Tarantella Op. 39, No. 2	Romantic	

50	Mendelssohn, F.	Gondola Song Op. 19, No. 6	Romantic	
51	Reinhold, H.	Zigeunerlied Op. 39, No. 13	Romantic	
52	Reinhold, H.	Russisch Op. 39, No. 24	Romantic	
53	Schubert, F.	Waltz Op. 9a, No. 1	Romantic	
54	Schubert, F.	Waltz D.365/5	Romantic	
55	Schubert, F.	Waltz D.365/6	Romantic	
56	Schumann, R.	Waltz Op. 124, No. 4	Romantic	
57	Streabbog, J.L.	By the Seaside Op. 63, No. 7	Romantic	
58	Streabbog, J.L.	The Orphan Op. 64, No. 4	Romantic	
59	Tchaikovsky, P. I	Morning Prayer Op. 39, No. 1	Romantic	(From Children's Album)
60	Tchaikovsky, P. I	The New Doll Op. 39, No. 9	Romantic	(From Children's Album)
61	Tchaikovsky, P. I	Waltz Op. 39, No. 8	Romantic	(From Children's Album)
62	Debussy, C. A	The Little Shepherd	20th Century	(From Children's Corner)
63	Maykapar, S.	Waltz Op. 28, No. 15	20th Century	
64	Maykapar, S.	Prelude No. 19	20th Century	
65	Maykapar, S.	Berceuse Op. 8, No. 6	20th Century	
66	Maykapar, S.	Waltz Op. 28, No. 5	20th Century	
67	Maykapar, S.	Prelude (Pedal Prelude) Op. Posth, No. 18	20th Century	
68	Rebikov, V.	Evening in the Meadow Op. 31, No. 5	20th Century	
69	Rebikov, V.	Little Girl Rocking Her Doll Op. 31, No. 7	20th Century	
70	Rebikov, V.	The Christmas Tree	20th Century	
71	Rebikov, V.	Clown	20th Century	
72	Satie, E.	Gnossienne No. 1	20th Century	

The "Nevhiz Ercan -Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Book 1" was published by Arkadaş Publishing in 2017. Under the category of "Number of Works", there are a total of 72 works in Book 1. In terms of the "Name of the Composer" category, it was seen that 8 different composers were included in the Baroque Period, 9 different composers in the Classical Period, 16 different composers in the Romantic Period, and 4 different composers in the 20th Century period. The works of 37 composers in total were included in Book 1. When the "Name of the Work" and "Reference Status of the Work" were examined, it was found that the work was included in the section of a major work or in a method/album in a total of 18 works. Although it was identified by the researcher that some of the other works, aside from these 18 works, were found to be included in an album/method, this information was not provided by the compilers of the book. In the category of "The Period of the Work", a total of 72 works in the book were distributed as 15 Baroque, 16 Classical, 30 Romantic Period, and 11 20th Century works. The works

were divided into the periods that they belonged to by the compilers of the book and listed according to their degree of difficulty. The composer names were also written alphabetically according to the period.

Table 4. Nevhiz Ercan - Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Book 2.

Number of Works	Name of the Composer	Title of the Work	Period of the Work	Reference Status of the Work
1	Bach, J.S	Prelude	Baroque	(From Little Preludes and Fugues)
2	Bach, J.S	Invention (3-part), BWV 801	Baroque	
3	Bach, J.S.	Prelude-XII	Baroque	(48 Preludes and Fugues from Book 2)
4	Bach, J.S.	Fugue-XII	Baroque	
5	Bach, J.S.	Prelude-VI	Baroque	(48 Preludes and Fugues from Book 2)
6	Handel, G.F.	Courante, Suite	Baroque	(From HWV 411)
7	Handel, G.F.	Passacaglia	Baroque	
8	Scarlatti, D.	Sonata (D major)	Baroque	
9	Scarlatti, D.	Sonata (C major)	Baroque	
10	Scarlatti, D.	Sonata (D minor)	Baroque	
11	Scarlatti, D.	Sonata (A major)	Baroque	
12	Beethoven, L. van	Sonatina	Classical	Section I (E flat major)
13	Beethoven, L. van	6 Ecossaises, WoO 83	Classical	
14	Diabelli, A.	Sonatina, Op. 168, No. 1	Classical	Section I
15	Haydn, F.J.	Sonatina, Hob.XVI:4	Classical	Section I
16	Haydn, F.J.	Sonata, Hob.XVI:34	Classical	Section III
17	Hummel, J.N.	Rondo	Classical	
18	Mozart, W.A.	Viennesse Sonatina, K.Anh 229 (K.439b), No. 2	Classical	Section I
19	Myslivecek, J.	Divertimento, No.6 (Rondo)	Classical	
20	Albeniz, I.	Tango, Op. 165, No. 2	Romantic	(From España)
21	Brahms, J.	Waltz, Op. 39, No. 8	Romantic	
22	Brahms, J.	Waltz, Op. 39, No. 15	Romantic	
23	Brahms, J.	Waltz, Op. 39,No. 3	Romantic	
24	Burgmüller, J.F.	L 'Orage, Op. 109, No. 13	Romantic	
25	Burgmüller, J.F.	Vélocité, Op. 109, No. 10	Romantic	
26	Chopin, F.	Mazurka, Op. 68, No. 3 (Posthumous)	Romantic	
27	Chopin, F.	Mazurka, Op. 7, No. 2	Romantic	
28	Grieg, E.	Arietta, Op. 12	Romantic	
29	Gurlitt, C.	Murmuring Brook, Op. 140, No. 5	Romantic	
30	Gurlitt, C.	Storm and Stress, Op. 140, No. 20	Romantic	
31	Gurlitt, C.	Con Moto, Op. 107, No. 6	Romantic	
32	Gurlitt, C.	Sonatina, Op. 54, No. 5	Romantic	Section III

Table 5. Nevhiz Ercan - Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Book 2 (Continued).

Number of Works	Name of the Composer	Title of the Work	Period of the Work	Reference Status of the Work
33	Heller, S.	Etude (E minor)	Romantic	
34	Heller, S.	Etude, Op. 47, No. 14	Romantic	
35	Kirchner, T.F.	Miniatures, Op. 62, No. 2	Romantic	
36	Liszt, F.	Consolation, S.172/1	Romantic	
37	Liszt, F.	Frühling, S.480/2	Romantic	
38	Mendelssohn, F.	Gondola Song, Op. 102, No. 7	Romantic	
39	Reinhold, H	Ungarisch, Op. 39, No. 9	Romantic	
40	Schubert, F.	Waltz, D. 783 (OP.33), No. 10	Romantic	
41	Schubert, F.	Waltz, D. 969 (OP.77), No. 1	Romantic	
42	Schubert, F.	Waltz, D. 969 (OP.77), No. 9	Romantic	
43	Schumann, R.	Von fremden Ländern und Menschen, Op. 15, No. 1	Romantic	(Kinderszenen)
44	Schumann, R.	Hasche-Mann, Op. 15, No. 3	Romantic	(Kinderszenen)
45	Schumann, R.	Träumerei, Op. 15, No. 7	Romantic	(Kinderszenen)
46	Schumann, R.	Prelude, Op. 82, No. 1	Romantic	
47	Streabbog, J.L.	A Sad Story, Op. 63, No. 12	Romantic	
48	Tchaikovsky, P. I	Mazurka, Op. 39, No. 10	Romantic	(From Children's Album)
49	Tchaikovsky, P. I	Sweet Dreams, Op. 39, No. 21	Romantic	(From Children's Album)
50	Tchaikovsky, P. I	Chanson triste, Op. 40, No. 2	Romantic	
51	Debussy, C. A	Cakewalk	20th Century	
52	Debussy, C. A	Page d'album	20th Century	
53	Gershwin, G.	Prelude, (Melody, No. 17)	20th Century	
54	Joplin, S.	Elite Syncopations	20th Century	
55	Nazareth, E.	Remando, (Tango)	20th Century	
56	Nazareth, E.	Ouro Sobre Azul (Tango)	20th Century	
57	Ravel, M.	Prelude	20th Century	
58	Satie, E.	Gymnopedie, No. 1	20th Century	

The "Nevhiz Ercan - Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Book 2" was also published by Arkadaş Publishing in 2017. Under the category of "Number of Works", there are a total of 72 works in Book 2. When the "Name of the Composer" category was examined, it was observed that only 3 different composers were included in the Baroque Period, and 6 different composers in the Classical Period. This number was 15 in the Romantic Period and 6 in the 20th Century. Book 2 includes works by 30 composers in total. When the "Title of the Work" and "Reference Status of the Work" were examined, it was found that a total of 17 works were in the section of a major work or included in a method/album. In this book, as in Book 1, some of the other works, apart from the 17 works mentioned, were found to be included

in an album/method; however, this information was not provided by the compilers of the book. It was determined that the distribution of 58 works in the book in the "Period of the Work" category was 11 Baroque, 8 Classical, 31 Romantic Period, and 8, 20th Century works. In this book, the works were also divided into the periods that they belonged to by the compilers of the book and listed according to their degree of difficulty. The composer names were, again, written alphabetically according to the period.

DISCUSSION AND CONCLUSION

The Nevhiz Ercan - Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Books 1 and 2 were analyzed within the framework of the "Work Review Form" based on sub-problems, and the following conclusions were reached:

1. The Nevhiz Ercan - Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Books 1 and 2 contain a sufficient number of works to enrich the piano repertoire of students, (130 works in total)

2. The books include a large number of different composers to help students expand their knowledge on composers,

3. The books include works that have an important place in the piano literature and will contribute to the repertoire of the students, and in addition to the most common works in the classical piano repertoire, lesser-known works are also included,

4. The books include works from the Baroque, Classical, Romantic, and 20th Century periods, which were divided into periods by the compilers of the books, and the number of works from the Romantic Period are higher in both books,

5. The information regarding whether the works in the book are sections of a major work or included in a method/album is included for some works while the same information is not included for some other works determined by the researcher.

According to Camp (1992) the main point to be considered when choosing repertoire in piano education, is that the pieces contain various technical skills and have various period and style features with different characters. This view supports the research. Ertem (2011) stated that educators should evaluate the repertoire as if it uses '4 basic food groups' and emphasized that the work program should include baroque, classical, romantic and modern periods. This view also supports the research. Işkın and Güdek (2019) concluded that Gül Çimen – Nevhiz Ercan's "Piano Album", which is considered a compilation is also a book that has a repertoire quality. This result is in parallel with the result of the research.

In addition to the results related to all of these sub-problems, the Nevhiz Ercan - Belir Tecimer Piano Classics from the Baroque Period to the 20th Century Book 1 and 2 have enriching features in terms of piano literature and repertoire by including various works from different periods and they are also suitable for the achievements related to piano training in the music teaching undergraduate program. Furthermore, the books are important additions to the literature in terms of being the first compilation books that arrange the works in accordance with the periods and difficulty levels.

In light of these results, the following recommendations were made:

• Since teacher candidates studying at music education institutions in Turkey have different piano playing levels, it would be beneficial to ensure that each student has access to notes, methods, and albums suitable for their level.

• It would be beneficial for educators to offer materials suitable to the levels of the students by following all new notes, albums, methods and similar works published instead of adhering to the same materials all the time.

• It would be beneficial for both educators and students to study the materials such as books, methods, albums, and similar works by understanding their purpose and content.

REFERENCES

Camp M. W. (1992) *Teaching Piano*, California: Alfred Publishing Co, Insc.

Çimen, G. (1995) Piyano Metotlarına Genel Bakış, *Orkestra Dergisi*, Haziran, 258 (13).

Ercan, N, Tecimer, B. (2017) *Barok Dönem'den 20. Yüzyıl'a Piyano Klasikleri 1. Kitap*, Ankara: Arkadaş Yayınevi.

Ercan, N, Tecimer, B. (2017) *Barok Dönem'den 20. Yüzyıl'a Piyano Klasikleri 2. Kitap*, Ankara: Arkadaş Yayınevi.

Ertem, Ş. (2011) Orta Düzey Piyano Eğitimi İçin Repertuar Seçme İlkeleri, *Kastamonu Eğitim Dergisi*, 19 (2) 645-652.

Gözdem, İ, Sarı, A (2020) Piyano Pedagojisine Yönelik Öğretim Yöntemlerinin Geliştirilmesi, ICIER 2020 Conference on 21st Century Skills, Smart Learning Environments and Reflections on Digitalization in Education, Near East University, Cyprus.

Işkın, S, Güdek, B. (2019) Yetişkin Müzik Eğitiminde Kullanılan Piyano Çalışma Kitapları, *Uluslararası Sosyal ve Beşeri Bilimler Araştırma Dergisi*, 6 (44), 3307-3322. http://dx.doi.org/10.26450/jshsr.1529

Karataş, Z. (2015). Sosyal Bilimlerde Nitel Araştırma Yöntemleri. *Manevi Temelli Sosyal Hizmet Araştırmaları Dergisi*, 1(1), 72.

Pamir. L. (1995) *Çağdaş Piyano Eğitimi*. İstanbul: Beyaz Köşk Yayınları.

Say, A. (2002). *Müzik sözlüğü [Music Dictionary]* Ankara: Sözkesen Matbaası.

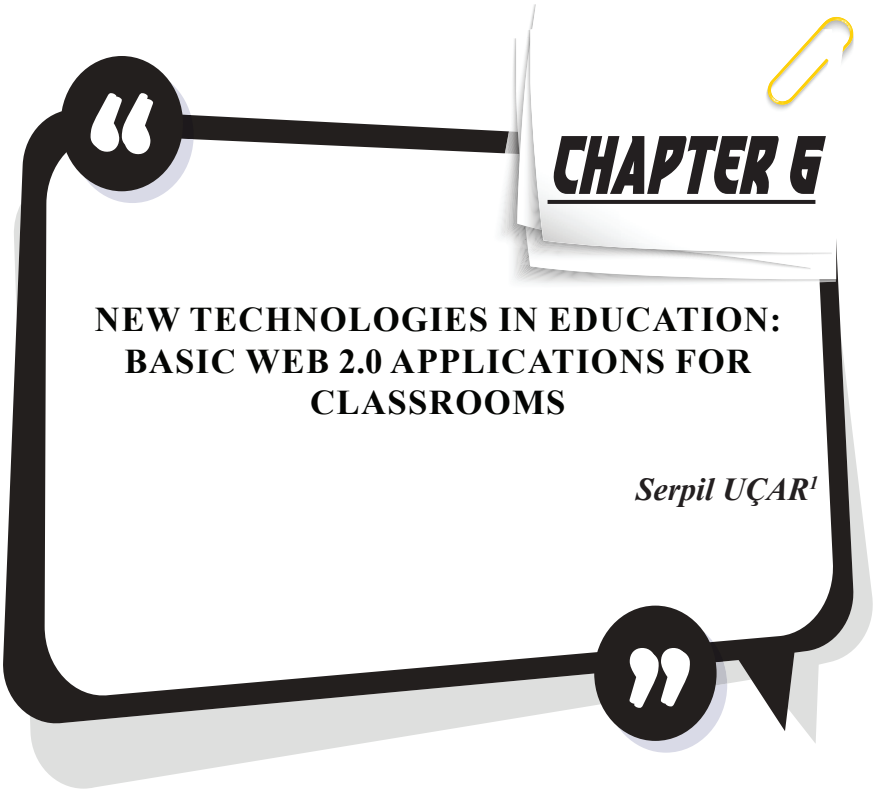
Tufan, E., Güdek, B. (2008). Piyano dersi tutum ölçeğinin geliştirilmesi. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi,* 28 (1), 79.

Türk Dil Kurumu (2019). Metot, 24 Temmuz 2021 tarihinde https://sozluk.gov.tr/ adresinden alındı.

Türk Dil Kurumu (2019). Repertuvar, 24 Temmuz 2021 tarihinde https://sozluk.gov.tr/ adresinden alındı.

Yıldırım, A., Şimşek, H. (2008). *Sosyal bilimlerde nitel araştırma yöntemleri [Qualitative research methods in the social sciences]*. 7thEdition, Ankara: Seçkin Publishing.

Yükseköğretim Kurulu, (2018). Müzik Öğretmenliği Lisans Programı, 25 Temmuz 2021 tarihinde https://www.yok.gov.tr/Documents/Kurumsal/egitim_ogretim_dairesi/Yeni-Ogretmen-Yetistirme-Lisans-Programlari/Muzik_Ogretmenligi_Lisans_Programi.pdf adresinden alındı.



CHAPTER 6

NEW TECHNOLOGIES IN EDUCATION: BASIC WEB 2.0 APPLICATIONS FOR CLASSROOMS

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1. Introduction

Today, a new term 'digital native' has come out to be used for young people who constantly use the technology in all aspects of their life. The term was identified by Prensky (2001a; 2001b) for calling young generations which seem native speakers of the digital language of social media, video games, computers and other sites on the web. Prensky (2001a) stated "Today's average college grads have spent less than 5,000 hours of their lives reading, but over 10,000 hours playing video games (not to mention 20,000 hours watching TV). Computer games, email, the Internet, cell phones and instant messaging are integral parts of their lives." Because of the distinction between new generations and their predecessors, it has become essential for technological tools to be used for educational goals in order to gain better results in education.

Moreover, fast changes in technology have brought profound transformations in the education system. Particularly, with the Covid-19 pandemic broken out in 2020, the field of education all over the world has turned from the traditional in-class atmosphere into the new digital environment where computers are the supporters of the learning (Richardson & Swan, 2003). This transformation has also made it essential to use technological tools for educational aims in this century.

