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To cite this article:

Dogan, M.F., & Gultekin, M. (2025). The effects of Multiple Intelligences Theory applications on students' cognitive, affective and skills dimensions. *International Journal of Education in Mathematics, Science, and Technology (IJEMST), 13*(5), 1113-1143. https://doi.org/10.46328/ijemst.5700

International Journal of Education in Mathematics, Science and Technology

2025, Vol. 13, No. 5, 1113-1143 https://doi.org/10.46328/ijemst.5700

The Effects of Multiple Intelligences Theory Applications on Students' Cognitive, Affective and Skills Dimensions

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Article Info

Article History

Received:
10 December 2024
Accepted:
19 June 2025

Keywords

Action research
Multiple intelligences
Primary school students
Science courses

Abstract

This study aims to reveal the applicability of the theory of multiple intelligences, based on daily life problem-solving skills, in primary school fourth-grade science courses. The study was conducted using an action research design. The participant group of the research consisted of 23 students, their parents, and the classroom teacher. The data for the study were collected through observation findings obtained via video recordings and observation forms, diaries kept by the researcher, products created by the students, evaluation and self-evaluation forms, and semi-structured interviews conducted with students, parents, and the classroom teacher. The content analysis technique was utilized for the analysis of the research data. As a result of the analysis of the obtained data, five main themes were identified under the headings: "process," "cognitive," "affective," "skills," and "problems and suggestions." In the process dimension, it was understood that the lesson plans prepared within the context of the theory of multiple intelligences were suitable plans that could help students achieve the relevant outcomes. In the cognitive domain, it was determined that students' abilities to understand and comprehend, as well as their academic success, increased, and this contributed to their permanent learning. In the affective domain, it was observed that during the activities, students were happy, enjoyed themselves, were entertained, felt excited, and were willing to participate. Furthermore, it was seen that students gained self-confidence and their self-efficacy perceptions developed. In the skills dimension, it was revealed that students' abilities to relate the knowledge they acquired to daily life and to communicate had developed. In the problems and suggestions dimension, it was concluded that the students' intense desire to take part in every activity and to speak more to express their thoughts during activities based on multiple intelligences led to some difficulties.

Introduction

Science refers to discovering, testing, separating and integrating the functioning and order in the natural environment in which humanity lives through a purposeful, planned study and the whole of secure knowledge

obtained in this way (MEB, 1995). This body of knowledge contained in the concept of science is based and consistent expertise that has been filtered, organized, accumulated, transferred, and tested between generations for many years and proven to be reliable and objective (Çilenti, 1985; Uluçınar Sağır, 2008). In this respect, science can be defined as an endeavor that enables humanity to investigate and understand itself and the environment in a better way and provides a basis for studies to obtain new knowledge in science subjects, to examine nature and natural events systematically through this knowledge and to make predictions about events that have not yet been observed (Çilenti, 1985; Kaptan & Korkmaz, 2001a).

Science sciences include all branches of science consisting of the knowledge acquired by human beings from examining themselves and their natural environment (Çilenti, 1985). With the rapid development of technology, the importance of science is rapidly increasing in the 21st century. The first aim of education is to raise well-equipped individuals who will keep up with age, research, and questions through critical thinking (Bökeoğlu & Yılmaz, 2005). Among the main objectives of the courses related to science, raising individuals who think, ask, and do comes to the forefront. To achieve these aims, it is necessary to work on teaching ways of learning and to provide the opportunity to apply what has been learned instead of giving students ready-made information (Gürkan & Gökçe, 1999). Science education allows individuals to recognize the world they live in and their environment while also providing them with creative thinking skills. In this direction, it enables individuals to identify their world, make sense of it correctly through good communication processes, and develop their logical thinking and problem-solving abilities. This allows students to solve the problems they encounter in daily life more efficiently and to control their learning processes. Thus, students' practical skills for daily life increase when they develop science skills and learn to learn (Hançer et al., 2003).

The main objectives of the education system are to prepare individuals for life and support them in making sense of the situations that arise in daily life. To fulfil these aims, science courses and other courses in this field are essential (Coştu et al., 2007). Science education is a set of activities that provides individuals with the knowledge, skills, and processes contained in science (MEB, 1995).

Technological innovations have gained significant momentum in today's "information and technology" age, where scientific and academic knowledge increases exponentially. The impact of science and technological developments is prominent in all areas of our lives; it can be seen that science education has a vital role in the development of society (MEB, 2006). Educational activities related to science enable individuals to understand their environment better while providing them with creative thinking skills. Science education also allows individuals to recognize their world and make sense of it correctly. It also develops the individual's logical thinking and problem-solving skills. This enables students to solve the problems they encounter in daily life more efficiently and to control their learning processes. Thus, while students' practical daily life skills are increased, science and learning skills are developed (Hançer et al., 2003).