1.1. Defining Web 2.0

Through the first used technological devices - television, radio, e-mail etc., users were provided opportunities for communication. However, users were passive consumers of content with these technologies which have been called as Web 1.0 (Usluel & Mazman, 2009). Web 1.0 was the first generation of the internet and it was mainly regarded as a read-only-web. The main purpose of the Web 1.0 was to distribute the knowledge for anybody at any time and build an online existence. Web 1.0 created a common information place exchanging of communication by sharing information (Hiremath & Kenchakkanavar, 2016).

However, because of the inadequacy of interactions and collaborations within Web 1.0, the term for Web 2.0 was raised by O'Reilly (2005) and was intended for enabling interaction and collaboration among users. Tim O'Reilly (2005) defined "Web 1.0 was about connecting computers and making technology more efficient for computers. Web 2.0 is about connecting people and making technology more efficient for people." Web 2.0 is the second generation of the web. It has been called as read-write web. Web 2.0 signifies web-based applications with which users can add information to the content on the Internet. Thus, users both have the opportunity to become the producers of content and the consumers of information (Cormode & Krishnamurthy, 2008). For instance, amateur

musicians can upload and share a video related to their performance with other users of the Internet through video sharing websites (Park, 2013).

According to Richardson (2006, as cited in Creighton, 2012), Web 2.0 differs from Web 1.0 regarding its capacity for reading and writing to sites which means that web 2.0 has been socially-created spot. Users can post comments to blogs, collaborate with other users of the Internet in instant messaging, create a new content by uploading photos, videos, audio files and other multimedia. These interactive properties of Web 2.0 make itself different from the static Web 1.0 (Creighton, 2012). Table 1.1 shows the distinction between Web 1.0 and Web 2.0:

Table 1.1. Web 1.0 versus Web 2.0

Web 1.0	Web 2.0
"Application based"	"Web based"
"Isolated"	"Collaborative"
"Offline"	"Online"
"Licensed or purchased"	"Free"
"Single creator"	"Multiple collaborators"
"Proprietary code"	"Open source"
"Copyrighted content"	"Shared content"

Solomon & Schrum (2007)

Web 2.0 which is interactive and socially-constructed platform, is in charge of user collaboration for 21st century. Collaboration, which is the key element of Web 2.0, signifies exchanging views and knowledge for common aims (Creighton, 2012). Online collaboration is not similar to the face-to-face collaboration since users both share ideas with each other and interact with the content by tagging, commenting or creating a new content. This structure makes Web 2.0 more dynamic and client-based than Web 1.0.

1.2. Web 2.0 Tools in Education

Six cognitive process dimensions in learning were described by Bloom's taxonomy of educational standards (Bloom, 1956). These dimensions are 'Knowledge', 'Comprehension', 'Application', 'Analysis', 'Synthesis' and 'Evaluation'. Understanding and use of the knowledge, those that are classified from Comprehension to Synthesis, are usually regarded as the most essential goals of education (Krathwohl, 2002). His taxonomy was one-dimensional. The structure of the original taxonomy was revised by some cognitive psychologists in 2001 turning it into two-dimensional framework in order to reflect correlation 21st century work (Anderson & Krathwohl, 2001).

Revised taxonomy included 'Remembering', 'Understanding', 'Applying', 'Analyzing', 'Evaluating' and 'Creating' dimensions. Anderson

and Krathwohl (2001, cited in Solomon & Schrum, 2007) describe these terms in detail: *Remembering* is noticing and recalling information from a long term memory; *understanding* is constituting meaning from written, oral or graphic messages via categorizing, summarizing, inferring etc.; *applying* conducting or using a procedure through practicing; *analyzing* is breaking materials into parts and examining how the parts constitutes the overall structure; *evaluating*: making inferences based on criteria via checking; *creating*: re-organizing the material into new structural position through generating or planning. In order to achieve these skills in learning, students should be provided access both to technological tools and pedagogical tools combined with technology. Both the combination of pedagogy and technology provide best strategies to teach students in schools (Solomon & Schrum, 2007).

Students have different learning styles depending on how they process information such as visual learning style, analytical learning style or kinesthetic learning style etc. In this aspect, technology might become one of the best way to target the right approaches and methods for each learner in order to construct an individualized instruction. Web 2.0 tools might satisfy students' needs in a variety of contexts constructing information in spatial, textual, aural or visual forms. Web 2.0 tools also enhance equal participation of the learners in the learning process. Students are both active learners and can become equal partners as they cooperate with each other and create information in a social environment (Heafner & Friedman, 2008).

According to Jimoyiannis (2013), the reasons for using Web 2.0 applications in educational platforms are as follows: the first reason is that web 2.0 tools are correlated with the nature of 21st century learning and theoretical considerations of contemporary pedagogy shifting instruction from traditional formulas into collaborative methods. The second reason is that Web 2.0 tools enhance students' critical thinking skills and student autonomy over the learning process. For the last reason, students already have a high readiness level towards the use of Web 2.0 applications as a majority of them engage Web 2.0 tools into their social and personal lives.

The use of Web 2.0 tools in education settings reveals the term of 'Technological Pedagogical Content Knowledge' (TPACK) which was offered by Mishra and Koehler (2006) in order to define technology integration in the classroom settings. Much research shows that TPACK enables teachers to concentrate on the relationship among technology, content and pedagogy as they have a significant correlation in school context (Koehler & Mishra, 2009, Lee & Tsai, 2009, Jimoyiannis, 2010). TPACK describes three dimensions of knowledge: technological content knowledge, pedagogical content knowledge and technological pedagogical

knowledge. Through technological pedagogical knowledge, it tries to perform specific pedagogical aims and strategies in the classrooms such as supporting cooperative and reflective learning, encouraging project-based activities.

As a result, Web 2.0 tools include a variety of opportunities for students in classroom. They have the potential to promote student democratic participation and to enhance collaboration groups, to increase higher order skills, student autonomy and to encourage reflective and project-based learning.

1.3. Basic Web 2.0 tools for Instructional Purposes

The most widely used applications of Web 2.0 which contain blogs, wikis, podcasts, social network and Google Docs and their implications for educational purposes were discussed in detail.

Blogs

Doctorow et al. (2002) defines blogs as web pages containing discrete posts which have texts, multimedia or images in a reverse chronological order. Vise (2007) offers another definition that blogs are web entries presented in a reverse order including posts and comments. According to Crane (2012), "A blog is someone's personal dated "log" frequently updated with new information about a particular subject or range of subjects." Some features of blogs are listed as follows in order to understand the concept better (Crane, 2012): a. blogs are usually personal and informal; b. blogs generally present the content in reverse chronological order with the latest entry listed first; c. blogs are generally updated; d. blogs do not have a professional editors in the procedure. According to Solomon and Schrum (2007), blogs are "natural tools for writing instruction". The existence of blogs began in the 1990s and becomes popular and widely used in the 21st century.

Regarding their implications for education, blogs are mainly recommended in education since they promote writing skills, enhance reflective learning, increase students' critical thinking and collaborative capabilities, and enhance an active learning (Seitzinger, 2006). Moreover, blogs can be used as e-portfolios keeping records of personal growth procedure, reflections and success (Lu, 2007). Blogs support teachers in terms of initiating conversations, prompting comments, doing science experiments, solving math problems, discussing books and field trips (Crane, 2012).

Wikis

A wiki is a web page which is accessible to everyone who owns a

web user and internet connection. The first wiki was constructed by Ward Cummingham as the Portland Pattern Repository in 1995 (Teehan, 2010). The most well-known wiki has been *Wikipedia* which is the online encyclopedia. It enables users to cooperate with others in terms of adding, editing or changing any content on the Web at any time. Wikis are one of the most widely used Web 2.0 tools for the educational goals in the 21st century. According to Arya & Mishra (2012) "Wikis are essentially open Web pages, where anyone registered with the wiki can publish to it, amend it, and change it."

As for the implications for educational purposes, wikis offer opportunities for collaboration and problem solving skills, peer editing and revising and e-portfolios. Since students are not restricted to class time, they can work from anywhere at any time (Solomon and Schrum, 2007).

Therefore, wikis are beneficial tools for teaching and learning since they encourage collaborative learning, project-based learning, encourage critical thinking, increase creativity, foster constructivist learning (Cress&Kimmerle, 2008)

Podcasts

According to Wikipedia (2011), "a podcast is a collection of digital media files which is distributed over the Internet, often using syndication feeds (e.g., RSS or Atom feeds) for playback on portable media players and computers." The term 'podcast' is the constitutions of two words: the Apple's "iPod" and "broadcast". It signifies "both the content and method of delivery" (Solomon &Schrum, 2007).

In education, Richardson (2006) stated that although podcasts are not a synchronous Web 2.0 tools, teachers might record their class sessions through podcasts in mp3 audio format and broadcast these podcasts to their students easily. Students are able to replay these podcasts in order to review to catch up with their peers. The major reasons why teachers should use them in the classroom as follows: a. engages different learners; b. students can create, edit, record or work together on their podcasts; c. for teachers, evaluating podcasts can be regarded as formative assessment tool; d. podcast brings together different curriculum fields such as science, social studies or art (Crane, 2012).

Social Networking

Bartlett- Bragg (2006) stated that "social software refers to the range of applications that augments group interactions and shared spaces for collaboration, social connections, and aggregates information exchanges in a web-based environment." Social networks contains sites such as Facebook, Twitter, Edmodo, and My Space etc. Facebook is the most

popular Web 2.0 social networking site widely used by college students (Junco, 2012).

As for the implications for educational aims, Crane (2012) indicated that social networking sites could be used for pedagogical tools for students with respect to aggregating and sharing knowledge, collaborating others to exchange ideas, make decisions, practice the skill of summarizing and condensing and working in or outside the classroom. According to Crane (2012), it also contributes teachers in terms of discussions, posting assignments, quizzes, tests, enhancing parent-teacher communication, increasing educator professional growth, exchanging content with colleagues, and engaging students in real-life issues and customizing learning activities to students' different learning styles etc.

Google Docs

Google Docs is a free web-based tool which is the combination of word-processor, spreadsheet, form, presentation and data storage system (Suwantarathip & Wichadee, 2014). Google Docs constitutes four essential options: Google Documents, Google Spreadsheets, Google Drawing and Google Presentations which all include similar functions. The word-processor tool enables students collaborate in the revision procedure. The spreadsheet is helpful for teachers organize projects and attendance sheet. The presentation tool might be beneficial for students to work together in order to make group presentations from any place (Crane, 2012).

Chinnery (2008) indicated that Google Docs is a useful tool where the different and creative activities can be designed for learning. A lecturer might post a text, filled with errors consciously, for students to correct. Google Docs is a web-based learning tool which assists carrying out a learner-centered approach in a collaborative context. Students might collaboratively prepare online materials reflecting their learning process, their previous knowledge, the course content etc. (Alkhataba et al., 2018).

Conclusion

The purpose of this study is to concentrate on defining interactive properties of Web 2.0 and to explain in what ways Web 2.0 differs from Web 1.0. It also emphasizes the importance of Web 2.0 in educational environment. Another aim of this paper is to show basic Web 2.0 tools used for educational purposes. The most common applications of Web 2.0 including blogs, wikis, podcasts, social network and Google tools and their implications for educational purposes were discussed in detail.

Bloom's revised taxonomy included Remembering, Understanding, Applying, Analyzing, Evaluating and Creating dimensions. In order to achieve these skills in learning, students should be provided access to

technological tools in the educational context. For this reason, Web 2.0 applications are strongly recommended to be used for instructional aims since they promote collaborative skills, reflective learning, promote students' critical thinking abilities and student autonomy, enhance the active learning and customize learning activities to students' different learning styles. Therefore, the integration of web 2.0 technologies into education are likely to facilitate a high-quality learning for students.

References

Alkhataba, E. H. A., Abdul-Hamid, S., & Bashir, I. (2018). Technology-supported online writing: an overview of six major web 2.0 tools for collaborative-online writing. Arab World English Journal (AWEJ) Volume, 9.

Anderson, L. W., & Krathwohl, D. R. (Eds.). (2001). A taxonomy for learning, teaching and assessing: A revision of Bloom's Taxonomy of educational objectives: Complete edition. New York: Longman.

Arya, H. B., & Mishra, J. K. (2012). Oh! Web 2.0, virtual reference service 2.0, tools & techniques (II). Journal of Library & Information Services in Distance Learning, 6(1), 28-46.

Bartlett-Bragg, A. (2006). Reflections on pedagogy: Reframing practice to foster informal learning with social software. Retrieved from https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.472.2265&rep=rep1&type=pdf

Bloom, B. S. (1956). Taxonomy of educational objectives, Handbook I: The cognitive domain. New York: David McKay.

Chinnery, G. (2008). You've got some GALL: Google-assisted language learning. Language Learning & Technology, 12(1), 3-11.

Cormode, G., & Krishnamurthy, B. (2008). Key differences between Web 1.0 and Web 2.0. *First Monday*.

Crane, B. (2012). Using web 2.0 and social networking tools in the K-12 classroom. American Library Association.

Creighton, P. M. (2012). *The secret reasons why teachers are not using Web 2.0 tools and what school librarians can do about it*. ABC-CLIO.

Cress, U., & Kimmerle, J. (2008). A systemic and cognitive view on collaborative knowledge building with wikis. Computer-Supported Collaborative Learning, 3, 105-122.

Doctorow, C. et al. 2002. Essential Blogging. CA: Sebastopol.

Heafner, T., & Friedman, A. (2008). Wikis and constructivism in secondary social studies:

Fostering a deeper understanding. Computers in the Schools, 25(3/4), 288-302

Hiremath, B. K., & Kenchakkanavar, A. Y. (2016). An alteration of the web 1.0, web 2.0 and web 3.0: a comparative study. *Imperial Journal of Interdisciplinary Research*, *2*(4), 705-710.

Jimoyiannis, A.(2010a). Designing and implementing an integrated Technological Pedagogical Science Knowledge framework for science teacher's professional development. Computers & Education, 55(3), 1259-1269.

Jimoyiannis, A., Tsiotakis, P., Roussinos, D., & Siorenta, A. (2013). Preparing teachers to integrate Web 2.0 in school practice: Toward a framework for Pedagogy 2.0. *Australasian Journal of Educational Technology*, *29*(2).

Junco, R. (2012). Too much face and not enough books: The relationship between multiple indices of Facebook use and academic performance. Computers in Human Behavior, 28(1), 187–198

Koehler,M.J.,&Mishra,P.(2009).What is technological pedagogical content knowledge?. Contemporary Issues in Technology and Teacher Education, 9(1),60-70

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into practice*, *41*(4), 212-218.

Lee, M.H.,&Tsai,C.C.(2009). Exploring teachers' perceived self-efficacy and technological pedagogical content knowledge with respect to educational use of the World Wide Web, Instructional Science,38,1-21.

Lu, P. C. (2007). The Integration of Blog Platform and E-portfolio in Art Assessment The International Journal of Arts Education, 5(2), 154-185.

Mishra,P.,&Koehler,M.J.(2006).Technological Pedagogical Content Knowledge:A framework for teacher knowledge.Teachers College Record, 108(6),1017-1054.

Park, S. W. (2013). The potential of web 2.0 tools to promote reading engagement in a general education course. *TechTrends*, *57*(2), 46-53.

Prensky, M. (2001a). Digital natives, digital immigrants. On the Horizon 9(5), 1-6.

Prensky, M. (2001b). Digital natives, digital immigrants part 2: Do they really think differently? On the Horizon 9(6), 1-6.

Richardson, W. (2006). Blogs, wikis, podcasts, and other powerful web tools for

classrooms. Thousand Oaks, CA: Corwin Press.

Richardson, C. J., & Swan, K. (2003). Examining social presence in online courses in relation to students perceived learning and satisfaction. Journal of Asynchronous Learning Networks, 7(1), 68–88

Seitzinger, J. (2006). Be constructive: Blogs, podcasts, and wikis as constructivist learning tools

[Electronic Version]. Learning Learning Solutions e-Magazine,

Solomon, G., & Schrum, L. (2007). New tools, new schools: Getting started with Web 2.0. *International Society for Technology in Education, Eugene, OR, USA*.

Suwantarathip, O., & Wichadee, S. (2014). The Effects of Collaborative Writing Activity Using Google Docs on Students' Writing Abilities. Turkish Online Journal of Educational Technology-TOJET, 13(2), 148-156.

Teehan, K. (2010). Wikis: The Educator's Power Tool. ABC-CLIO.

Usluel, Y. K., & Mazman, S. G. (2009). Adoption of Web 2.0 tools in distance education. *Procedia-Social and Behavioral Sciences*, *1*(1), 818-823.

Vise, D. A. C. (2007). The effects of wiki-and blog-technologies on the students' performance when learning the preterite and imperfect aspects in Spanish. West Virginia University.

Wikipedia. 2011. "Podcast." Wikimedia Foundation. Last modified October 31. http://en.wikipedia.org/wiki/Podcast.