The main aim of science education, which offers rich experiences to individuals in an approach based on research and discovery, can be stated as raising creative individuals who can handle and examine the universe and the environment they live in from a scientific point of view, can think critically, establish a relationship between

science and technological developments, and use the knowledge and skills obtained in daily life (YÖK, 1997; Kaptan & Korkmaz, 2001b; Çepni et al., 2001; Hançer et al., 2003). In science education, individuals are expected to recognize problems in their environment, make observations, collect information, form hypotheses, carry out tests based on them, interpret data and findings, perform analyses and generalizations based on cause-effect relationships, and make the acquired knowledge and skills operational (Geban, 1996; Aktamış & Ergin, 2006; Uluçınar Sağır, 2008).

Throughout history, scientists have developed many theories about intelligence through their research on intelligence, the formation process, development, parts, and measurement of intelligence (Kolaç, 2008). Wechsler (1958) defines intelligence as a mental capacity used by individuals to act purposefully, reason and cope with the environment. Glover et al. (1990) stated that intelligence is the ability individuals develop to learn, deal with new situations, use verbal and logical reasoning, and think abstractly. Woolfolk and Hoy (1990) also considered intelligence the ability to acquire and remember information and to adapt to the world (Açıkgöz, 2003).

Gardner, who states that human intelligence includes many different ability groups and cannot be explained within the framework of a single factor, states that intelligence is the individual's capacity to create products that are valued in one or more cultural environments, the ability to find effective and efficient solutions to problems encountered in daily life, and the ability to reveal new and complex problems that need to be solved (Gardner, 2006). Gardner (1983) emphasizes that individuals have many types of intelligence at different levels in the multiple intelligence theory. This contributes to forming their learning styles, interests, skills, and tendencies.

The theory of multiple intelligences is a student-centered educational approach that offers rich activities and materials that are compatible with the individual differences and dominant intelligence areas of students and their specific learning styles in this direction, where the teacher is in the guiding position and shows educators the differences of students and how they can learn (Baykal, 2005). Multiple intelligence theory is an educational theory developed by Howard Gardner as an alternative perspective to intelligence, who argues that the traditional method of testing intelligence does not capture the wide range of potential people have (Armstrong, 2020).

Gardner's theory aims to reveal a set of skills based on individual competencies. In this vein, the theory of multiple intelligences points out that there are various and different aspects of cognition, and that people have different cognitive powers and contrasting cognitive styles within themselves (Gardner, 2006). The multiple intelligences theory allows students to use their unique intelligence. With this theory, Gardner draws attention to the differences in students and how these differences can use their unique intelligence to create learning experiences.

Gardner (1999, 2006) states that intelligence solves problems and produces a product valued in a particular society or cultural structure. Problem-solving skills help individuals find a suitable way to achieve a goal in the face of a situation encountered and to approach the goal by proceeding on this path. The ability to produce a product that is valued in the structure of society or culture helps the individual in the process of acquiring and advancing knowledge or in revealing the characteristics of the individual, such as beliefs and emotions, and in developing the individual's ability to solve problems that are seen as necessary in a cultural environment or community

(Gardner, 2006; Gürbüzoğlu, 2009).

The theory of multiple intelligences suggests teaching practices that can be used effectively in every lesson. In this context, the theory of multiple intelligences can also be used in science courses. Science is the systematic examination of the observable nature, the situations that occur in nature, and the studies carried out to predict situations that have not yet been observed (Çepni, 2006).

According to Gardner's theory of multiple intelligences, eight areas of intelligence are innate to every individual and offer options that can support the individual's understanding and learning styles. These include "verbal-linguistic intelligence", "logical-mathematical intelligence", "visual-spatial intelligence", "musical-rhythmic intelligence", "bodily-kinesthetic intelligence", "interpersonal-social intelligence", "intrapersonal-introverted intelligence" and naturalistic intelligence (Türkuzan, 2004).

Wilson (2018) explains each intelligence as a transformative process for students' education. However, Gardner (1993) interpreted human intelligence in his study as each student discovering their power in teaching. Accordingly, each intelligence defines how students can understand various lessons taught in the classroom. The fact that each student's strengths are different presents two significant challenges for the instructor in helping students in a group reach their maximum learning potential (Gardner, 2004).

With the theory of multiple intelligences, educators have revealed new methods for preparing programs that attach importance to students' differences and add power to the basic principles they use creatively. Multiple intelligence theory, which enables a student-centered approach, has a vital role in achieving the goals of the science education process (Kurt, 2012). The importance of science courses has increased in the curricula implemented in Türkiye from the past to the present. However, the scope of science courses focuses on individuals' ability to solve daily life problems. It is thought that the activities developed for the theory of multiple intelligences will positively affect the students' daily life problem-solving skills, academic achievement, and attitudes towards the course.

Multiple intelligence theory is a practical approach that can be applied to every lesson and subject (Gardner, 2006). Research conducted within the scope of numerous intelligence theories shows that multiple intelligence theory contributes to learning products. According to the findings of the study conducted by Aslan Efe and Bakçı (2022), which revealed the meta-synthesis of science education studies conducted in Türkiye, as a result of most of the experimental studies in which activities appropriate to the theory of multiple intelligences were tested, it was revealed that numerous intelligence-based activities were effective in improving students' achievement and retention of knowledge, motivation, attitude and perception. Similarly, in experimental studies conducted within the scope of a quantitative research model, Karabay et al. (2011) found that the theory of multiple intelligences increased academic achievement, retention in learning and attitude level. In the studies conducted with qualitative research models, the students stated that they were satisfied with the teaching of the course supported by the theory of multiple intelligences, that they enjoyed it, that they understood the lesson better, that more intelligence areas were addressed, that what they learned was more permanent and that it facilitated learning, while the teachers stated that they were satisfied with the teaching of the course supported by the theory of multiple intelligences,

that the students understood the lesson better, that it increased their motivation, that they were active, that they enjoyed it, that it facilitated learning and that what was learned was more permanent.

The roles of teachers and students, as well as the curricula from past to present, have changed over time, and in this direction, the aim of creating more efficient learning environments has come to the fore in the teaching process (Alkan et al., 2013; Deniz, 2019). In this context, the course content applied within the curricula should transform to keep up with the age of the new perspectives gained by the programs and the expectations of the students. Research shows that students have positive attitudes towards lessons taught in line with lesson plans developed based on the theory of multiple intelligences (Kural, 2020). In this direction, a multidimensional approach to the teaching processes related to various intelligence applications carried out within the scope of science courses will provide a better understanding of this change process.

The studies carried out in Türkiye within the scope of science courses at the primary school level for multiple intelligence theory are primarily aimed at determining the intelligence areas of the students and do not focus on the gains expected to be gained by the students in line with the objectives of the science curriculum; therefore, multiple intelligence theory does not fully reflect the functioning of the theory of multiple intelligences within the scope of the science course curriculum. This research must show its contributions to learning products beyond revealing how multiple intelligence theory-based applications can be carried out in science courses. Therefore, this study aims to reveal the effects of multiple intelligence theory applications on students' cognitive, affective and skills dimensions in primary school science courses.

Method

Research Design

This research, which was carried out to reveal the change and development in students' academic achievement, attitudes towards the course and daily life problem-solving skills with lesson plans and activities prepared based on multiple intelligences theory in science courses, was carried out according to an action research model, which is a qualitative research method. Action research is also known as teacher research because teachers assume the role of researchers in the research process (Köklü, 2001). Action research can be defined as a research method carried out through practices carried out with participants to identify problems specific to their situations and to find solutions to these problems (Watts, 1985 cited in (Watts, 1985). Ferrance, 2000; Kemmis, 1988; Elliot, 1991; Glanz, 1999; Karasar, 1999; Calhoun, 2002; O'Brien, 2003; Yıldırım & Şimşek, 2008). Action studies are designed to understand, recognize, and develop solutions to the problems that arise during the implementation process in educational organizations by addressing the process. This research model is applied by people who are personally involved in the practice to find solutions to the problem (Glesne, 2012; Yıldırım & Şimşek, 2008). The starting point of action research is a concrete problem or a deficiency encountered in practice. Each new finding obtained in the research poses a new question, and this ensures that the action research cycle becomes continuous (Knight et al., 2000; Büyüköztürk et al., 2009). Action research is categorized in different ways in the literature. O'Brien (2003) categorizes action research as participatory, collaborative, emancipatory, action learning, and contextual action research. Action research is generally conducted in the context of two different designs. These

are applied action research, which includes improvement studies for regional and minor group problems, and participatory action research, which involves the researcher trying to find solutions to the real problems of individuals in the environment according to their priorities and together with them (Mills, 2013). Based on these two designs, action research is classified into three types, "technical-scientific - collaborative action research", "applied - collaborative - discussion-oriented action research", and "emancipatory - developmental - critical action research", in terms of philosophical foundations, nature of the research, problem situation and researcher-participant distinction (Berg, 2001; Norton, 2009). This research covers the problem of daily life problem-solving skills in primary school science courses and the effects of multiple intelligence theory applications on the problem as a theoretical framework, which the researcher reached within the processes specified in the research focus. In this direction, the action research carried out within the scope of this research was designed as technical-scientific-collaborative action research. In this vein, the practices carried out within the scope of action research enable us to determine the means of intervention that will allow us to reach the solutions related to the problem situation put forward within this process defined by the researcher. In this context, Mills' dialectical action research cycle was used. Mills (2013) stated that the action research process consists of the steps of "determining the focus area", "collecting data", "analyzing and interpreting data", and "developing an action plan".