CHAPTER 7

PRE-SERVICE HISTORY TEACHERS' EXPERIENCES OF USING THE EDMODO APPLICATION DURING THE COVID-19 PANDEMIC

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INTRODUCTION

Technological developments and pandemics in the world in recent years have made it a necessity to re-design educational institutions and settings. In this context, the knowledge and especially the technological skills of teachers who are responsible for managing educational settings have started to be questioned again. The COVID-19 pandemic, which started in Wuhan, China, and spread across the world and caused people to have a nightmare, has deeply affected social life. Exchange of knowledge has now gone beyond stone walls and time and has acquired a virtual dimension. During the pandemic, educational institutions, like many institutions and organizations, have moved their work to virtual environments. Educational processes have been continued in virtual classrooms. There are many virtual classroom applications (Edmodo, Moodle, Classdojo, Remind, White Board, Google Classroom, Adobe Connect, Bigbluebutton, Schoology, Engrade, Blendspace, EBA) that can be used in distance education. Virtual classrooms are preferred by teachers to ensure interaction among learners, develop community awareness, and easily reach learners living in different places (Martin & Parker, 2014). However, after the pandemic, virtual classroom applications were no more a preference: they had to be used widely. The Edmodo virtual classroom application offers an alternative educational setting for use in times of extraordinary circumstances like the COVID-19 pandemic. It offers students the opportunity to learn by doing, which is in line with the constructivist approach to teaching, and it can be used free of charge. Since launching in 2008, it has functioned as both an education platform and a social network, with more than 100 million users. In this global education network, Edmodo helps connect all learners with the people and resources that they need to reach their full potential (Edmodo, 2021). Edmodo enables teachers to easily create and manage an online classroom environment regardless of time and place, students to easily communicate with each other and with the teacher, see their grades, and parents to become involved in educational processes (Balasubramanian, Jaykumar, & Fukey, 2014; Kongchan, 2012; McLean, Edwards, & Morris, 2017). Edmodo, also known as the "Facebook of Education" (Sarrab, Elbasir, & Alnaeli, 2016), offers students a technological, social, educational, and free communication network (Porcel, Ching López, Lefranc, Loia, & Herrera Viedma, 2018). Edmodo allows teachers to communicate with their students in a virtual environment, assign homework according to a specific schedule, score completed assignments, use warnings or messages in the system, and receive feedback from students on certain topics through questionnaires or quizzes (Kongchan, 2012). Edmodo is also used in learning environments where course documents are stored digitally (Taşgın

& Küçükoğlu, 2016) and in other learning environments such as blended learning, distance learning, e-learning, flipped learning. Edmodo is a safe social platform where teachers can collaborate with students, share content for them, and view students' work (Sarrab, Elbasir, & Alnaeli, 2016). On the other hand, although social media applications such as Facebook have been the subject of educational research, they can be distracting for students. Therefore, Edmodo is one of the best social networks that can be used for education. Indeed, several studies have reported the advantages of using Edmodo for educational purposes. Some studies have reported teachers' positive attitudes towards using Edmodo (Yaylak, 2020). Trust (2017) investigated the use of Edmodo in math classes. In the study in question, teachers reported that with the use of Edmodo, they were more motivated to improve their teaching practices, felt stronger to make changes in their practices, and could better implement student-centered and innovative practices. Some studies conducted with pre-service teachers (Kazez & Bahçeci, 2016; Kurt, 2017) have reported the positive results of using Edmodo. On the other hand, some studies about Edmodo have been conducted with parents (McLean, Edwards, & Morris, 2017) while some with primary school students (Aldemir, Çelik, & Kaplan, 2018). Similarly, the authors of these studies concluded that using Edmodo had positive effects on educational processes.

Hence, the literature review yielded studies reporting the positive views of teachers, pre-service teachers, students, and parents about using Edmodo for distance learning. However, no study has so far been conducted to investigate pre-service history teachers' views about using Edmodo in Instructional Technologies and Material Design classes. In this regard, the present study is thought to contribute to the relevant literature. The present study aims to analyze pre-service history teachers' experiences of using the Edmodo virtual classroom application for Instructional Technologies and Material Design classes during the COVID-19 pandemic. To this end, answers to the following questions were sought:

- What are the pre-service history teachers' views on using Edmodo for Instructional Technologies and Material Design classes?
- What are the positive and negative aspects of using Edmodo for Instructional Technologies and Material Design classes?

METHOD

Considering the problem situation and research problems, case study design was used in the research. In the case study design, factors such as individuals, environment, processes and events related to a situation are handled with a holistic approach. In addition, it focuses on how these factors affect the relevant situation and how they are affected by the

relevant situation. Due to the nature of case studies, both qualitative and quantitative data can be used together (Yıldırım & Şimsek, 2011).

Participants

The study groups consisted of 12 pre-service history teachers studying at the Social Studies Teaching Department of the Faculty of Education of a state university in the spring semester of the 2019-2020 academic year. While selecting the participants, the criterion sampling technique, one of the purposeful sampling methods, was used. The criterion sampling method involves selecting cases that meet some criteria determined by the researcher in advance (Yıldırım & **Şimşek**, 2013). The inclusion criteria were determined as follows: (a) taking the Instructional Technologies and Material Design course and (b) voluntarily participate in the study.

The Process of Experiencing the Phenomenon

Due to the Covid-19 pandemic, the Instructional Technologies and Material Design course was taught with the pre-service history teachers via Edmodo, a virtual classroom application. Theoretical training was given in the first four weeks of the course. In the first four weeks, information and documents regarding the Edmodo application, the theoretical framework of the course, the purpose and scope of the course were shared with the pre-service history teachers. The next week, the volunteer participants of the study were determined and briefed about the purpose of the study. Two weeks of the process consisted of the midterm and final exams. A week has been allocated to raise awareness and motivate students to study. Thus, the study covered a period of 14 weeks in total. In the remaining seven weeks, each group used the materials they had prepared for the lesson, accompanied by an exemplary History lesson design, through the Edmodo virtual classroom application. In this process, pre-service teachers were informed that they should design a material in the context of the achievements in the History curriculum and share it with the class via Edmodo. Teacher candidates are divided into groups of four. Pre-service teachers were encouraged to work in cooperation and task sharing. Each week, a student group shared the materials they prepared through the Edmodo application. Classmates and lecturer of the course examined the studies and offered comments and suggestions.

Data Collection

To obtain the participants' views on using Edmodo in Instructional Technologies and Material Design course, a semi-structured interview form developed by the researchers was used. Three experts were consulted about the form, and necessary corrections were made and the form was finalized according to their feedback.

Data Analysis

In the research, the data were collected with the qualitative method, and content analysis was used to analyze the data. According to Stemler (2000), content analysis is the systematic classification or coding of large volumes of data. In other words, content analysis is an explanatory method that seeks to make inferences (Krippendorff, 2004). As a result of content analysis, themes and codes were obtained from qualitative data. After the codes were determined under the themes, even the smallest data were tried to be interpreted. To ensure confidentiality, expressions (S1, S2, S3, etc.) instead of participants' names were used during data entry.

Validity and Reliability

In order to increase the validity of the study, after the interview data were written down, they were presented to the participants for confirmation. For the internal reliability of the study, expert help was received about how much the codes reached in the study matched the categories. In addition, no changes were made in the interview data and the researcher did not add his own interpretation to the data while quoting directly. Reliability [Reliability = Consensus / (Consensus + Disagreement)] formula recommended by Miles and Huberman (2015) was used for the percentage of agreement between the analyzes. Considering the agreement percentages of the analyzes made by the experts, it was found that the result was 90%. In addition, the documents related to the process were preserved for the external reliability of the study.

FINDINGS

Themes and codes were created from the participating pre-service history teachers' experiences of using Edmodo during the COVID-19 pandemic. Their views were collected under five themes: "technological contributions," "affective effects," "pedagogical contributions," "offer the alternatives," and "limitations." Figure 1 presents the themes reached from the participants' views on using Edmodo during the COVID-19 pandemic.

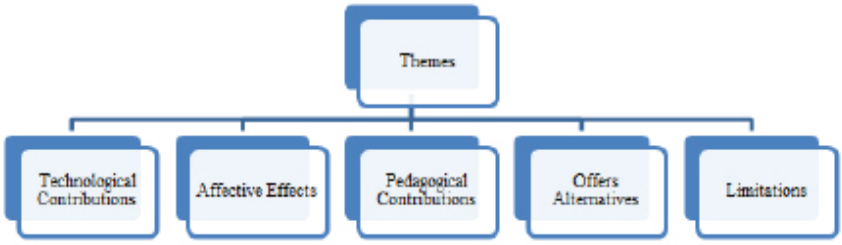

Figure 1. Themes obtained from participants' views on using Edmodo during the COVID-19 pandemic

Theme 1: Technological Contributions of Edmodo

Edmodo offered many technological advantages to the students (see Figure 2). This application enabled students to easily share and view course contents. Some students, who, at first, thought that they could not become accustomed to technological applications, started to favor using technology in education. It was emphasized that using Edmodo was similar to using some other social networks, which led to the ease of use for the students. Edmodo also allowed students to carry out their learning activities at any time and place. Furthermore, with the ease of accessibility it offers, Edmodo contributed to achieving continuous education. Other technological contributions include the ease of content sharing and viewing, ease of communication, uninterrupted education, and the ability to review previous lessons.

Figure 2. Technological contributions of Edmodo

S-5: "We can review other students' applications at any time and have an idea about them."

S-6: "This application process has helped me a lot in learning to develop

teaching materials, develop skills, create visuals, learn individually, use technology in a better way, and also design games such as quizzes to make the lesson fun."

S-8: "Edmodo has enabled us to continue our education, which was interrupted by the pandemic. It was a very good app for our friends who could not attend classes or were late for classes. Thanks to this system, there was no problem with communication with our teachers. Sometimes when we wanted to consult with our teachers about a subject, we would send them e-mails, and we sometimes had problems with that. But thanks to this system, we do not have such problems anymore."

S-9: "It is an application that everyone can easily access and use. Since we used Google Classroom in the first term of the pedagogical formation certificate program, I had no difficulty using this application. Edmodo is actually similar to apps like Facebook and Instagram."

Theme 2: Affective Effects of Edmodo

The participants also mentioned some affective effects of using Edmodo (see Figure 3). Students first expressed their gratitude to the lecturer of the course for offering such a learning environment during the pandemic. The Edmodo virtual classroom application was generally appreciated by the students. Satisfied with the virtual classroom, the students noted that the activities in the virtual classroom helped them move away from the stress of the real classroom environment. In addition, the classes in Edmodo were found to be fun and interesting.

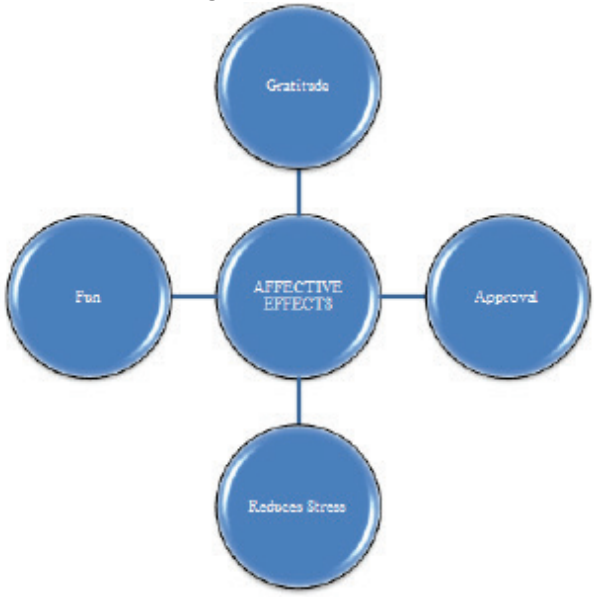

Figure 3. Affective effects of Edmodo

S-1: "Instead of stressful exam weeks, we were a little bit relieved by this app in these difficult times."

S-4: "I would like to extend my endless thanks to our teacher who pioneered the execution of this lesson in this efficient way."

S-8: "I would like to express my gratitude to our teachers who facilitated this process and helped and supported us in the process."

S-12: "Using Edmodo is fun."

Theme 3: Pedagogical Contributions of Edmodo

Students expressed some of the pedagogical contributions of using Edmodo during the pandemic (see Figure 4). With this application, students were able to collaborate in learning activities. This application ensured the active participation of students and helped them learn the topics effectively and efficiently. It also facilitated the learning process by contributing to permanent learning. Furthermore, Edmodo helped students achieve new information and learning outcomes.

Figure 4. Pedagogical contributions of Edmodo

S-5: "We can easily find sample applications for the applications we will do. It also helps us deliver our homework (to the teacher)."

S-6: "I learned new things by watching the presentations of my friends in the Edmodo application."

S-8: "It enabled us to get back in touch with our teachers and friends. It is an application that allows us to exchange ideas with our friends."

Theme 4: Alternatives that Edmodo Offers

Using Edmodo offered various advantages to students (see Figure 5). Learning independent of time and space is one of its most noteworthy advantages. Thanks to this application, students found the opportunity to attend classes from their homes without having to come to the real classroom environment. This provided convenience especially for students living in other cities. Also, students were able to wear whatever they wanted or listen to lessons however they wanted. Moreover, Edmodo contains teaching materials for other lessons, as well. In this regard, Edmodo seems to be generally liked by lecturers and pre-service teachers with different teaching specialties. Besides, technology skills acquired through Edmodo contributed to some students in other classes, as well. In addition, some of the students expressed the necessity of implementing such a virtual classroom, taking into account the health conditions during the pandemic period.

Figure 5. Alternatives that Edmodo offers

S-1: "Thanks to Edmodo, we will have the opportunity to do our homework at our homes."

S-2: "In this app, you can create classes for different courses."

S-5: "(During face-to-face education) we were sometimes late for or unable to attend our classes. However, we do not have such problems in Edmodo."

Theme 5: Limitations of Edmodo

As well as several advantages of the Edmodo virtual classroom

application, some limitations were also mentioned by pre-service history teachers (see Figure 6). Most of the students emphasized that they found the virtual classroom application useful, but face-to-face education was more efficient, so they wanted to return to face-to-face classes. Another noteworthy limitation of distance education noted by the participants was the need for the technological infrastructure. The lack of necessary technological infrastructure (e.g., computers, tablets, or the Internet) in every student's home poses a problem for virtual classroom activities. Internet disconnections also interrupt students' learning activities. Some students reported having encountered some problems with uploading course contents to the system. Also, the lack of equal opportunities for every student was noted as another major problem. Online lessons were also found to be less adequate in terms of classroom interaction and socialization than face-to-face classes. Some participants stated that virtual classrooms could not create a real classroom atmosphere and that it took time to get accustomed to virtual classes. Besides, the lack of live lessons was expressed as another limitation of the virtual classroom application. Some of the students stated that they participated in virtual classes only because of the pandemic and that online learning did not fully meet their expectations.

Figure 6. Limitations of Edmodo

S-1: "Although the Edmodo virtual classroom is good in terms of

communication, I think it can never replace face-to-face education. I wish we could return to our face-to-face classes as soon as possible."

S-8: "Some of our friends do not have the Internet or computers, which poses a problem for them. Another downside of virtual classes is that they are not as effective as face-to-face classes."

S-4: "Some of our friends sometimes could not access the necessary infrastructure (computers, the Internet, or due to geographical conditions."

S-5: "Since we have always been educated in face-to-face classes, I had a hard time (getting accustomed to virtual classes) like everyone else in the beginning. The application does not give the real classroom atmosphere, which negatively affects the education system. In virtual classes, we cannot give the reactions or make the gestures that we do in face-to-face classes."

S-6: "It does not contribute to our social development as much as face-to-face classes. It is less effective than face-to-face learning in terms of collaboration, socialization, or discussion among students. I think the fact that everyone does not have equal opportunities is the most important reason for this."

DISCUSSIONS

The COVID-19 pandemic has caused the compulsory replacement of face-to-face classes with virtual classrooms all over the world. In regions where the impact of the pandemic is observed, it is primarily aimed to provide uninterrupted education. On the other hand, it is important to ensure that teaching activities carried out compulsorily in virtual classrooms are effective and efficient. In this study, it was aimed to determine pre-service history teachers' experiences of using the Edmodo virtual classroom app and thus to reveal the potentials and limitations of using this app in education.

As regards the technological contributions of Edmodo, some advantages that were stated by the participants of this study include ease of content sharing and viewing, getting accustomed to using technology, ease of use, asynchronous learning, instant messaging, benefits of using technology, accessibility, continuity of education, ability to add content, ease of communication, uninterrupted education, and ability to review previous lessons. Likewise, the literature review yielded similar contributions of using technology to students. Lugrin, Latoschik, Habel, Roth, Seufert, and Grafe (2016) argue that to ensure technological efficiency, the system to be designed should be inexpensive, useful, and adaptable. In addition, the system to be designed should be able to provide feedback in synchronous and asynchronous environments. Thus, the

system can reach every audience with its low cost, can be easily adopted by students with its usefulness, and can be used for different courses with its adaptability. Besides, learning can be supported by providing instant feedback in synchronous and asynchronous learning environments. Liu, Lomovtseva, and Korobeynikova (2020) state that virtual classrooms offer greater freedom of access and lower education prices. Similarly, in the current study carried out with pre-service history teachers, the participants stated that Edmodo was free and allowed access from different platforms. Indeed, the literature review showed that virtual classrooms provided students with the ease of access, use, and communication, saved their time, enabled feedback and control, and provided students with the experience of using technology (Balasubramanian, Jaykumar, & Fukey, 2014; Yaylak, 2020). Similarly, in some studies, it was stated that using Edmodo was easy, posts in Edmodo were useful for learning the topics, and it was easy to access announcements and documents in the app (Kazez & Bahçeci, 2016; Kongchan, 2012). Indeed, the results of the current study support these findings reported in the literature. Edmodo was designed specifically for use in education and has been called the "Facebook of education" (Sarrab, Elbasir, & Alnaeli, 2016). Some studies (Rogers, 2011) have also highlighted the similarities between Edmodo and Facebook usage. In this study, participants pointed out the similarities between the interface and usage of Edmodo and Facebook apps, too. It can be shown among the advantages of technology that teachers can carry out assessment processes via homeworks and quizzes on Edmodo.