Focus Area Determination

In the focal area identification stage, research questions and objectives are defined, variables affecting the research are determined, and the study schedule and the research road map are drawn accordingly, constituting the starting point of action research (Mills, 2013). In this context, first, the topic to be studied within the scope of the research was determined. When the curricula implemented in Türkiye from past to present are examined, the importance of science courses is increasing (Aykaç et al., 2011). In this vein, it was thought that there was a need to prepare lesson plans to develop students' skills in line with the aims of the 2018 Science program and to determine their effectiveness. The theory of multiple intelligences developed by Gardner (1983) suggests that individuals have diverse intelligence areas at different levels, which reveals individuals' learning styles, interests, skills, and tendencies. The theory of multiple intelligences, which enables a student-centered approach, plays an essential role in achieving the goals of the Science Program (Kurt, 2012). Therefore, it was decided to conduct a study based on the theory of multiple intelligences in developing students' skills. In this context, the researcher determined the focal area of the research as investigating the effects of various intelligence theory applications on students' cognitive, affective and skills gains in the primary school science course through research and pilot studies conducted with preservice teachers studying at the university where the researcher works.

Action Plan Development

Action research is focused on better understanding and improving the practices carried out. Deciding which steps to achieve this goal is integral to the research process (Mills & Gay, 2016). During the development of action plans, the researcher realizes solution plans or alternative practices for the application or process (Yıldırım & Şimşek, 2008). The findings revealed from the analysis and evaluation of the data obtained within the plan's scope in which the implementation is carried out are used in developing subsequent action plans (Mills, 2013). Within

the scope of the focus of the research, six-week lesson plans prepared in line with the acquisitions of the "Our Food" unit in the fourth-grade program of the Science course were used as action plans. The validity committee evaluated the lesson plans weekly in line with the data obtained, and the plans were finalized and implemented.

Participants and Their Roles in the Implementation Process

Action studies are carried out with people directly related to the research problems. The problems within the research scope, the research findings, the research suggestions put forward by the researcher to solve the problems and the research results are related to these people. In this direction, the population and sample are generally the same in action research conducted with a specially defined group (Büyüköztürk et al., 2009). These people constitute the participants of the research. First, the school where the research will be conducted was determined to determine the research participants. After deciding the school where the research will be conducted, selecting the research participants began. Within the scope of the research, the criteria and the determination process taken into consideration during the determination of the school where the research will be carried out, the participant students and the classroom teacher are explained below.

Determination of the School where Research Will Be Conducted

Within the scope of the research, a state primary school in the Bağcılar district of Istanbul Province was selected as the school where the research would be conducted. In determining this school, the nature of the research population, the distribution of the characteristics sought within the population and the research opportunities were considered. First, by the classification of Fraenkel and Wallen (2006), the "Analogous Sampling" method within the "Purposive Sampling" method, which is a nonrandom sampling method, was used. In purposive sampling, the researcher selects a subgroup that they think represents the universe and is a typical example of the universe as a sample to choose information-rich situations in the context of the purpose of the study to conduct in-depth research. Affinity sampling, on the other hand, can be defined as forming a sample from a similar subgroup or situation in the universe related to the problem of the research.

The fact that the students in the selected school do not show clustering in terms of socioeconomic and sociodemographic characteristics is essential for the quality of the research population. In terms of socioeconomic status, when we compare Istanbul Province in general and some of its districts, Bağcılar District is better adapted to Istanbul Province in general (TÜİK, 2022). When demographic data are analyzed, it can be considered that Bağcılar district is a typical example of the research universe within the scope of purposive sampling by comparing it with the general Istanbul province and other districts evaluated in terms of the old/young population ratio, primary school age population ratio, education level and household averages.

After identifying the Bağcılar district of Istanbul Province for the study, the researcher contacted the principals of the primary schools in the district. In this context, three of the primary school principals in the district stated that they were willing and eager to carry out the application in their schools. The researcher interviewed the principals of these three schools and provided detailed information about the research. After the interviews with the

principals, observation activities were carried out in these three schools. During the observation activities, interviews were conducted with the students, parents, teachers, and other administrators of the schools. As a result of the observations and interviews, one primary school came to the forefront within the scope of the research. In line with factors such as the school administrators' support for the research, the willingness of the classroom teachers towards the research, and the fact that various research activities and teaching practices had been carried out in the school in the past, the researcher decided to determine the relevant school as the implementation school in terms of being the school that he thought could manage the implementation process most effectively and efficiently.

Identification of Participating Students

In qualitative research, purposive sampling methods are used for in-depth investigation of situations that are thought to have rich information content (Yıldırım & Şimşek, 2008). This study used the criterion sampling method, which is a purposeful sampling method, to identify the participants. Considering the purpose of the research, the criteria used to determine the students who participated in the study are given below:

1. Being a fourth-grade student in primary school,
2. Volunteering to participate in the study
3. Their families allowed them to participate in the study.
4. Having problems with the research focus.

In line with the criteria determined for the study participants, this study consisted of fourth-grade students attending a public primary school in Bağcılar district of Istanbul Province in the autumn of the 2022-2023 academic year. To identify the participant students, the class teacher to whom the application would be sent was determined first. In this direction, three teachers working in the application school were identified, and preliminary applications were sent to the teachers and their classes.