As regards the affective effects of Edmodo, participants were generally in favor of using the Edmodo application in educational processes. Students expressed their gratitude to the lecturer of the course, who introduced Edmodo, which ensured the continuity of their education under the difficult conditions of the pandemic. In addition to being satisfied with virtual classes, the students also found them interesting. Virtual classes helped the students move away from the exam stress of face-to-face education. Similar findings have also been reported in the literature (Aycock, Jaykumar, & Fukey, 2014; Bery, 2019; Çankaya, Durak, & Yünkül, 2013; Erten, 2019; Kongchan, 2012; Nee, 2014). To ensure that virtual classes are effectively used in educational processes, teachers should be provided with all kinds of technical support while creating virtual classrooms. Thus, virtual classrooms can be more widely used in teaching environments. According to McSweeney (2010), with the increase in the demand for distance learning, investments have been made in virtual classroom systems, which, in turn, has led to an increase in the popularity of virtual classrooms.

As regards the pedagogical contributions of Edmodo, it offers collaborative learning environments to students and enables active

learning during the process. Indeed, this finding is consistent with the finding reported by Rufai, Alebiosu, and Adeakin (2015) that virtual classrooms enable discussion and collaboration among students. Several studies have also reported that virtual classrooms increase the interaction and collaboration between teachers and students (Asadı, Khodabandeh, & Yekta, 2019; Enriquez, 2014; Gedera, 2014; Kazez & Bahçeci, 2016; Kongchan, 2012; Martin, & Parker, 2014; McClain, Brown, & Price, 2015; Yaylak, 2020; Yünkül & Çankaya, 2017). While using Edmodo, the students were able to carry out effective learning activities, achieve permanent learning, and obtain new information and learning outcomes. Moreover, Edmodo made pedagogical contributions to the students by facilitating the learning process. Findings reported in the literature that Edmodo virtual classroom application contributes to learning (Yaylak, 2020) and supports active learning (Kazez & Bahçeci, 2016) are in line with the findings of this research that Edmodo provides pedagogical contributions. Therefore, the pedagogical contributions of Edmodo reported by previous studies, as well as the current study, suggest that the Edmodo virtual classroom application can be used effectively and efficiently for educational purposes.

Some other advantages of Edmodo reported by the participants include learning independent of time and space, usability in other lessons, contributions to other lessons, and contributions to health. Indeed, the literature review yielded similar advantages of virtual classrooms reported by previous studies. Virtual classes can be held independently of time and space (Balasubramanian, Jaykumar, & Fukey, 2014; Erten, 2019; Kongchan, 2012), they promote creativity and offer the alternatives that support student engagement with flexible and attractive interfaces (Arias-Masa, Alonso-Diaz, Cubo-Delgado, Gutiérrez-Esteban, & Yuste-Tosina, 2014), and they eliminate the distance between home and university where there are inequalities of opportunity (Rufai, Alebiosu, & Adeakin, 2015; Sarrab, Elbasir, & Alnaeli, 2016; Willmann, Zebedin, & Miksche, 2020). Considering today's harsh conditions as a result of the COVID-19 pandemic, the pre-service history teachers participating in the present study had to take the Instructional Technologies and Material Design course via the virtual classroom app. However, in some of the previous studies, participants attended virtual classes not as a result of necessity but because researchers intended to test the effect of virtual classes on learning. Online learning during the pandemic may seem to be a necessity (rather than a choice) for teachers and students; however, it has been an important step in protecting students' health. Thanks to online learning, students have been able to continue their education at their safe homes without being exposed to health risks. Indeed, carrying out online classes for many courses during the pandemic seems to have contributed a great deal to students all over the world.

Some limitations of the Edmodo virtual classroom application reported by the participants include lack of technological infrastructure, lack of equal opportunities, decrease in social interaction, difficulty in getting accustomed to the app, compulsory participation, technological problems, lack of live lessons, lack of a real classroom environment, and failure to meet expectations. Due to these limitations, some of the students emphasized their desire to return to face-to-face education. Indeed, several studies in the literature have reported similar limitations of virtual classrooms. It has been reported that the physical distance between the student and the teacher sometimes leads to a decrease in social interaction (Alsahrani, Ahmed, & Ward, 2017). Also, it has been stated that students face problems in virtual classes such as lack of technological infrastructure (e.g., the Internet), reduced interaction, pedagogical and professional problems, lack of teaching materials, reduced classroom time, and access problems (Can, 2020; Dumont & Raggo, 2018; Erten, 2019; Gedera, 2014 Kaya & Ağaoğlu, 2013). In contrast, Bettinger, Fox, Loeb, and Taylor (2017) found that students who attended online classes showed higher academic performance than those who attended face-to-face classes, which is consistent with the positive aspects of virtual classrooms reported in this study.

CONCLUSION and RECOMMENDATION

Although the Edmodo virtual classroom application brings some disadvantages in the course activities, it has been found useful in learning environments in general. Although the Edmodo application is seen as an inequality of opportunity by some students due to technological inadequacies, it can actually prevent inequality of opportunity in education with the many advantages it provides to students. If the technological requirements are met, it can be said that the only disadvantage is that it cannot create the sence of presence in the same environment as in the real classroom environment. Although it is a compulsory educational activity in times of extraordinary disasters and epidemics, virtual classrooms can take their place in learning environments as alternative learning tools that support face-to-face education due to their potential advantages.

Based on the results of the research, virtual classroom activities can be made more effective and efficient by taking certain measures. The following are some recommendations to use virtual classroom applications more effectively and efficiently and to evaluate the use of virtual classrooms in education:

- First, to ensure that every student enjoys uninterrupted education, equal technological opportunities should be provided. Technological infrastructure should be provided to students who do not have the Internet

or a device to access the Internet (phones, tablets, laptops, etc.). Doing so can prevent the inequality of opportunity in education.

- Needs analysis can be made with students and lecturers to reveal their expectations from virtual classroom applications.

- Teaching/learning activities in the virtual classroom environment can be enriched and made more interesting with the inclusion of learning activities similar to those in the real classroom environment. In this way, students' expectations can be met.

- Future research can investigate the effect of virtual classroom applications on different student groups or courses. Thus, virtual classroom applications can be more widely used in education.

- Virtual classroom applications, whose effectiveness and efficiency have been revealed by scientific research, can be included in curricula as alternative learning tools.

REFERENCES

Aldemir, T., Celik, B., & Kaplan, G. (2018). A qualitative investigation of student perceptions of game elements in a gamified course. *Computers in Human Behavior, 78,* 235-254. https://doi.org/10.1016/j.chb.2017.10.001

Alsahrani, S., Ahmed, E., & Ward, R. (2017). The influence of online resources on student–lecturer relationship in higher education: A comparison study. *Journal of Computers in Education. 4*(2), 87-106. https://doi.org/10.1007/s40692-017-0083-8

Arias-Masa, J., Alonso-Diaz, L., Cubo-Delgado, S., Gutiérrez-Esteban, P., & Yuste-Tosina, R. (2014). Assessment of the use of synchronous virtual classrooms in higher education. *The New Educational Review, 38*(4), 223-237.

Asadı, N., Khodabandeh, F., & Yekta, R. (2019). Comparing and contrasting the interactional performance of teachers and students in traditional and virtual classrooms of advanced writing course in distance education university. *Turkish Online Journal of Distance Education-TOJDE, 20*(4), 135-148. https://doi.org/10.17718/tojde.640552

Aycock, B., K., Jaykumar, V., L., & N. Fukey. (2014). A study on student preference towards the use of Edmodo as a learning platform to create responsible learning environment. *Procedia – Social and Behavioral Sciences, 144*(20), 416–422. https://doi.org/10.1016/j. sbspro.2014.07.311

Balasubramanian, K., Jaykumar, V., & Fukey, L. N. (2014). A study on "Student preference towards the use of Edmodo as a learning platform to create responsible learning environment". *Procedia-Social and Behavioral Sciences, 144*, 416-422. https://doi.org/10.1016/j.sbspro.2014.07.311

Berry, S. (2019). Teaching to connect: Community-building strategies for the virtual classroom. *Online Learning Journal, 23*(1), 164-183. https://doi.org/10.24059/olj.v23i1.1425

Bettinger, E.P., Fox, L., Loeb, S., & Taylor, E.S. (2017). Virtual classrooms: How online college courses affect student success. *American Economic Review, 107*(9), 2855-2875. https://doi.org/10.1257/aer.20151193

Can, E. (2020). Sanal sınıf yönetimi: İlkeler, uygulamalar ve öneriler [Virtual class management:Principles, implementations and recommendations]. *Açıköğretim Uygulamaları ve Araştırmaları Dergisi (AUAd), 6*(4), 251-295.

Çankaya, S., Durak, G., & Yünkül, E. (2013). Using educational social networking sites in higher education: edmodo through the lenses of undergraduate students. *European Journal of Educational Technology, 1*(1), 3-23.

Dumont, G., & Raggo, P. (2018). Faculty perspectives about distance teaching in the virtual classroom. *Journal of Nonprofit Education and Leadership, 8*(1), 41-61. https://doi.org/ 10.18666/JNEL-2018-V8-I1-8372

Edmodo. (2022). *About Edmodo*. Retrieved May 20, 2022 from https://go.edmodo.com/about/

Enriquez, M. A. (2014). Students' perceptions on the effectiveness of the use of Edmodo as a supplementary tool for learning. *Presented at the DLSU Research Congress. Manila, Philippines: De La Salle University.*

Erten, P. (2019). Opinions of preservice ınformation technologies teachers on virtual classroom and implementations. *Batman University Journal of Life Sciences, 9*(2), 236-252.

Gedera, D. S. P. (2014). Students' experiences of learning in a virtual classroom. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 10*(4), 93-101.

Kaya, S., & Ağaoğlu, E. (2013). Opinions of instructors related to the physical layout dimension of virtual classroom management. *Literacy Information and Computer Education Journal (LICEJ), Special Issue, 2*(1), 1342-1350. https://doi.org/ 10.20533/licej.2040.2589.2013.0178

Kazez, H., & Bahçeci F. (2016). BÖTE bölümü öğretmen adaylarının Edmodo kullanımına dair görüşlerinin incelenmesi [Examination of opinions of CEIT teacher candidates regarding the usage of Edmodo]. *Eğitim ve* Öğretim *Araştırmaları Dergisi, 5*(1), 9-20.

Kongchan, C. (2012). *How a non-digital-native teacher makes use of Edmodo*. In ICT for Language Learning 5th Edition.

Krippendorff, K. (2004). *Content Analysis: An Introduction to Its Methodology (2nd ed. ed.)*. Thousand Oaks: CA: Sage.

Kurt, Ç. S. (2017). Bir harmanlanmış öğrenme deneyimi [A blended learning experience]. İlköğretim *Online, 16*(2), 860-886. https://doi.org/10.17051/ilkonline.2017.304740

Liu, Z. Y., Lomovtseva, N., & Korobeynikova, E. (2020). Online learning platforms: Reconstructing modern higher education. *International Journal of Emerging Technologies in Learning (iJET), 15*(13), 4-21. https://doi.org/10.3991/ijet.v15i13.14645

Lugrin, J-L., Latoschik, M.E., Habel, M., Roth, D., Seufert, C., & Grafe, S. (2016). Breaking bad behaviors: A new tool for learning classroom management using virtual reality. *Front. ICT, 3*(26). https://doi.org/10.3389/fict.2016.00026

Martin, F., & Parker, M.A. (2014). Use of synchronous virtual classrooms: Why, Who, and How? *MERLOT Journal of Online Learning and Teaching, 10*(2), 192-210.

McClain, C., Brown, A., & Price, G. (2015). Characterization personified: using Edmodo to strengthen student interaction with literature. *Meridian, 18*, 1-19.

McLean, K., Edwards, S., & Morris, H. (2017). Community playgroup social media and parental learning about young children's play. *Computers & Education, 115,* 201-210. https://doi.org/10.1016/j.compedu.2017.08.004

McSweeney, D. (2010). A framework for the comparison of virtual classroom systems. *NAIRTL/ LIN Conference on Flexible Learning at the Royal College of Surgeons. Dublin, Ireland.*

Miles, M. B., & Huberman, A. M. (2015). *The qualitative researcher's companion*. Sage Publishing.

Nee, C. K. (2014). The effect of educational networking on students' performance in Biology." International *Journal on Integrating Technology in Education (IJITE) 3*(1): 21–41. https://doi.org/10.5121/ijite.2014.3102

Porcel, C., Ching López, A., Lefranc, G., Loia, V., & Herrera Viedma, E. (2018). Sharing notes: An academic social network based on a personalized fuzzy linguistic recommender system. *Engineering Applications of Artificial Intelligence, 75*, 1-10. https://doi.org/10.1016/j.engappai.2018.07.007

Reiners, G. M. (2012). Understanding the differences between Husserl's (descriptive) and Heidegger's (interpretive) phenomenological research. *Journal of Nursing & Care, 1*(119). https://doi.org/10.4172/2167-1168.1000119

Rogers, A. (2011). Using Edmodo to extend literacy learning: Grade 6 novel study. *Learning, Literacies, & Libraries, 4*(1), 28.

Rufai, M. M., Alebiosu, S. O., & Adeakin, O.A.S. (2015). Conceptual model for virtual classroom management. *International Journal of Computer Science, Engineering and Information Technology (IJCSEIT), 5*(1), 27-32. https://doi.org/10.5121/ijcseit.2015.5103

Sarrab, M., Elbasir, M., & Alnaeli, S. (2016). Towards a quality model of technical aspects for mobile learning services: An empirical investigation. *Computers in Human Behavior, 55*, 100-112. https://doi.org/10.1016/j.chb.2015.09.003

Stemler, S. (2000). An Overview of Content Analysis. *Practical Assessment, Research & Evaluation, 7*(1), 17. https://doi.org/ 10.7275/z6fm-2e34

Taşgın, A., & Küçükoğlu, A. (2016). Klinik uygulamaların öğretmen adaylarının öğretmen özyeterlik algılarına etkisi [The effect of clinical practice on teacher candidates' self-efficacy perceptions]. Çukurova Üniversitesi *Eğitim Fakültesi Dergisi, 45*(2), 265.

Trust, T. (2017). Motivation, empowerment, and innovation: Teachers' beliefs about how participating in the Edmodo math subject community shapes teaching and learning. *Journal of Research on Technology in Education, 49*(1-2), 16-30. https://doi.org/10.1080/15391523.2017.1291317

Willmann, R., Zebedin, G., & Miksche, D. (2020). Technical setup of an inverted virtual classroom. *2020 IEEE Global Engineering Education Conference (EDUCON), pp. 931-936, Porto, Portugal.*

Yaylak, E. (2020). Attitudes of pre-service teachers for edmodo use in education. *Eurasian Journal of Teacher Education, 1*(2), 113-128.

Yıldırım, A., & Şimşek, H. (2011). *Sosyal bilimlerde nitel araştırma yöntemleri (Qualitative research methods in the social sciences)*. Ankara: Seçkin Yayıncılık.

Yünkül, E., & S. Çankaya. (2017). Students' attitudes towards Edmodo, a social learning network: A scale development study. *Turkish Online Journal of Distance Education-TOJDE 18*(2), 16–29. https://doi.org/10.17718/tojde.306554

CHAPTER 8

THE IMPACT OF SOCIOECONOMIC STATUS AND PARENTAL INVOLVEMENT IN HOME LEARNING ACTIVITIES ON LANGUAGE AND LITERACY SKILLS AND SOCIAL DEVELOPMENT OF CHILDREN

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Introduction

Theorists and researchers have argued that socioeconomic status (SES) can present parents with advantages and disadvantages to encourage and motivate their children to learn, and that these SES-related advantages and disadvantages impact children's abilities and skills. The present study utilized data from the Millennium Cohort Study with national longitudinal samples. The research investigated the association between socioeconomic status and parental involvement in home learning activities of their children as well as their impact on language and literacy skills and social-emotional development of children. Regardless of socio-economic status, the findings consistently displayed that parents were almost equally involved and engaged in various home learning activities, except for reading. In the present study, socioeconomic-cultural factors such as family income and maternal educational level and qualifications were examined and it was found that family income and maternal educational level and qualifications had a stronger influence on language and literacy skills of children compared to social-emotional ability. It was also discovered that especially lower maternal education level or lack of maternal educational qualifications as socioeconomic cultural disadvantages emerged as strong factors affecting the abilities of children aged three and at the start of primary school. Such findings gained even more significance as the economic, social and cultural inequalities and gaps among people of lower, middle or upper SES groups or social classes increased worries and concerns related to equal opportunities in education.

Theorists and researchers refer to a connection between poverty and cognitive abilities and social-emotional development of children, and deliberate on the impact of poverty on both cognitive abilities of children and their social-emotional abilities (Mayer, 2002; Gershoff, Aber & Raver, 2003; Dahl & Lochner, 2005). It was claimed that enhances in family income, especially in poor families, had a positive influence on children (Costello, Compton, Keeler & Angold, 2003; Morris & Gennetian, 2003; Gershoff, Aber, Raver, & Lennon, 2007). Researchers exposed connections between poverty and behavioral outcomes of children (Dearing, McCartney, & Taylor, 2001) and discovered that SES-related risk factors were more strongly related to long-term cognitive and language development of children compared to their social-emotional development (Duncan & Brooks-Gunn, 1997; Duncan, Yeung, Brooks-Gunn, & Smith, 1998; Aber, Jones, & Cohen, 2000). It was asserted that poverty had negative effects both on the psychological and emotional well-being of parents and on socialization, education and child-rearing practices in the family. It was emphasized that the negative impacts of poverty, especially on the cognitive skills of children younger than 5 years, were more evident and

stronger and were associated with behavioral difficulties (Bor, Najman, Andersen, O'Callaghan, Williams, & Behrens, 1997). It was also stated that poor home learning environments most likely affected cognitive skills and language development of children (Feinstein, 2003).

The family investment model explains the effects of socioeconomic-cultural disadvantages on cognitive and social-emotional development of children via parents' decisions about how to allocate and spend a variety of resources, such as money, time and energy (Foster, Lambert, Abbot-Shim, McCarty, & Franze, 2005). Parents spend and invest not only money but also time in education of their children. While they purchase books, toys and the like for learning and education of their children, they spend time doing joint activities with them such as reading books, telling stories, singing songs and reciting short poems. It was stressed that such parental investments by spending both money and time on their children's education had the potential to encourage, nurture, develop cognitive skills and language development of children (Gershoff et al., 2007) and increased their emergent literacy (Dickinson & Tabors, 2001). The investment model often elucidates the connection between family income and cognitive and linguistic development of children. The family stress model, on the other hand, defines the connection between socioeconomic disadvantage and behavioral functioning of children via the influence of poverty on parental skills and capabilities (Foster et al., 2005) and this impact has been found to be modest (Linver, Brooks-Gunn, & Kohen, 2002).

Studies revealed that parents' spending and investing both money and time in their children's home learning was associated with early linguistic and cognitive development of children as well as their emergent literacy (Whitehurst, Zevenberger, Crone, Schultz, Velting, & Fishcer, 1999), which were indicators of school success, particularly in reading (Dickinson & Tabors, 2001). Parents who were engaged with and involved in their pre-school children in literacy-rich environments and age-appropriate learning opportunities with books and other printed materials available and accessible at home contributed positively not only to children's literacy and language development (Raz & Bryant, 1990) but also to their emotional and behavioral regulation (Brinton & Fujiki, 1993). Parents engaged their children in not only teaching reading but also a variety of activities and practices such as teaching the alphabet, letters, syllables, words and numbers (Parker, Boak, Griffin, Ripple, & Peay, 1999), telling stories (Watson, 2002), reciting short poems and singing songs (Baker, Serpell, & Sonnenschein, 1995). Opportunities to access to and benefit from the increased human capital, financial resources and services accumulated through educational levels and qualifications affected not only the relationship, interaction and communication between parents

and children but also the type of activities and practices they promoted. This human capital, or social and cultural capital, that accumulated and increased through educational level and qualifications was able to determine the parental values, attitudes, beliefs about the learning they promoted, as well as their views on child development and capabilities they wished to develop and enhance in their children (Hoff, Laursen, & Tardiff, 2002). Maternal educational level and qualifications were found to be associated with access to financial resources (Duncan & Magusson, 2002) and human capital, or social and cultural capital (Hoff et al., 2002). Also, it was emphasized that literacy competence of children was strongly associated with parental education. Children of parents who had reading difficulties were exposed to a greater risk for literacy difficulties (National Institute for Literacy 1997).

Studies indicated the benefits of parental involvement in home learning and discussed its effectiveness especially in terms of learning activities such as homework, which were directly related to school (Hill & Taylor, 2004; Dearing, Kreider, Simpkins, & Weiss, 2006). Although home learning activities initiated by parents were not directly associated with school that encouraged, nurtured, enhanced and promoted children's overall cognitive and intellectual development, it was shown that these activities were associated with school success (Dickinson & Tabors, 2001) and that helping with homework positively impacted and benefited children's academic achievement. A number of studies on families from diverse SES backgrounds revealed that parental involvement in homework was related to poor performance in school (Cooper, Lindsay, & Nye, 2000). Parents were often able to assist their children with homework by increasing their involvement on account of and in response to their poor school performance. Discussions about the effectiveness of parental involvement in home learning underlined that parental involvement in home learning of children, particularly in low-income families, could benefit children and enhance learning (Ritblatt, Beatty, Cronan, & Ochoa, 2002).

Discussions about the effectiveness of home learning (Dearing et al., 2006) evoked the need to explore the influence of parental involvement in various learning activities related to literacy skills and social competence of children in families from diverse SES backgrounds or social classes. The association between home learning and social adjustment of children in particular has been relatively less studied in young children (Pomerantz, Ng, & Wang, 2006). Considering that the impacts of socio-economic and cultural disadvantages were stronger in early childhood (Yeung, Linver, & Brooks-Gunn, 2002) and were associated with adjustment problems in later life (Tremblay, 2000), parental involvement at home became important for children's learning and behavioral regulation. Also, there are few studies using a nationally representative sample on the effect of socioeconomic-

cultural factors and parental involvement at home on language/literacy and social-emotional skills of young children before and at the end of the first year of primary school. Investigating parental involvement in children's home learning before and after formal schooling required a focus on parental support for homework as a response to school demands of children. On the other hand, it called for more active parental support, such as reading books, telling stories, reciting short poems, singing songs and playing music to prepare them for formal education and enrich their lives. It was emphasized that the time parents spared for and spend with their children playing or doing homework had enhanced significantly over the years (Gershuny, 2000). It was also pointed out that the frequency with which parents from diverse SES groups engaged in their pre-school children could positively impact cognitive and language development of children as well as their literacy.

The aim of the present study is to investigate not only the association between parents' socioeconomic-cultural factors and home learning at the ages of three and five, but also their effects on language and literacy skills and socio-emotional competence development of children at the end of the first year of primary school. It was emphasized that family income and maternal educational level and qualifications are the main SES indicators in the society and that the income level in the family could vary temporarily, while the maternal educational level and qualifications might vary less over time (McLoyd, 1989). It was also indicated that some families with income below the poverty line and parents with some educational qualifications could be more successful in achieving the goals they had set (Gershoff et al., 2003).

The present study has sought to answer the following guiding research questions:

(1) Do parents differ in their involvement and engagement with home learning activities for their children at age three before of formal schooling and at age five after the start of formal schooling as a function of socioeconomic-cultural factors such as family income, maternal educational level and qualifications?

(2) What are the impacts of socioeconomic-cultural factors and the frequency of home learning activities such as homework, enrichment activities, emergent literacy activities on the development of language and literacy skills and social competence in children as measured and evaluated by teachers at the end of the first year at school?

(3) Are family income and maternal educational levels and qualifications related to a differential change in language and literacy skills and social-emotional competence of children?

Methods

Participants

The present research utilized data from the Millennium Cohort Study (MCS), a national longitudinal birth cohort study that offers large-scale information about children born at the turn of the century and their families. The first sweep of the study was carried out in 2001-2002 and included approximately 19000 children from ages 9-11 months. The second and third sweeps of the study were carried out when the children reached the ages of three and five, respectively, and between 78% and 79% of subjects including the initial target sample responded and the data obtained was used in the study. Only one child from twin or triplet births was included and the working sample used for this study was composed of 15,600 singleton cohort children and their parents. Interviews with parents were conducted when the child in the cohort was three and five years old, and teacher questionnaire assessments were recorded at the end of the first school year. The Millennium Cohort Study sample mostly consisted of families with high levels of child poverty as well families from minority ethnic backgrounds. As for the Index of Deprivation 2000, data were collected from regions with families living in poverty. Complete details related to the origins and objectives of the Millennium Cohort Study can be obtained from the UK Data Archive at Essex University.

Measures

Three sets of measures utilized for this research include: (1) socioeconomic-cultural factor, (2) home learning, and (3) Foundation Stage Profile (FSP). Data related to the socioeconomic-cultural factors and home learning measures were obtained from face-to-face interviews with parents when their children reached three and five years of age. On the other hand, data related to Foundation Stage Profile measures were obtained from teacher assessments of child performance. Teachers assessed children's social and academic progress based on continuous observation during the first grade of primary school. The Millennium Cohort Study data were linked to Foundation Stage Profile data obtained during the academic year 2005-2006.

The socioeconomic measures used in the study included family income below the poverty line and maternal educational qualifications, ranging from no qualifications to qualifications at a degree or vocational equivalent level. Equivalence scales produced by the Organization for Economic Cooperation and Development, and adjusted for age and the number of family members were utilized for family income data. Maternal educational qualifications were classified into five levels equivalent and corresponding to the National Vocational Qualification (NVQ) scale (See Table 1).

While home learning included emergent literacy activities such as learning the alphabet, singing songs/rhymes, reading books at age three, it involved parental support with homework such as help with reading and writing and enrichment activities such as reading books, playing music, telling stories at age five. Data related to learning activities and practices at home were collected during parent interviews and the responses were assessed using a Likert scale, ranging from 'every day' to 'not at all'.

Foundation Stage Profile was obtained through teachers' ratings of children's personal, social and emotional development as well as their communication, language and literacy skills. Children's personal, social and emotional aspects included their dispositions and attitudes as well as their social and emotional development. The development of children's communication, language and literacy competence required not only speaking and language skills for communication and thinking, but also linking sounds and letters as well as reading and writing. Scores for personal, social and emotional development ranged between 3 to 27 with an arithmetic mean of M = 21.11 and a standard deviation of SD = 4.2, while scores for communication, language and literacy skills development ranged between 4 to 36, with an arithmetic mean of M = 25.36 and a standard deviation of SD = 6.9. Sample size of the survey was N = 8407. The first three points refer to children still progressing towards the achievements specified in the early learning objectives and guidance for the Foundation Stage (Qualifications and Curriculum Authority, 2000). The next five points were actually taken from the learning objectives and displayed in an approximate order of difficulty.

Final scores on each scale described children who managed to obtain all scores from one to eight on the scale, developed further and worked steadily beyond the level of their early learning objectives. Compared to standardized tests, it was asserted that the Foundation Stage Profile was developed for the purpose of providing a more developmentally appropriate description and picture of children's cognitive, linguistic, literacy, academic, and social progress within the school context (Qualifications and Curriculum Authority, 2000).

Table 1 Frequency of family income and educational qualifications as indicators of socioeconomic status

	Second survey at age 3	Third survey at age 5
Family Income		
Above the poverty line	% 61,7	% 64,1
Below the poverty line	% 24,2	% 26,8
Missing	-% 14	% 9,1
Educational Qualifications		

National Vocational Qualification 1	% 7,5	% 7,1
National Vocational Qualification 2	% 28,6	% 27,4
National Vocational Qualification 3	% 15,4	% 15,4
National Vocational Qualification 4	% 31,4	% 29,5
National Vocational Qualification 5	% 4,3	% 8,5
No National Vocational Qualification	% 10,4	% 9,7

Sample size in the first and the second surveys, N = 12204 (Hartas, 2011, p. 897)

Results

A one-way analysis of variance (ANOVA) was carried out as a means to investigate the main impacts of home learning activities at the ages of three and five, and socioeconomic-cultural factors such as family income and maternal education level and qualifications on both children's communication, language and literacy competence and their personal, social and emotional development. Descriptive statistics provided information about the frequency and rate of parental involvement and engagement with home learning activities with their children. Chi-square tests explored and revealed differences in the frequency or rate of parental involvement and engagement with home learning activities across different SES backgrounds.

Socioeconomic-Cultural Factors and Parental Involvement and Engagement with Home Learning

Generally, it was found that parents across different SES groups displayed small differences in parents' helping their children with homework such as writing, teaching the alphabet, songs and short poems, telling stories and playing music. Parents seemed to differ little in their involvement and engagement with these home learning activities across family income and educational level and qualifications as the main indicators of SES groups (See Tables 2, 3 and 4).

Table 2 Percentages of parental involvement and engagement with home learning activities for their three-year-olds across family income and educational qualifications as main indicators of socio-economic status

		Reading			Alphabet			Songs and short poems		
		Every day	Once or several times a week	Less frequent	Every day	Once or several times a week	Less frequent	Every day	Once or several times a week	Less frequent
Family Income										
Above the poverty line	%	65,8	30	3	24,8	59,7	15,5	58	38,5	3,5
Below the poverty line	%	45,4	41,6	7,5	23,7	61,9	14,4	53,2	42,2	4,6
Maternal Educational Level and Qualification										
National Vocational Qualification 1	%	44,1	44,1	8,5	25	61,2	14,8	54,2	41,5	4,3
National Vocational Qualification 2	%	54,5	38,7	5,1	23,6	60,2	16,2	55,8	39,8	4,4
National Vocational Qualification 3	%	63,4	31,8	4	25	60,5	14,4	58,6	38,3	3,2
National Vocational Qualification 4	%	72,9	25,1	1,6	25,2	59,7	15,1	60,1	36,8	3,2
National Vocational Qualification 5	%	78,8	19,4	1,5	22,2	59,9	17,8	56,5	40,4	3,1
No National Vocational Qualification	%	33,1	44,6	9	22,4	63,1	14,4	47,3	47,5	5,1

(Hartas, 2011, p. 899)

It was discovered that parents displayed significant differences in a modest manner regarding reading to children at three and helping with reading at five. While the percentage of less wealthy parents who read to their children and helped them with homework in reading every day was 45.4% at age three, it was 45.2% to 56.2% at five. As for the parents above the poverty line, 65.8 % read to their children and helped them with homework in reading every day at age three and this percentage was 61.2% at five. While the percentage of mothers without any educational qualifications who read to their children and helped them with homework in reading every day was 33.1% at age three and 37.8 and 55% at five, the percentage of mothers educated at a degree was 78.8% at age three, and 54.1 and 61.2% at five.

Across different SES groups, more than three-quarters of parents were involved and engaged in their children's home learning activities daily or several times a week. A small percentage of parents were less or not engaged in home learning activities.

Table 3 Percentages of parental involvement and engagement in home learning activities for their five-year-olds across family income and educational levels or qualifications as main indicators of socioeconomic status

		Reading			Telling stories			Music		
		Every day	Once or several times a week	Less frequent	Every day	Once or several times a week	Less frequent	Every day	Once or several times a week	Less frequent
Family Income										
Above the poverty line	%	54,1	41,9	2,3	12,1	43,8	17,7	35,9	51,4	5,2
Below the poverty line	%	45,2	45,9	3,5	14,9	43,0	12,6	40,6	44,4	9,8
Maternal Educational Level and Qualification										
National Vocational Qualification 1	%	43,3	49,8	3,1	10,6	41,3	14,8	36,5	49,0	6,6
National Vocational Qualification 2	%	47,4	46,9	3,4	12,5	42,4	15	38,3	49,5	6,3
National Vocational Qualification 3	%	52,4	52,9	2,9	14,7	44,4	15	39,2	48,1	6,7
National Vocational Qualification 4	%	59,6	38,2	1,5	13,1	45,1	18,6	36,6	51,3	7,4
National Vocational Qualification 5	%	60,7	35,7	2,1	15,1	46,6	17,1	37,1	50,5	7,3
No National Vocational Qualification	%	37,8	46,4	3,5	13,8	40	12,4	35,4	42,3	6

(Hartas, 2011, p. 899)

Table 4 Percentages of parents helping with homework for their five-year-olds across family income and educational levels or qualifications as main indicators of socio-economic status

		Help with reading			Help with writing		
		Every day	Once or many several a week	Less frequent	Every day	Once or many several a week	Less frequent
Family Income							
Above the poverty line	%	61,2	38,2	0,4	30,4	65,8	2,4
Below the poverty line	%	56,2	22,7	0,6	38,1	58,6	2,1
Maternal Educational Level and Qualification							
National Vocational Qualification 1	%	52,7	46,5	0,6	33,2	62,8	1,8
National Vocational Qualification 2	%	58,9	40,4	0,3	34,5	61,9	2
National Vocational Qualification 3	%	62,2	37,1	0,6	37,1	59,5	2,2
National Vocational Qualification 4	%	63,2	36,4	0,3	28,9	67,3	2,5
National Vocational Qualification 5	%	61,6	38,4	0,6	31,7	63	3,7
No National Vocational Qualification	%	55	43,7	0,8	37	60	1,7

(Hartas, 2011, p. 900)

These results seemed to be consistent with findings obtained from previous studies. Previous research revealed that approximately 70% of parents helped their children at least once a week, irrespective of socioeconomic status or social class, educational level, educational attainment, and ethnicity (US Department of Education, 2006). Activities such as reading books and learning songs and short poems were directly linked to school. Over half of all parents read to their three- to five-year-old children every day and provided help for five-year-olds with their reading homework. A very small percentage of parents were less often involved in reading, or were not involved and engaged at all.

Impact of Socioeconomic Status and Home Learning Activities on Cognitive and Social Outcomes of Children

As main indicators of socioeconomic status, the impacts of family income, maternal educational level and qualifications, and home learning activities on language and literacy communication skills of children as well as their personal, social and emotional development were investigated in the context of Foundation Stage Profile measures. Analyzes revealed the main impacts of not only family income and maternal educational level or qualifications but also the frequency of home learning activities (See Tables 5 and 6).

Table 5 Mean (*M*), Standard Deviation (*SD*), *F* for Main Impacts of Reading on Language and Literacy Communication Skills, and Personal, Social and Emotional Development

		Every day		Several times a week		Once or twice a week		*F, P*	Cohen's *d*
		M	*SD*	*M*	*SD*	*M*	*SD*		
Communication, Language and Literacy Skills	Reading to children at age 5	25,66	6,9	24,54	7,0	23,57	6,8	50,65***	.30
	Reading to children at age 3	26,35	6,6	24,50	6,9	22,92	7,1	138,83***	.50
	Helping children with homework in reading at age 5	25,44	6,9	24,81	6,9	22,13	7	88,85***	.47
Personal, Social and Emotional Development	Reading to children at age 5	21,16	4,2	20,73	4,3	20,43	4,3	16,97***	.17
	Reading to children at age 3	21,55	4,0	20,69	4,4	20,06	4,5	66,61***	.34
	Helping children with homework in reading at age 5	21,11	4,2	20,82	4,3	19,86	4,5	32,90***	.28

N = 7095–8398; ****p* < .000 (Hartas, 2011, p. 900)

The main impacts of the frequency of home learning activities on child consequences were found to be insignificant for all learning activities except for reading to child at age three and five and providing support for

homework in reading at age five (See Table 5). These outcomes displayed that the frequency of home learning activities such as providing aid for learning alphabet and writing, telling stories singing songs and short poems and playing music affected neither language and literacy skills of children nor their social-emotional development. Parental engagement in these activities every day or once or twice a week did not necessarily make any substantial distinction in communication, language and literacy skills of their children or their personal, social and emotional measures. Conversely, it was established that the frequency of parents' reading to their children and helping them with homework in reading generated a modest influence on communication, language and literacy skills of children and a weak/ modest impact on their personal, social and emotional development.