One of the criteria used for the study participants was "having problems with the research focus". In this direction, practices and interviews with sample experiences were conducted with prospective students and classroom teachers. The students' compliance with the criteria determined in line with the sample experiences was evaluated during the applications. Their opinions about the implementation process were also obtained in the interviews with the classroom teachers. After the participants were identified, the parents of the students allowed their children to participate in the research, and parental permission was obtained from the parents. In line with research ethics, the students' names were changed, and specific information that could be used to identify the students was removed from the research data.

Classroom Teacher

The teacher of the class where the implementation will be carried out is an integral part of the research process and a data source. The criterion sampling method was used to identify the class teacher within the research scope. For this reason, in determining the classroom teacher, it was assumed that the students had problems with the

research subject, were interested in the research processes and were volunteers. In this context, interviews were conducted with fourth-grade teachers. After the interviews, three teachers were interested in the implementation process. To determine the class where the application would be carried out, preliminary applications were carried out with these three teachers and their students regarding the focus of the research. As a result of this application, the class and teacher who were observed to have the most problems related to the focus of the study were determined within the scope of the research.

The classroom teacher among the study participants is the classroom teacher of 23 students who have problems in daily life problem-solving skills, working in a middle socioeconomic level primary school in Istanbul. The classroom teacher, who has a bachelor's degree program in Classroom Teaching at the Faculty of Education, is also continuing her master's degree in classroom teaching. The classroom teacher, who has been a teacher for nine years, was assigned to the practice school after working in a different province for the first five years of his duty period and has been working as the classroom teacher of the students within the scope of the practice since the first grade. The classroom teacher was included in the research process as an uninvolved observer due to factors such as having the opportunity to provide direct data about the research process and having high objectivity and reliability (Erten, 2015). In uninvolved observation, the observer looks at the observed situation from the outside instead of directly participating. The observer does not consciously interact with the observed event, behavior, relationship, phenomenon, or institution (Altunışık et al., 2007).

Apart from the observer role, the classroom teacher contributed to the preparation of the lesson plans before the research through expert opinion and contributed to the study by collaborating with the researcher during the research, providing information about student characteristics, communicating with parents, preparing the research environment, and providing feedback on the implementation process.

Researcher

The role of the researcher in the research process is of great importance in action research. In experimental research, the researcher tries to determine the effects of variables affecting the observed event in a controlled manner in an environment created by the researcher (Büyüköztürk, 2001). Action research, on the other hand, is highly related to the researcher's competence in understanding and representing individual and social events. Unlike experimental research, in this research model, the researcher is a measurement tool (Karaşahin, 2015). In this direction, the researcher's role, one of the most essential features emphasized in action research, ensures that research and practice are intertwined. In this study, the researcher carried out the preparation of lesson plans within the role of instructor, the implementation of the lesson plans prepared by the researcher, and thus, the transfer of knowledge necessary for students to acquire the relevant outcomes. In addition, the emergence of student products was also carried out through actions within the scope of this role. With the role of guide, the researcher carried out the guidance activities necessary for the use of the data collection tools within the scope of the research by the purpose of the research and to meet the feedback needs of the participants regarding the problems that arose during the process. The researcher carried out the necessary activities to obtain the findings by creating reports on the behaviors exhibited by the participants during the implementation, the processes put forward, and the

implementation of the prepared lesson plans. Finally, the researcher was involved in the research as a participant observer. In participant observation, the researcher is a part of the phenomenon under investigation (Baltacı, 2019). Qualitative research defines events and phenomena in their natural environment and focuses on understanding the participants' perspectives. Other essential features of qualitative research methods are that the researcher has a participant role, is sensitive to the natural environment, has a holistic approach, enables perceptions to emerge, and is flexible (Çokluk et al., 2011). In participant observation, the researcher is the most important data collection tool for the research (Aydın, 2018).

Validity Committee

In action research, colleagues and experts related to the subject must be involved in analyzing the data obtained from data collection tools and maintaining the action process. In the validity committees formed in this direction, the experiences and different perspectives of the committee members play essential roles in improving the quality of the action research process (Johnson, 2012; Mertler, 2014). During the action research process, the validity committee guides the researcher and helps the study continue systematically. In this direction, weekly meetings were held with the committee members throughout the implementation process. In the meetings, the data obtained from the applications were evaluated, and the plans to be realized for the following applications were checked and made ready for implementation.

Research Environment

The research was conducted in a middle socioeconomic level primary school in Bağcılar district of Istanbul Province in the autumn of the 2022-2023 academic year. Dual education is carried out in the school. For this reason, the participants studied between 08.00 and 12.50 hours. The four-story school consists of a single building and a garden.