Also, socioeconomic status was found to have significant main impacts on children's foundation stage profile, both on language, literacy, communication skills, and on their personal, social and emotional development (See Table 6). Children of families living below the poverty line received a significantly lower rating from their teachers regarding language, literacy and communication skills, and personal, social and emotional development compared to their peers in wealthier families. The effect size was found to be moderate for language, literacy and communication skills (d =.57), and modest for personal, social and emotional development (d =.45). Furthermore, children who had educated mothers performed significantly better than children of mothers who lacked any educational qualifications in communication, language and literacy skills and in personal, social and emotional development.

Table 6 Mean (M), standard deviation (SD), F for the main impacts of socioeconomic status on personal, social and emotional development and language, literacy and communication skills

		Personal, Social and Emotional Development		*F*, Cohen's *d*	Communication, Language and Literacy Skills		*F*, Cohen's *d*
	N	*M*	*SD*		*M*	*SD*	
Educational Qualifications				88.19*, .709			171.34***, 1,08
National Vocational Qualification 1	712	19,70	4,76		22,38	7,28	
National Vocational Qualification 2	2472	20,56	4,33		24,33	6,98	
National Vocational Qualification 3	1170	21,10	4,05		25,37	6,59	
National Vocational Qualification 4	2205	22,04	3,90		27,28	6,21	
National Vocational Qualification 5	625	22,09	4,04		27,76	5,97	

No National Vocational Qualification	1171	18,99	4,67		20,61	7,22	
Family Income				1 8 5 . 9 2 * , .452			305.19***, .574
Above the poverty line		21,54	4,10		26,25	6,64	
Below the poverty line		19,57	4,60		22,26	7,24	

N = 8670–8671; **p* < .000 (Hartas, 2011, p. 901)

Group comparisons between mothers who had educational qualifications at a degree level corresponding to National Vocational Qualification 5 and those without any educational qualifications produced significant moderate effects on personal, social and emotional development (*d* =.70) and strong effects on language, literacy and communication skills (*d* = 1.08). The results consistently displayed that family income, and especially maternal educational level and qualifications, had an important and significant effect on both language and literacy skill scores of children and their social and emotional development scores. While family income seemed to have a moderate effect on communication, language and literacy skills of children, it had a modest effect on their personal, social and emotional development. Maternal educational level and qualifications, on the other hand, appeared to have a strong influence on the mothers' communication, language and literacy skills, and a moderate effect on their personal, social and emotional development.

Findings obtained from this study displayed that parents roughly differed regardless of socioeconomic status, in their frequent involvement and engagement with various home learning activities for their children other than reading. Although a large proportion of parents from different SES groups were involved and engaged in activities directly associated with school, such as learning the alphabet and writing, children's outcomes regarding literacy skills and social development at the end of the first school year differed based on their parental socioeconomic status. In addition, it was found that the frequency of parental involvement in home learning activities, such as every day, several times a week, once or twice a week, affected neither the language and literacy skills outcomes of the children nor their social development consequences. On the one hand, parental socioeconomic status or social class did not affect their support for learning of children through home learning activities, on the other hand, it was demonstrated that risk factors related to socioeconomic status or social class had a moderate to strong effect on language and literacy skills of children as well as their social development. These findings showed that there were large inequalities and gaps regarding language and literacy skills and social development outcomes between lower SES children and those from middle or upper SES groups. The research provided evidence that the existence of inequalities and gaps in language and literacy skills

and social development outcomes between lower SES children and their peers from middle or upper SES groups was independent of the frequency of parents' involvement and engagement with home learning.

Discussion

The level of parental involvement in home learning of children was specified as a risk factor stemming from socioeconomic status and accepted as a route that affects children's skills (Foster et al., 2005). The present study examined both the association between socioeconomic status of parents and home learning activities of children, as well as their influence on language and literacy skills and social development of children. Results obtained from the study were consistent and compatible with previous research findings. Previous research revealed that family income and maternal educational level and qualifications as main indicators of socioeconomic status produced moderate to strong impacts on language and literacy skills of children, and modest to moderate impacts on their social arrangement (Yeung et al., 2002; George, Hansen, & Schoon, 2007). Especially, it was shown that the children of educated mothers with a certain degree of education and a corresponding and equivalent occupation were on average about six months ahead in language and literacy development, when compared with the children of parents without any educational qualifications. Findings obtained from the present study displayed similarities and parallelism with those from earlier studies. Previous analyses of the Millennium Community Study revealed that three-year-olds in families with socioeconomic status disadvantage not only were less likely to demonstrate advanced cognitive skills but also had higher risks for externalized and internalized behavioral difficulties (Kiernan & Huerta, 2008).

Studies revealed that risk factors related to socio-economic status had a stronger influence on children's language and literacy development compared to their impact on children's social capability (Duncan & Brooks-Gunn, 1997; Yeung et al., 2002). It was also emphasized that SES-related factors produced different impacts. It was stated that while family income had a moderate effect on language and literacy development of children, it was asserted that maternal educational level and qualifications produced a strong influence on language and literacy development of children. It was reported that a similar pattern existed concerning children's social ability development. It was also indicated that family income had a modest influence on social ability development of children, whereas maternal educational level and qualifications produced a moderate effect on social ability development of children.

It was stated that the distinction between family income and maternal educational level and qualifications was crucial considering that their relationship was not routine and monotonous. Families with educated mothers seemed more likely to reach higher income levels. It was argued that in poor families, mothers with some education and educational qualifications might be more talented in accessing and using cognitively stimulating materials for their children, as well as support, experiences, activities, and services that assisted and contributed to cognitive development of their children. It was also emphasized that family income allowed parents to spend both money and time to provide or purchase educational resources and services for their children, and thus invest in education of their children. It was found that much of the effect of family income on cognitive and academic outcomes of children occurred through parents' investment in their children's education by spending time and money on educational resources and services, and that the influence of this family income on cognitive and academic outcomes of children was modest or moderate (Linver et al., 2002; Yeung et al., 2002).

Economic, social, cultural and human capital, and also possibilities of less educated mothers might be inadequate, limited and deficient in accessing and benefiting from educational resources and services effectively, and thus they might be in a disadvantaged position. It was discovered that the increase in income, especially in poor families, produced a positive impact on cognitive and academic development of children (Gershoff et al., 2007). Nevertheless, it was asserted that family income alone was not sufficient to reduce the negative impact of socioeconomic status on language and literacy skills and emotional-social development of children, or to reduce and eliminate SES-related inequalities and gaps in language and literacy skills and social-emotional development during childhood. Parents' educational level and their human capital or social and cultural capital level through access to education and training played an essential and significant role in not only learning process of children but also their language, literacy skills and social development.

Findings consistently displayed that parents from different SES groups were involved and engaged in their children equally frequently related to a variety of home learning activities such as learning the alphabet and writing other than reading. Differences in the frequency of reading books indicated that a lower percentage of mothers without any educational qualifications and those living below the poverty line read to their children frequently, which led to a negative influence on children's literacy, compared to more wealthier families. It was asserted that less educated mothers read to their children less frequently (Raikes, Pan, Luze, Tamis-LeMonda, Brooks-Gunn, Constantine, et al., 2006) and used less complex, less contextual,

less sophisticated language or speaking and literacy skills (Rowe, Pan, & Ayoub, 2005). It was also stressed that the verbal communication and interaction between less educated mothers and their children were both quantitatively and qualitatively lower (Hoff, 2003).

It was discovered that the differences in children's participation in reading might contribute modestly to the gap and inequalities observed in language and literacy scores of children from low SES families and those from middle or upper SES families. Reading was established as a determinant of language and emergent literacy and it promoted ability of children to understand and express language and language skills (Whitehurst et al., 1999). The present research revealed that children's participation in reading created a modest effect on their literacy, and that various learning activities such as learning the alphabet, reciting short poems, writing or telling stories might promote and improve children's language development and school readiness. Shared reading, which contributed to enhancing home literacy of children, played a significant role in encouraging, nurturing, developing and boosting vocabulary, phonemic skills, print concept knowledge of children as well as their positive attitudes towards literacy and performed an important function (Dickinson & Tabors, 2001; Rodriguez, Tamis-LeMonda, Spellmann, Pan, Raikes, Lugo-Gil et al., 2009). The relationship between reading and positive literacy outcomes of children revealed that reading alone could create a specific effect. Parents tried to help their children learn to read by initiating reading activities and practices, Parents read books to their children, provided modeled reading, and encouraged and supported their reading. Reading activities and practices served to enhance a variety of skills in children, such as phonics, verbal language, and listening-comprehension.

The research pointed to a broader trend in parenting culture in terms of socializing, educating and childrearing over the past 30 years, and showed that parents were increasingly involved and engaged with their children's learning (Gershuny, 2000). Findings obtained from the present study supported this trend and displayed that many parents, regardless of socioeconomic status, were involved and engaged in their children's home learning every day or at least once a week. On the other hand, it was reported that the effect of parental involvement and engagement in home learning of children was modest, and it was asserted that the frequency of home learning activities, other than reading, did not create much effect on the literacy skills and social abilities of young children. These findings implied that what parents from different socioeconomic status groups routinely do with their children did not cut down the inequalities and gaps in both language and literacy skills and social development observed between low socioeconomic status children and their middle or upper socioeconomic status peers. It was asserted that the disadvantages stemming from

socioeconomic status, especially lack of educational qualifications of the mother, emerged as a strong factor in influencing children's abilities at the beginning of primary school.

Many studies reported that parental involvement in children's home learning not only improved children's skills such as language, speaking, organizing, planning and monitoring, but also increased their academic and learning interest and enabled them to make connections between curriculum topics and daily experiences. Parental involvement was also able to pave the way for children to develop attitudes and behaviors towards learning, thus made a positive contribution to their cognitive language and literacy development (Hoff et al., 2002). Nevertheless, it was stated that parental involvement in children's home learning relied on the conditions related to socioeconomic status. It was also established that parents, with their monetary and non-monetary strength and capacity, spent and invested both money and time to access educational services and resources to promote children's learning. It was emphasized that education of parents as one of the main indicators of socioeconomic status and human capital as knowledge, skills, values and attitudes acquired through formal education had an impact on parental behavior and parenting practices related to socializing, educating and childrearing. It was asserted that educated mothers were able to interact and communicate with their children in loving, warm, responsive and supportive ways, and became more tenacious and talented in coping with and overcoming economic hardships and troubles.

As indicated by the findings obtained from this study, frequency of parental involvement in home learning of children was not enough by itself to reduce or eliminate the observed inequalities and gaps in cognitive development, linguistic and literacy skills, and social development between children from low socioeconomic status and those from middle or upper socioeconomic status. It was seen that frequent parental involvement with home learning alone could not offset the influence of the socio-economic gap on child consequences stemming from SES-related disadvantages. It was asserted that it was too simplistic and potentially misleading to approach parental involvement as a panacea and a cure-all medicine to offset, eliminate, and restore the negative and detrimental impacts of SES-related inequalities and disadvantages arising from low socioeconomic status. Irrespective of parents' socioeconomic-cultural conditions, it was indicated that an idealized parenting style that they did to their children in order to develop and enhance them cognitively, intellectually, academically and educationally, and to ensure their social-emotional well-being was a key determinant. Debates to hold parents accountable for children's cognitive, intellectual, educational, academic, and social difficulties and make a moral evaluation centered around whether parents had real possibilities and opportunities to educate, socialize, and rear their children,

or whether they had economic capital and resources and human or social, cultural capital and resources. Debates on both the consequences of social inequalities or the inequalities and gaps related to growing socioeconomic status and lack of social mobility for cognitive, intellectual, academic, educational, and social-emotional development of children discussed how effective parental involvement could be and how it could fulfill a positive function in decreasing and eliminating the negative and detrimental impacts of disadvantages arising from social class or socioeconomic status.

This research depended on and utilized data from the Millennium Cohort Study (MCS), a national longitudinal birth cohort study conducted at the beginning of the 2000's on approximately 19000 children and their parents to investigate the influence of socioeconomic status and parental involvement in home learning on cognitive development, language and literacy skills and social development of children. The Millennium Cohort Study has paved the way for the expansion and replication of other studies with rather smaller samples. It is thought that the strength of the present research lies in the fact that it is based on and uses data from the Millennium Cohort Study. This study utilized longitudinal rather than cross-sectional measures to explore parental involvement in home learning at ages three and five. The present research explored parental involvement as both a dynamic action in children's education and a response to school aspirations. Research addressed and focused on the function and role of parental involvement and engagement in enriching children's lives educationally, culturally and socially as well as increasing their school readiness significantly.

The study had certain limitations, one of which was dependence on parent's reports to obtain measures related to parents' socioeconomic status indicators and the frequency of home learning activities. Nevertheless, teachers tried to conduct objective assessments of both measures of children's language and literacy, such as language, literacy and communication, skills, and measures of children's social-emotional skills, such as personal, social and emotional development in accordance with children's Fundamental Stage Profile. Children's home learning was assessed by measuring their continuous participation in routine literacy activities and determining the frequency of time spent with them. It was emphasized in the study that it was not possible to make a comparison between involved and non-involved parents regarding various learning activities owing to the low number of non-involved parents who rated and reported their involvement as "less often" or "not at all". In the future, further research is needed to examine the relationship, interaction and communication dynamics between parents and children that enhance and enable or restrain the benefits of home learning in families, and to throw light on "how" parents reinforce children's learning at home.

Conclusion and Implications

Findings obtained from this study showed that family socioeconomic status was of great importance for cognitive, linguistic, literacy, and social outcomes of children. It was discovered that although the majority of parents from low, middle or upper socioeconomic status backgrounds were often able to spend and invest time and money in their children's home learning, children living in poverty and children of mothers who had no educational qualifications performed less well in their cognitive, linguistic and literacy skills and social development compared to their peers in economically better-off families and had a certain level of education and educational qualifications. In this study, frequent home learning activities by parents alone could not reduce or eliminate the inequalities and gaps observed in cognitive, linguistic, literacy and social skills between children from lower socioeconomic status and those from middle or upper socioeconomic status. Negative and detrimental effects of SES-related disadvantages on children's cognitive development, linguistic and literacy skills, and social development continued to persist. SES inequalities and gaps were clearly observed in children's scores related to cognitive development, linguistic and literacy skills, and social development. It was discovered that the frequency of parental involvement in home learning could not offset and compensate for the disadvantages arising from the socioeconomic status of families at school entry. On the other hand, it was emphasized that the impacts of home learning activities on cognitive, linguistic, literacy and social development of children might take time to produce observable consequences. A study revealed that parental involvement at home to support learning of children at ages three and four was significantly linked to greater reading and math success at age 12 (Reynolds, Mavrogenes, Bezruczko, & Hagemann, 2008). It was indicated that rather than having a direct effect on specific academic areas, home learning activities and practices could encourage and promote more general and motivational experiences in children. It was also found that home learning activities contributed to children's understanding and internalizing the value of learning and parents' educational expectations with regard to academic achievement and awareness of the connections between learning at home and learning at school (Melhuish, Phan, Sylva, Sammons, Siraj-Blatchford, & Taggart, 2008). The effectiveness of home learning rested on the ability of parents to have access to economic, social, cultural or human capital and resources. Parents spent and invested both time and money for learning and education of their children. Parents' financial and educational, intellectual resources as well as parental capital could determine the effectiveness of home learning. As parents mobilized, used and spent their financial resources and capital on the one hand and their educational and intellectual resources and capital as knowledge and skills on the other

hand, effectiveness and efficiency of home learning on children was most likely to increase. Parents who had the financial, social, cultural, or human capital and resources to maximize their children's learning experience and who were financially and educationally well equipped worked and strived to motivate, stimulate and encourage their children to learn effectively at home. In families experiencing disadvantages arising from socioeconomic status, the effectiveness of learning activities and educational experiences at home could be jeopardized owing to inaccessibility or limited access to educational resources and services.

Interventions designed to promote parental involvement should improve the positive strength and function of families and center on the ways parents relate, interact and communicate with their children. Income should be increased in poor families. Educational opportunities should be provided for parents who are illiterate or lack necessary educational qualifications to enhance their literacy, social, cultural, human and financial capital. The government, the Ministry of Education, and universities should seek assistance from experts such as educators, psychologists, and sociologists to provide parents with theoretically oriented materials and activities and present information and enlighten them on issues such as providing cognitively stimulating materials and activities, and engaging them in literacy-based activities such as reading as well as educationally enriching activities such as museum visits and music effectively. Experts should explain to parents from different SES groups how they could support learning and social development of their children. The frequency of parental involvement in home learning can transform learning into a routine activity. The quality of parent-child relationship, verbal interaction and communication, and the proximity and harmony between family and school cultures played an important and significant role in turning home learning into an effective activity. Family literacy programs should aim to support parents in terms of educating and equipping them with knowledge and skills as well as expanding their human, social and cultural capital in order to teach, communicate and transfer certain literacy or numeracy skills to their children. These programs and interventions should be undertaken with the aim of reducing or offsetting the negative and detrimental impacts of poverty on the cognitive, behavioral and social development of children, on the one hand, and solving the problems encountered by families living in poverty and responding to their needs, on the other hand. Such programs and interventions should concentrate on parental practices such as socializing, educating and rearing children to promote their abilities and skills at school entry and beyond, and also include economic, social and cultural measures aimed at protecting children from detrimental effects of poverty.