Preparation of Lesson Plans and Implementation

A literature and resource review were conducted to prepare the lesson plan within the application's "Our Foods" unit scope. Education and training in primary schools in Türkiye are carried out within the official program established by the Ministry of National Education. Accordingly, it is compulsory to implement this program in all classes across the country. In addition, to ensure equality of opportunity in education, textbooks to be used in the teaching process are also determined by the Ministry of National Education and delivered to students. Primary School Science 4 Textbooks prepared by Seyrek (2019), Özkan (2019) and Yaman et al. (2021) and Primary School Science 4 Workbooks prepared by Altıntaş et al. (2020) and Komisyon (2020) were used for the preparation of the application lesson plans. The literature review evaluated scientific-academic publications published in Türkiye and abroad, as well as activities attempted by educators and their applications' results. Within the scope of the lesson plans, activities were prepared for different types of intelligence in the context of the subject area to reveal problems related to students' research focus within the scope of the "Our Food" unit. The activities were enriched with improvisation studies, including case studies related to acquisitions in the "Our

Food" unit. In this way, students were allowed to observe the problems related to the research focus and the solutions they would develop for these problems in the classroom environment. In this direction, a 6-week lesson plan was prepared within the scope of the "Our Food" unit for the theory of multiple intelligences.

During the implementation process, a 6-week lesson plan prepared within the scope of the "Our Food" unit of the fourth-grade Science course of primary school was applied. The plans were implemented in the classroom environment in the autumn of the 2022-2023 academic year. After each implementation, the students were asked to complete weekly evaluation forms. The weekly evaluation forms developed by the researcher contain questions requiring students to reflect within the scope of the subject content at the end of the lesson. Students completed these forms at the end of the lesson. During the implementation, the researcher conducted a process evaluation through researcher diaries and observation forms, and the process evaluation was supported by semi structured interviews conducted at the end of the implementation.

Data Collection Tools

During the research process, qualitative data collection tools were used. Information about these data collection tools is given below.

Researcher Diaries

Writing researcher diaries has a vital role in the qualitative research process. Researcher diaries are an auxiliary tool in the data analysis from the beginning to the end of the research process. The notes were kept in a diary format during the research to help the researcher in the analysis process and provide a connection between concrete data and theoretical ideas (Corbin & Strauss, 1998, 2008; Charmaz, 2006; Charmaz & Belgrave, 2012). In this direction, researcher diaries were kept by the researcher within the scope of the research.

Observation

Observation, used to describe in detail the behaviors that occur in any environment, has an essential place in educational research. In educational and other academic research, studies are conducted on motor movement, verbal behavior, physiological response, and nonverbal behavior by making observations (Gündoğdu, 2012). Within the scope of the research, camera recordings and observation forms were used during the observation process. A video camera was used to record the application process. The records obtained with the video camera helped to observe the in-class activities carried out by the students during the implementation process. Apart from in-class activities, video recordings were also used to observe the activities carried out by the students at home.

Evaluation Forms

Evaluation forms are data collection tools used to reveal the current status of individuals related to the research process. In this context, at the end of each application in the study, students were asked to fill out evaluation forms

to test their knowledge, develop products for evaluation related to the application, and subjectively evaluate the experience they gained due to the application. Evaluation forms were prepared separately for each application in the subject context.

Student Products

Student products are frequently used in the evaluation phase in education, as they allow teachers, students, and parents to provide first-hand data about students that are reliable and dynamic (De Fina, 1992; Asturias, 1994; Micklo, 1997; Adams, 1998). In this vein, the weekly programs prepared within the scope of the research were designed in a format where students could exhibit the products they created related to their in-class studies. The researcher then collected and evaluated these products.

Semi-structured Interviews

Patton (2014) emphasizes the importance of interviews in revealing people's feelings, thoughts, and intentions that we cannot observe directly and in determining people's perspectives on a subject. The interviews revealed a mutual and interactive communication process carried out by posing and answering questions in line with a predetermined purpose (Stewart & Cash, 1985, cited in Yıldırım & Şimşek, 2008). Semi-structured interviews reveal a technique in which the researchers prepare the questions they plan to ask. However, researchers can change the flow of interviews by directing different questions that vary depending on the interview process or obtaining more detailed answers from the individuals to whom the questions are directed (Türnüklü, 2000). The continuation of Semi-structured interviews based on previously prepared interview questions enables Semi-structured interviews to reveal more systematic and comparable information (Yıldırım & Şimşek, 2008). In this direction, interviews were conducted through a semi-structured interview form" prepared by the researcher.

Data Collection and Analysis

Data analysis can be defined as the process of exporting the meaning of the data to answer the research questions. Transferring the meaning of the data is a process of interpretation that combines, reduces, and interprets what the participants say with what the researcher sees and reads (Merriam, 2015). Qualitative data were used to seek solutions to the problems in the scope of the research. These data were collected with the participants from the school where the study was carried out in the autumn semester of the 2022-2023 academic year with the activities carried out in the classroom environment within the scope of the Our Foods unit in the primary school fourth-grade science course program and the data collection tools used within the scope of the research. The "content analysis" method was used to analyze the collected data. Content analysis is a data analysis method used to analyze written, verbal, and visual communication (Cole, 1988). Content analysis is an analysis method that can produce reproducible and valid results to comprehend texts and provide information from texts (Krippendorff, 1980).

The data obtained within the scope of the research were analyzed and interpreted using the microanalysis method. In this method, the data are evaluated by reading the data line by line to the finest detail (Corbin & Strauss, 1998).

In this context, the data were first divided into sections containing meaning; the conceptual meaning of each section was analyzed, and the sections were named and coded. After this stage, the thematic coding stage was started to reveal the findings. In the thematic coding phase, the data were re-evaluated to determine the similarities and differences between the codes. The coding process was completed by categorizing the codes and identifying similar and different situations between the codes. In this vein, the data defined through the reorganized codes were used to explain the findings.

Validity and Reliability of the Study

The concepts of validity and reliability are fundamental in scientific research. The concepts of validity and reliability in quantitative research are expressed by the concepts of "credibility", "transferability", "consistency", and "confirmability" in qualitative research due to the nature of the study (Guba & Lincoln, 1994, Patton, 2014; Creswell, 2017; Yıldırım & Şimşek, 2008). The studies conducted to ensure this research's credibility, transferability, consistency, and confirmability are described below.

Credibility

In qualitative research, internal validity is expressed by the concept of credibility. In action research, methods such as "long-term interaction", "deep-focused data collection", "data triangulation", "expert review", and "participant confirmation" are used to ensure the credibility of the research (Lincoln & Guba, 1985; Guba & Lincoln, 1994; Merriam, 1998). Before the research, the researcher interacted with the school's cultural environment, students, teachers, and administrators, where the study was conducted for a long time. The researcher also kept researcher diaries and observation forms throughout the research to increase the depth of the data collected. In addition, semi-structured interviews, evaluation forms and student products were utilized to triangulate the data. In the evaluation of the approach to data analysis, the researcher consulted the expert reviews of the thesis advisor, the members of the thesis monitoring committee and the teachers working in the school where the application took place and shared the data obtained as a result of the application with the participants and received participant confirmation regarding the accuracy of the data.

Transferability

The concept of transferability expresses external validity in qualitative research. It is impossible to generalize the results obtained in such studies, but these results should be transferable to similar situations (Erlandson et al., 1993). In this regard, the features related to transferability were emphasized to ensure the study's external validity. The most important feature used to provide the transferability of the results in action research is a detailed description (Yıldırım & Şimşek, 2008). To ensure this, first, the lesson plans prepared within the scope of the study should be in an order that all classroom teachers can apply. In the prepared lesson plans, basic information about the activities to be carried out was first given, and then this information was elaborated. The activities were linked to the subjects, concepts, acquisitions, and explanations in the curriculum, and it was ensured that they could be used in the classroom environment within the practice program. Learning-teaching methods and

techniques, resources, measurement and evaluation and associations with other courses were also emphasized, and a holistic lesson plan was presented. In addition, the data collection tools used within the scope of the research, the findings obtained, and the tables and graphs prepared in connection with them are described in detail in a way that supports the transferability feature.

Consistency

The concept of consistency expresses internal reliability in qualitative research. However, in qualitative research, different measurements are not expected to yield the same result each time. For this reason, consistent results in action research, such as the coding that the outside eye and the researcher find daily, provide consistency (Ceylan, 2021). In this vein, the coding carried out during the research was carried out by two different coders to contribute to consistency. The data collection tools used within the scope of the study were prepared under the supervision of the thesis advisor and the members of the thesis monitoring committee, and the opinions of expert classroom teachers were also consulted in this process.

Verifiability

The concept of confirmability expresses external reliability in qualitative research. While data are expected to be collected and presented objectively in quantitative research, this cannot be achieved in qualitative research. In action research, data sources should be revealed and logically explainable when necessary (Ceylan, 2021). The researcher demonstrated a consistent and unbiased approach during the data collection and analysis. However, to ensure confirmability, the data obtained during the research were regularly examined and evaluated by the thesis advisor and members of the thesis monitoring committee. In this process, the aim was to strengthen confirmability by applying the opinions of expert classroom teachers.

Results

Process Dimension Theme

In this research, seven subthemes were revealed within the scope of the process dimension. These subthemes are "The relationship between living life and nutrient contents", "The presence of water and minerals in all foods", "The importance of freshness and naturalness of foods for a healthy life", "Human health and balanced nutrition", "The negative effects of alcohol and cigarette use on human health", "Taking responsibility to reduce smoking in the immediate environment" and "Multiple intelligence theory-based teaching processes".

Every week, practices were carried out within the scope of these subthemes. Within the practices, activities were carried out within the lesson plans prepared for the theory of multiple intelligences. Each prepared activity used various skills for a different intelligence field. Students' behaviors were recorded during these activities, and observation activities were carried out. In addition, continuous interviews were conducted with the students, and the process was followed from the students' point of view.