REFERENCES

Aber, J. L., Jones, S. M. & Cohen, J. (2000). The impact of poverty on the mental health and *development of very young children*, in: C. H. Zeanah Jr. (Ed.) *Handbook of infant mental* health (2nd ed.) (New York, Guilford Press), 113-128.

Baker, L., Serpell, R. & Sonnenschein, S. (1995). Opportunities for literacy learning in the homes of urban preschoolers, in: L. Morrow (Ed.) *Family literacy: connections in schools and communities* (Newark, International Reading Association), 65-98.

Bor, W., Najman, J. M., Andersen, M. J., O'Callaghan, M., Williams, G. M. & Behrens, B. C. (1997). The relationship between low family income and psychological disturbance in young children: an Australian longitudinal study, *Australian and New Zealand Journal of Psychiatry 31*, 664-675.

Brinton, B. & Fujiki, M. (1993). Language, social skills and socio-emotional behaviour. Clinical forum: language and social skills in the school age population, *Language, Speech and Hearing Services in Schools 24*, 194-198.

Cooper, H., Lindsay, J. J. & Nye, B. (2000). Homework in the home: how student, family and parenting-style differences relate to the homework process, *Contemporary Educational Psychology 25*, 464-487.

Costello, E. J., Compton, S. N., Keeler, G. & Angold, A. (2003). Relationships between poverty and psychopathology: a natural experiment, *Journal of the American Medical Association 290*, 2023-2029.

Dahl, G. B., & Lochner, L. (2005). The impact of family income on child achievement https://www.nber.org/system/files/working_papers/w11279/w11279.pdf

Dearing, E., McCartney, K. & Taylor, B. A. (2001). Change in family income-to-needs matters more for children with less, *Child Development 72*, 1779-1793.

Dearing, E., Kreider, H., Simpkins, S. & Weiss, H. B. (2006). Family involvement in school and low-income children's literacy: longitudinal associations between and within families, *Journal of Educational Psychology 98*, 653-664.

Dickinson, D. K. & Tabors, P. (2001). *Beginning literacy with language* (Baltimore, MD, Paul H. Brooks).

Duncan, G. & Brooks-Gunn, J. (Eds) (1997). *Consequences of growing up poor* (New York, Russell Sage Foundation).

Duncan, G., Yeung, W., Brooks-Gunn, J. & Smith, R. (1998). How much childhood poverty affect the life chances of children? *American Sociological Review 63*, 406-423.

Duncan, G. J., & Magnusson, K. A. (2002). Off with Hollingshead socio-economic resources, parenting and child development, in: M. H. Bornstein & R.

H. Bradley (Eds) *Socio-economic status, parenting and child development* (Mahwah, NJ, Lawrence Erlbaum), 189-207.

Feinstein, L. (2003). Inequality in the early cognitive development of British children in the 1970 cohort, *Economica 70*(277), 73-97.

Foster, M., Lambert, R., Abbot-Shim, M., McCarty, F. & Franze, S. (2005). A model of home learning environment and social risk factors in relation to children's emergent literacy and social outcomes, *Early Childhood Research Quarterly 20*, 13-36.

George, A., Hansen, K. & Schoon, I. (2007). Child behaviour and cognitive development, in: K. Hansen, K. and H. Joshi (Eds) *Millennium Cohort Study Second Survey: a user's guide to initial findings* (London, Centre for Longitudinal Studies, Institute of Education, University of London), 6-35.

Gershoff, E. T., Aber, J. L. & Raver, C. C. (2003). Child poverty in the United States: an evidencebased conceptual framework for programs and policies, in: F. Jacobs, D. Wertlieb, & R. M. Lerner (Eds) *Handbook of applied developmental science: promoting positive child, adolescent and family development through research, policies and programs* (vol. 2) (Thousand Oaks, CA, Sage), pp. 81-136.

Gershoff, E., Aber, J., Raver, C. & Lennon, M. (2007). Income is not enough: incorporating material hardship into models of income association with parenting and child development, *Child Development 78*(1), 70-95.

Gershuny, J. (2000). *Changing times: work and leisure in post-industrial society* (Oxford, Oxford University Press).

Hartas, D. (2011). Families' social backgrounds matter: socio-economic factors, home learning and young children's language, literacy and social outcomes, *British Educational Research Journal 37*(6) 893-914.

Hill, N. E. & Taylor, L. C. P. (2004). Parental school involvement and children's academic achievement: pragmatics and issues, *Current Directions in Psychological Science* 13, 161-164.

Hoff, E., Laursen, B. & Tardiff, T. (2002). Socioeconomic status and parenting, in: M. H. Bornstein (Ed.) *Handbook of parenting: biology and ecology of parenting* (vol. 2) (Washington DC: Psychology Press), 231-252).

Hoff, E. (2003) The specificity of environmental influence: socio-economic status affects early vocabulary development via maternal speech, *Child Development*, 74, 1368-1378.

Kiernan, K. E. & Huerta, M. C. (2008). Economic deprivation, maternal depression, parenting and cognitive and emotional development in early childhood. *British Journal of Sociology 59*(4), 783-806.

Linver, M., Brooks-Gunn, J., & Kohen, D. (2002). Family processes as pathways from income to young children' development, *Developmental Psychology*, *38*(5), 719-734.

Mayer, S. E. (2002). The influence of parental income on children's outcomes (Wellington, New Zealand, Knowledge Management Group, Ministry of Social Development). https://msd.govt.nz/documents/about-msd-and-our-work/publications resources/research/influence-parental-income/influence-of-parental-income.pdf

McLoyd, V. (1989). Socialisation and development in a changing community: the effects of paternal job and income loss on children, *American Psychologist 44*, 293-302.

Melhuish, E., Phan, M., Sylva, C., Sammons, P., Siraj-Blatchford, I. & Taggart, B. (2008). Effects of home learning environment and pre-school centre experience upon literacy and numeracy development in early years, *Journal of Social Issues 64*(1), 95-114.

Morris, P. A., & Gennetian, L. A. (2003). Identifying the effects of income on children's development using experimental data, Journal of Marriage and Family *65*, 716-729.

National Institute for Literacy (1997). *Fact sheet: family literacy* (Washington, DC, Author)

Parker, F. L., Boak, A.Y., Griffin, K.W., Ripple, C. & Peay, L. (1999). Parent–child relationship, home learning environment, and school readiness, *School Psychology Review 28*, 413-425.

Pomerantz, E. M., Ng, F. & Wang, Q. (2006). Mothers' mastery-oriented involvement in children's homework: implications for the well-being of children with negative perceptions of competence, *Journal of Educational Psychology 98*, 99-111.

Qualifications and Curriculum Authority (QCA) (2000). *Curriculum guidance for the Foundation Stage* (London: QCA/DfEE).

Raikes, H., Pan, B. A., Luze, G., Tamis-LeMonda, C. S., Brooks-Gunn, J., Constantine, J., et al. (2006). Mother-child bookreading in low-income families: correlates and outcomes during the first three years of life, *Child Development 77*(4), 924-953.

Raz, I. & Bryant, P. (1990). Social background, phonological awareness and children's reading, *British Journal of Developmental Psychology 8*, 209-225.

Reynolds, A., Mavrogenes, N., Bezruczko, N. & Hagemann, M. (2008). Cognitive and familysupport mediators of preschool effectiveness: A confirmatory analysis, *Child Development 67*(3), 1119-1140.

Ritblatt, S. N., Beatty, J. R., Cronan, T. A. & Ochoa, A. M. (2002). Relationships among perception of parent involvement, time allocation and demographic characteristics: implication for policy formation, *Journal of Community Psychology 30*, 519-549.

Rodriguez, E., Tamis-LeMonda, C., Spellmann, M., Pan, B., Raikes, B., Lugo-Gil, J., et al. (2009). The formative role of home literacy experiences across the first three years of life in children from low-income families, *Journal of Applied Developmental Psychology 30*, 677-694.

Rowe, M. L., Pan, B. A. & Ayoub, C. (2005). Predictors of variation in maternal talk to children: a longitudinal study of low-income families, *Parenting: Science and Practice 5*, 259-283.

Tremblay, R. E. (2000) The development of aggressive behaviour during childhood: what we have learned in the past century? *International Journal of Behavioural Development*, 24, 129-141.

US Department of Education (2006). *Parent and family involvement in education*: 2002-2003 and the parent survey (Parent: 1999) and the parent and family involvement in education survey (PFI: 2003) of the nation household education surveys programs (Washington, DC, National Center for Education Statistics).

Watson, R. (2002). Literacy and oral language: implications for early literacy acquisition, in: S. B. Neuman & D.K. Dickinson (Eds) *Handbook of early literacy research* (New York, The Guilford Press), 43-53.

Whitehurst, G., Zevenberger, A., Crone, D., Schultz, M., Velting, O. & Fishcer, J. (1999). Outcomes of an emergent literacy intervention from Head Start through second grade, *Journal of Educational Psychology 9*, 261-272.

Yeung W., Linver, M. & Brooks-Gunn, J. (2002). How money matters for young children's development: parental investment and family processes, *Child Development 73*(6), 1861-1879.

CHAPTER 9

INVESTIGATION OF PROSPECTIVE SCIENCE TEACHERS' UNDERSTANDING REGARDING STATIC AND KINETIC FRICTION FORCES

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GİRİŞ

From the very first moment people came into existence, they have struggled to survive and make their lives easier. In line with these struggles, science holds a key position for life. In this context, countries try to give due importance to science education and carry out studies for qualified science education. For a qualified science education, above all, relevant science subjects should be acknowledged and exercised correctly, and the situations encountered in daily life. This is because it is the most fundamental requirement for both individuals and societies formed by those individuals to comprehend, monitor and consciously use the scientific and technological developments as well as to adapt to the present age.

As one of the forces that affect our daily lives, the friction force is one of the oldest problems studied in science (Lukovic, 2019). In this context, the desire and need to understand the subject better has made friction force one of the basic subjects in science education (Bonanno, Bozzo, Grandinetti, & Sapia, 2016; Zorlu & Zorlu, 2018). In the mechanical teaching of science education, friction force, the nature of static and kinetic friction, and the relationships between other forces are discussed (Abu, Wolfson, Bran, & Yizhaq, 2017). Friction force can be examined in three subgroups: kinetic, static and rolling friction. The static frictional force is a type of force that prevents these surfaces from sliding between each other (Cross, 2018). The kinetic frictional force is a force that always resists sliding action and reduces the sliding speed of the overlapping surfaces (Ludwigsen & Svinarich, 2009). Although different models have been performed to explain these forces in more detail, coulomb's friction force model is dominant, using the coulomb friction model, and the friction force in modern books is discussed in laws developed by Coulomb (Lukovic, 2019). The rolling friction is the resistance of the rolling surfaces to the contact surfaces. The friction force is broadly defined as the loss of energy due to a shift or deformation of the normal reaction force (Cross, 2016; 2017). In this context, the frictional force is addressed in the light of the laws developed by Coulomb. These laws are related to the fact that the frictional force is proportional to the load, is not dependent on the area of the friction surface, is largely independent of the velocity and is dependent on the structural properties of the contacting material (Cross, 2016; Serway & Jewett, 2015).

When the related literature is investigated, it was determined that the effects of various learning methods and techniques were employed to detect their impact in the teaching of the related subject (Akbulut, 2013; Akdeniz & Yiğit, 2001; Taşkın & Moğol, 2017), the relationship states of the concepts were put forward (Ingerman, Berge, & Booth, 2009), misconceptions were identified (Chee, 1996), and activity development

studies were conducted (Zorlu & Zorlu, 2018). However, it is seen that the studies on friction force in the literature are carried out in a limited number at the undergraduate level and it is seen that there are suggestions (Hahn & Russell, 2018; Ludwigsen & Svinarich, 2009) that the prospective science teachers' understanding should be determined in this subject. According to Hahn and Russell (2018), and Ludwigsen and Svinarich (2009); static and kinetic friction for some students and at times even their instructors is not simple enough to extract from textbooks, and in-depth research needs to be done on this subject. According to the studies of Cheong, Ha and Byun (2019), and Tavukçuoğlu (2018); students have difficulty in understanding the concepts of friction force and it is important to establish the cognitive structures the students possess. This study is based on these needs and is thought to contribute to the relevant literature. Accordingly, the aim of this study was investigated the prospective science teachers' understanding of static and kinetic friction force subjects.

METHOD

The case study method is a research method that executes an in-depth examination by analyzing the event, situation or program in a comprehensive and systematic holistic structure (Johnson & Christensen, 2019; Patton, 2014). In this study, which was conducted to reveal the prospective science teachers' understanding of static and kinetic friction forces in detail, the case study method was used as one of the qualitative research approaches.

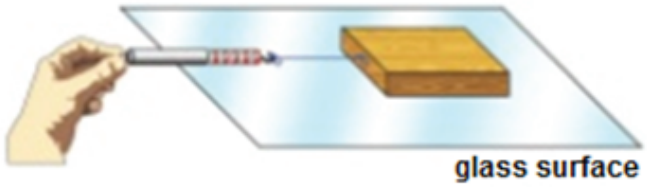
Participants

It was determined by the criterion sampling, which is one of the purposeful sampling methods for the sample of this study. In the criterion sampling, all states are studied in accordance with a list of criteria that meet the criteria or criteria set by the researcher (Patton, 2014; Yıldırım & Şimşek, 2006). In this study, the prospective science teachers took the courses of "General Physics I", "General Physics II", "General Physics III", "Special Subjects in Physics" and "Modern Physics" successfully passed them as criteria. The sampling of this study was not included because 7 of the 39 prospective science teachers who volunteered to participate in the study did not meet the criteria. The sample of the study was determined by simple random method. The study was performed with the participation of 32 prospective science teachers (5 males and 27 females) who were third-grade students in faculty of education at a public university.

Data Collection Method

In the study, a structured interview method was used as a data collection method. The time of the interviews with the prospective science

teachers lasted 15-20 minutes. In the interviews, the prospective science teachers were given a problem case for the subject and three questions were asked about the problem case (see Figure 1). In the research, there is a problem case related to static and kinetic friction and three parts related to this situation. The first section (applied force is 2 N), the force applied to a wooden block is smaller than the kinetic friction and the determination of the static friction, the second section (applied force is 6 N) is equal to the kinetic friction applied to the wooden wedge and the third section (applied force 9 N) It is related to the fact that the force applied to the wooden block is greater than the kinetic friction.



Forces applied to the wooden block in the above figure are parallel to the glass surface. The coefficient of friction between the wooden block and the glass surface is 0.3 and the mass of the wooden block is 2 kg. Block is pulled with 2 N, 6 N and 9 N forces. Provide information about the movement and friction force regarding the block (g= 10 N/kg)

In case that the applied force is 2 N

In case that the applied force is 6 N

In case that the applied force is 9 N

Figure 1. The problem case of the structured interview

Validity and reliability process of the data collection tools

In order to collect data for the research, a problem case was prepared with regards to expert opinion gathered from two academicians specialized in their fields. In the expert opinion, it was suggested to take gravity acceleration as 10 N/kg and to form three sections for the problem case. The request of experts to obtain the impetus of gravity 10 N/Kg is intended to reveal information about the subject rather than the mathematical processing capability. The prepared problem was read by 10 prospective science teachers who had previous knowledge of this subject and unclear points were revised. Based on the feedbacks received from field experts and prospective teachers, the problem was arranged and finalized.

Data Analysis

The data obtained from the three sections were analyzed by content analysis method. Content analysis was conducted by two academicians and the compliance was determined as 82%. The final version of content analysis was made in accordance with the joint decisions of the two academicians. Three themes, "the applied force is lesser than kinetic friction force", "the applied force ıs equal to the kinetic friction force" and "the applied force ıs greater than the kinetic friction force", were determined as a result of the analysis of the content from the data obtained from the research. Eight codes belonging to the first theme, six belonging to the second theme and six belonging to the third theme were determined.

FINDING

Findings of the themes and codes formed from the data obtained through the research are given as percentage and frequency.

Table 1

Analysis results of the data obtained from the applied force is lesser than kinetic friction force theme

Codes	f	%
Calculation of kinetic friction force	24	75.00
Kinetic friction force being known as maximum friction	24	75.00
Non-moving of the block to which force is applied	22	68.75
The force applied to the block being less than the kinetic friction force	21	65.63
Calculation of static friction force	5	15.63
Moving of the block	5	15.63
Miscalculation of friction force	4	12.50
Determination of net force applied to block	2	6.25

n=32

When the Table 1 is examined regarding the theme of force being applied to the block being lesser than the kinetic friction force the prospect science teachers' acknowledgments were mostly inclined towards four codes "*calculation of kinetic friction force*", "*kinetic friction force being known as maximum friction*", "*non-moving of the block to which force is applied*" and "*the force applied to the block being less than the kinetic friction force*". It is seen that approximately 15.63% of the prospective science teachers calculated static friction force. In addition, it was seen that 15.63% of the prospective science teachers stated that the block is in motion and 12.50% miscalculated the friction force. Examples of prospective science teachers' understanding regarding the 2 N force applied to the block were given in Table 2.

Table 2

Examples of prospective science teachers' understanding regarding the 2N force applied to the block

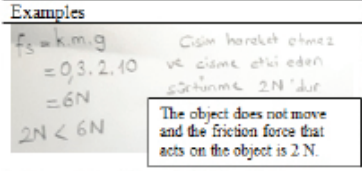
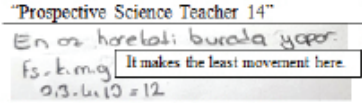
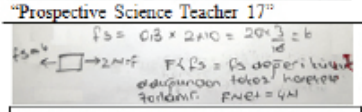
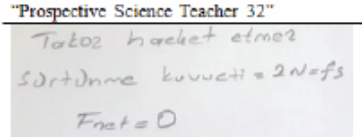
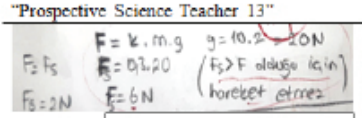
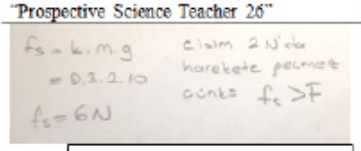
Examples	Codes
 The object does not move and the friction force that acts on the object is 2 N. "Prospective Science Teacher 14"	Calculation of kinetic friction force Kinetic friction force being known as maximum friction Calculation of static friction force Non-moving of the block to which force is applied The force applied to the block being less than the kinetic friction force
 It makes the least movement here. "Prospective Science Teacher 17"	Moving of the block Miscalculation of friction force
 The block is forced to act because the fs value is "Prospective Science Teacher 32"	Calculation of kinetic friction force Kinetic friction force being known as maximum friction Determination of net force applied to block
 The block isn't moving. Friction force = 2 N = fs "Prospective Science Teacher 13"	Calculation of static friction force Non-moving of the block to which force is applied Determination of net force applied to block
 It doesn't move because of F>fs. "Prospective Science Teacher 26"	Calculation of kinetic friction force Calculation of static friction force Kinetic friction force being known as maximum friction Non-moving of the block to which force is applied The force applied to the block being less than the kinetic friction force
 The object won't move in 2 N. Because fs>F "Prospective Science Teacher 1"	Calculation of kinetic friction force Kinetic friction force being known as maximum friction The force applied to the block being less than the kinetic friction force Non-moving of the block to which force is applied

Table 3

Analysis results of the data obtained from the applied force is equal to the kinetic friction force theme

Codes	f	%
The kinetic friction force is known as maximum friction and is equal to the applied force	20	62.50
Beginning of motion in the force applied block	15	46.88
Non-moving of the block to which force is applied	12	37.50
Miscalculation of friction force	7	21.88
Determination of net force applied to block	3	9.38
The force applied to the block is less than kinetic friction force	1	3.13

n=32

When Table 3 is examined, regarding the theme of force applied to block being equal to the kinetic friction force, more than half of the prospect science teachers' understanding was in line with "*the kinetic friction force is known as maximum friction and is equal to the applied force*" code. In addition, approximately half of prospect science teachers stated "*beginning of motion in the force applied block*" code. It was observed that 37.50% of the prospective science teacher stated that the block did not move. It is presented that 21.88% of prospective science teachers miscalculated the friction force. Examples of prospective science teachers' understanding regarding the 6 N force applied to the block were given in Table 4.

Table 4

Examples of prospective science teachers' understanding regarding the 6 N force applied to the block

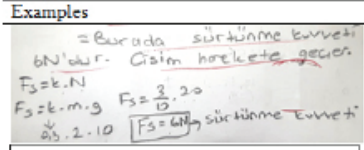
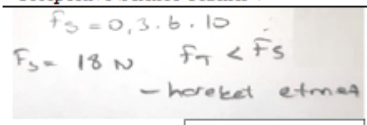
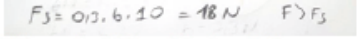
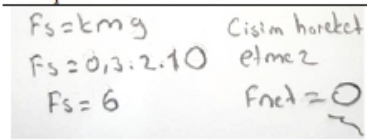
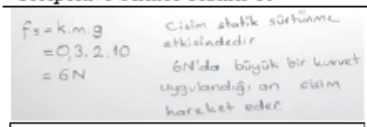
Examples	Codes
 The friction force here is 6 N. The object moves. "Prospective Science Teacher 7"	Beginning of motion in the force applied block The kinetic friction force is known as maximum friction and is equal to the applied force
 The object doesn't "Prospective Science Teacher 9"	Miscalculation of friction force The force applied to the block is less than kinetic friction force
 "Prospective Science Teacher 22"	Miscalculation of friction force
 The object doesn't move. "Prospective Science Teacher 16"	The kinetic friction force is known as maximum friction and is equal to the applied force Non-moving of the block to which force is applied Determination of net force applied to block
 The object is under the influence of static friction. A force greater than 6 N moves as soon as it is applied. "Prospective Science Teacher 14"	The kinetic friction force is known as maximum friction and is equal to the applied force Beginning of motion in the force applied block

Table 5

Analysis results of the data obtained from the applied force is greater than the kinetic friction force theme

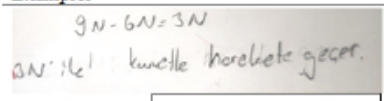
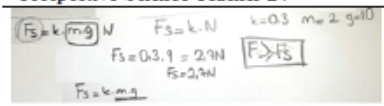
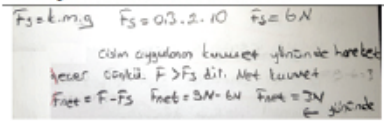
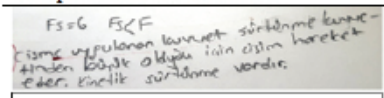
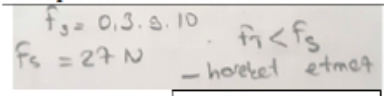
Codes	f	%
To know that the force applied to the block is greater than the kinetic friction force	20	62.50
Moving of the block in the direction of net force	20	62.50
Calculation of net force acting on the block	17	53.13
Calculation of kinetic friction fore and the kinetic friction force is known as maximum friction	15	46.88
Miscalculation of friction force	7	21.88
Non-moving of the block	2	6.25

n=32

When Table 5 is examined, more than half of the prospective science teachers' understanding regarding the theme of force applied to the block is greater than kinetic friction force is towards the codes of "*to know that the force applied to the block is greater than the kinetic friction force*", "*moving of the block in the direction of net force*" and "*calculation of net force acting on the block*". It is seen that prospective science teachers have an understanding that the block moves in the direction of net force when a force greater than kinetic friction force is applied. It is seen that approximately 21.88% of the prospective science teachers miscalculated the friction force and 6.25% stated that the block did not move. Examples of prospective science teachers' understanding regarding the 9 N force applied to the block were given in Table 6.

Table 6

Examples of prospective science teachers' understanding regarding the 9 N force applied to the block

Examples	Codes
 It moves with a force of 3 N. "Prospective Science Teacher 24"	To know that the force applied to the block is greater than the kinetic friction force Calculation of net force acting on the block Moving of the block in the direction of net force
 "Prospective Science Teacher 21"	To know that the force applied to the block is greater than the kinetic friction force
 The object moves in the direction of the force applied. Because of F>fs. "Prospective Science Teacher 4"	To know that the force applied to the block is greater than the kinetic friction force Moving of the block in the direction of net force Calculation of net force acting on the block Calculation of kinetic friction force and the kinetic friction force is known as maximum friction
 Because it is greater than the friction force applied to the object, the object moves. There is kinetic friction. "Prospective Science Teacher 8"	To know that the force applied to the block is greater than the kinetic friction force Calculation of kinetic friction force and the kinetic friction force is known as maximum friction Moving of the block in the direction of net force
 The object doesn't move. "Prospective Science Teacher 9"	Miscalculation of friction force Non-moving of the block

CONCLUSION, DISCUSSION AND SUGGESTIONS

In this study in which the prospective science teachers' perceptions about kinetic and static friction forces issues were determined, the results obtained from the findings were presented in relation to the related literature and given below.

When a force is applied in the same direction as the friction force, it is seen that most of the prospect science teachers calculate the kinetic friction force and that the block does not move because the applied force is lesser than the kinetic friction force (See of Table 1). It is seen that very few of the science teachers calculate the static friction of the block (See of Table 1). According to these results, it was understood that the prospect science teachers who participated in the study knew the frictional force as only kinetic friction force and did not know the static friction force comprehensively.

Most of the prospective science teachers participating in the research use the formula used to calculate the kinetic friction force when calculating the friction force was seen. This can be said that the subjects are caused by trying to learn from mathematical formulas by prospective science teachers. In the studies carried out in the literature, it is stated that formulas are often used to learn the subjects of science (Bayrak & Bezen, 2013; Karakuyu, 2008). However, in addition to using formulas in learning science subjects, by associating them with daily life, it can be achieved to learn subtopics and variables in formulas by establishing relationships between variables through experiments, animation and simulation.

When force is applied to stationary objects;

"Applied Force<Kinetic Friction Force" (1)

"Object does not move when the net force is zero Equation" (2).

"F_{net}=0" (2)

"From following statement"

"F_{net}= Applied Force - Friction Force" (3)

"It is equal Applied Force and Friction Force from Equation. The friction force is the static friction force" (3).

If the object does not move when force is applied to the stationary object, the friction is static friction force (Cross, 2018). When a force equal to kinetic friction force is applied in the same direction as the friction force, it is seen that most of the prospect science teachers calculate the kinetic friction force and express that it is the maximum friction and equal to the applied force (See of Table 3). It was seen that the prospective science teachers participating in the research were indecisive about whether the block would move in the direction of the applied force, some of them thought that the block did not move and some of them considered it as the starting moment of the movement (See of Table 3). According to these results, it was seen that the prospective science teachers who participated in the study knew kinetic friction force and maximum friction forces. While explaining that the block is not in motion due to the net force affecting the block, it is also observed that they do not consider it as the movement starting moment of the block. The kinetic friction force is a reacting force decelerating the movement independently of speed and force at the moment of movement. Kinetic friction force being equal to applied force expresses the moment in which object is stationary and then begin it first begin movement (Ludwigsen & Svinarich, 2009). It can be said that they are in conflict with the movement of the block. It can be stated that the main reason for this contradiction is prospect science teachers who

participated in the research had insufficient knowledge about friction force. In researches conducted on this subject, it is seen that prospect teachers have insufficient information when describing friction force (Trumper & Gorsky, 1997; Prasitpong & Chitaree, 2009) and cannot explain friction force at an invisible in other words in a microscopic level (Corpuz & Rebello, 2011; Kurnaz & Ekşi, 2015).

Most of the prospective science teachers calculate the kinetic friction force, maximum friction and net force when a force larger than kinetic friction force is applied in the same direction as the friction force to the block and state that the block moves in accordance with the net force regarding these calculations (See of Table 3). According to this result, it can be said that the prospective science teachers who participated in the research can explain the application of a force greater than kinetic friction force to an object and know the concepts of kinetic friction force and maximum friction correctly. In all three cases, it was seen that some of the prospective science teachers who participated in the study miscalculated the friction force (See of Table 1 and Table 5). It can be stated that some prospective science teachers did not know the friction force correctly. Conclusion drawn in the body of literature on friction force that these concepts are not fully comprehended and have difficulties in understanding, is in parallel with the results of the research (Cheong, Ha, & Byun, 2019; Tavukçuoğlu, 2018).

In daily life, many cases are related to frictional force. However, the concept of scientific friction force can be quite different from the students' pure understanding (Cheong, Ha, & Byun, 2019). Individuals who possess accurate knowledge about friction force can devise original products in these fields. Because in today's world where science is trying to be integrated with maths, technology and engineering apart from its relating fields individuals can effectively put their skills to only with the accurate knowledge. According to results obtained from study, it was understood that the prospective science teachers who participated in the study knew the friction forces as only kinetic friction force and did not know the static friction force comprehensively. Accordingly, studies should be carried out to ensure that prospective science teachers learn static and kinetic friction forces issues correctly and effectively. The results obtained from this study will guide the studies to be carried out in the future is thought. In addition, the results obtained from the research be shared with the prospective teachers who participated in the research in similar studies in the future is recommended. In this way, prospective teachers can be contributed to seeing the shortcomings and better developing.

Ethical Text

REFERENCES

Abu, Y. B., Wolfson, I., Bran, G., & Yizhaq, H. (2017). Downhill Cycling Symmetry Breaking: How The Rider Foils Experiment. *Physics Education, 52*(6), 1-6. https://doi.org/10.1088/1361-6552/aa81f0

Akbulut, H. İ. (2013). *Examining the Effect of Instruction with Dual Situated Learning Model on Students' Cognitive Achievement and Conceptual Change: Force and Motion Unit Sample*. Unpublished Doctoral Dissertation, Karadeniz Teknik University Institute of Education Sciences, Trabzon.

Akdeniz, A. R., & Yiğit, N. (2001, September). *Fen Bilimleri Öğretiminde Bilgisayar (Logo) Destekli Materyallerin Öğrenci Başarısı Üzerine Etkisi: Sürtünme Kuvveti Örneği [The Impact of Computer (Logo) Supported Materials on Student Success in Science Teaching: Friction Force Example]*. Paper presented at the Science Education Symposium in Turkey at the Beginning of the New Millennium, İstanbul, Turkey.

Bayrak C., & Bezen, S. (2013). Teacher Opinions on the New Teaching Syllabus and the Issues Encountered When Teaching the Subjects of the 9th Grade Physics Syllabus. *Hacettepe University Journal of Education,* 1, 27-38.

Bonanno, A., Bozzo, G., Grandinetti, M., & Sapia, P. (2016). Work-Energy Theorem and Friction Forces: Two Experiments. *Physics Education, 51*(6), 1-10. https://doi.org/10.1088/0031-9120/51/6/065004

Chee, C. T. (1996). Common Misconceptions in Frictional Force among University Physics Students. *Teaching and Learning, 16*(2), 107-116.

Cheong, Y. W., Ha, S., & Byun, T. (2019). Two Patterns of Student Reasoning in Problem Solving Concerning Frictional Force. *Physics Education, 54*(2), 1-13. https://doi.org/10.1088/1361-6552/aaf6f9

Corpuz, E. D., & Rebello, N. S. (2011). Investigating Students' Mental Models and Knowledge Construction of Microscopic Friction. II. Implications for curriculum design and development, *Physical Review Special Topics-Physics Education Research, 7*(2), 1-8.

Cross, R. (2016). Coulomb's Law for Rolling Friction. *American Journal of Physics,* 84, 221-230. https://doi.org/10.1119/1.4938149

Cross, R. (2017). Origins of Rolling Friction. *Physics Education, 52*(5), 1-4. https://doi.org/10.1088/1361-6552/aa77b4

Cross, R. (2018). Static Friction on a Ball Rolling Down an Incline. *Physics Education, 53*(6), 1-3. https://doi.org/10.1088/1361-6552/aadd8b

Develi, F., & Namdar, B. (2019). Defining Friction Force: A Proposed Solution to a Textbook Problem. *Journal of Education in Science, Environment and Health, 5*(1), 91-101. https://doi.org/10.21891/jeseh.487399

Hahn, K. D., & Russell, J. M. (2018). The Indeterminate Case of Classical Static Friction When Coupled with Tension. *The Physics Teacher, 56*(2), 83–87. https://doi.org/10.1119/1.5021433

Ingerman, A., Berge, M., & Booth, S. (2009). Physics Group Work in a Phenomenographic Perspective-Learning Dynamics as the Experience of Variation and Relevance. *European Journal of Engineering Education, 34*(4), 349-358. https://doi.org/10.1080/03043790902989382

Johnson, R. B., & Christensen, L. (2019). *Educational Research: Quantitative, Qualitative, and Mixed Approaches* (7th ed.). California: Sage Publishing.

Karakuyu, Y. (2008). Problems of Physics Teachers in Physics Education: Afyonkarahisar Sample. *Mustafa Kemal University Journal of Social Sciences Institute, 5*(10), 147-159.

Kurnaz, M. A., & Ekşi, Ç. (2015). An Analysis of High School Students' Mental Models of Solid Friction in Physics. *Educational Sciences: Theory & Practice, 15*(3), 787-795. https://doi.org/10.12738/estp.2015.3.2526

Ludwigsen, D., & Svinarich, K. (2009). Choose Wisely: Static or Kinetic Friction-The Power of Dimensionless Plots. *The Physics Teacher, 47*(3), 158-161. https://doi.org/10.1119/1.3081298

Lukovic, M. (2019). The Influence of Surface Temperature on the Coefficient of Static Friction. *The Physics Teacher, 57*(9), 636–638. https://doi.org/10.1119/1.5135798

Patton, M. Q. (2014). *Qualitative Research & Evaluation Methods* (4th ed.). Thousand Oaks, CA: Sage Publishing.

Prasitpong, S., & Chitaree, R. (2009). What Thai Students Think About Directions and Types of Frictional Forces. *International Conference on Physics Education,* 1263, 66-69.

Serway, R. A., & Jewett, J. W. (2015). *Physics for Scientists and Engineers with Modern Physics* (9th ed.). USA: Brooks Cole.

Taşkın, T., & Moğol, S. (2017). An Example for Creative Drama in Physics Education: Friction Force. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, 11*(1), 198-221. https://doi.org/10.17522/balikesirnef.356147

Tavukçuoğlu, E. (2018). *Investigating High School Students' Cognitive Structures about Friction, Acceleration and Inertia Concepts.* Unpublished Master's Thesis, Hacettepe University Institute of Education Sciences, Ankara.

Trumper, R., & Gorsky, P. (1997). A Survey of Biology Students' Conceptions of Force in Pre-Service Training for High School Teachers. *Research in Science & Technological Education, 15*(2), 133-147. https://doi.org/10.1080/0263514970150201

Zorlu, Y., & Zorlu, F. (2018). Fen Bilgisi Öğretmen Adaylarının ''Sürtünmeli ve Sürtünmesiz Yüzeylerde Hareket'' Konusunda Modellemeye Dayalı

Etkinlik Ürünleri [Modelling Activity Products for Prospective Science Teachers on “Movement on Frictional and Frictionless Surfaces”]. *Değişen Dünyada Eğitim[Education in a changing world]* (191-216). Ankara: PegemA Publishing.