In this context, the students were asked to compare the activities carried out during the unit with those they performed in other courses. All students revealed differences between the activities in the science course and the activities in different courses. What the students named Büşra, Mehmet, Eda and Deniz, who responded to the question, said about this issue is given below. It was observed that some students associated differences in teaching the lessons with course achievement. Again, some students related the differences in the courses' learning to their interests and attitudes towards the courses.

The students who responded to the question stated that previous science and other courses were taught using traditional processes. For this reason, they revealed that science courses taught with activities based on multiple intelligences differ from different courses. They stated that this difference affected their course achievement and attitudes towards the course. In this vein, conducting science courses with activities based on multiple intelligences positively impacts students' academic achievement and attitudes towards the course in the context of their self-evaluations.

The students were asked whether the application process carried out within the scope of the science course affected their other courses. Some of the students who answered the question stated that they applied the new methods and techniques they learned within the scope of the application in their other courses. Some students also evaluated the question regarding attitude and stated that they participated more in similar activities in other courses. A significant portion of the students who answered the question evaluated the question in terms of activities. It stated that activities identical to those in the science course were not carried out in other courses. In this vein, students' expectations about activities in other courses are essential regarding their attitudes towards other courses. For this reason, the activities carried out during the implementation positively affected the students' attitudes in the science course, unlike other courses. Still, this effect was not observed in other courses due to the continued use of traditional teaching methods. This positive change in student attitudes could not be transferred to other courses.

In addition, according to the classroom teacher's evaluation, the lesson plans within the application's scope are appropriate and can help students acquire the relevant outcomes. The findings obtained from the interviews conducted after the implementation process are in parallel with those obtained during the implementation process. In this direction, students have cognitive gains related to the subject with the application process.

The "Process Dimension Theme" revealed in the research process was analyzed under seven subthemes. In this vein, "The relationship between living life and nutrient contents", "The presence of water and minerals in all foods", "The importance of freshness and naturalness of foods for a healthy life", "Human health and balanced nutrition", and "The negative effects of alcohol and smoking on human health". According to the findings obtained within the scope of the subthemes of "Assuming responsibility for reducing smoking in the immediate environment" and "Multiple intelligence theory-based teaching process", it was revealed that the lesson plans prepared within the scope of the research were appropriate lesson plans that could be used to provide students with achievements within the scope of the "Our Food" unit, which is among the fourth-grade units of the primary school science course, that the students did not have problems in the implementation of the teaching methods and techniques and activity processes within the scope of the activities and that the adaptation process was short; it

was revealed that the students adopted the application process and the teaching process as a whole, and in this direction, their course achievement for the unit achievements was high.

Cognitive Dimension Theme

This research revealed two subthemes within the cognitive dimension: "Understanding, comprehension, and academic success" and "Effective learning."

Understanding, Comprehension and Academic Success

The findings obtained during the research's implementation period showed that the students improved cognitive comprehension and academic achievement during the activities. The evaluation activities during the implementation period showed that the students understood the subjects better, comprehended the information and achieved academic success.

In the research, concept maps related to the concepts discussed in the lesson were created with the students after the practices within the scope of the subthemes "The relationship between living life and nutrient contents", "The presence of water and minerals in all foods", "The importance of freshness and naturalness of foods for a healthy life", "Human health and balanced nutrition" and "Taking responsibility to reduce smoking in the immediate environment". Then, evaluation forms were distributed to the students. The students answered questions related to the subject on the front side of the evaluation forms. Accordingly, it was observed that almost all of the students gave correct and satisfactory answers to the questions related to the subjects. When the answers given to the evaluation forms are evaluated, the activities carried out positively affect the students' understanding of the subjects and concepts explained in the lesson and their success.

In the interviews conducted with the parents after the implementation, the parents were asked how they thought that the science course taught to their children affected their success in the course. When the parents' answers are evaluated, the students' course achievement increases in a way that the parents can observe in addition to using measurement tools such as concept maps, evaluation forms and student products. The classroom teacher, to whom the same question was directed, also stated that he observed that the implementation increased the students' academic achievement.

Effective Learning

In addition to the findings obtained during the implementation period of the research, semi-structured interviews with the students showed that the students realized effective learning. Within the scope of the six-week application, the students were asked to convey what was done about the activities carried out in the lessons and the teaching process. Most students answered this question in line with the relevant unit acquisitions. When the students' answers were evaluated, they understood that they mostly learned the relevant unit outcomes. In this direction, the activities based on multiple intelligences within the scope of the application enabled students to

learn effectively. The question of how the activities with the students affected their learning of the subjects within the scope of the "Our Food" unit was asked. All students stated that the science lessons taught with activities based on multiple intelligences in the 6-week period positively affected their learning within the scope of the related unit.

Affective Dimension Theme

In the present study, four subthemes were identified within the affective dimension. These subthemes are "being happy, enjoying, having fun", "feeling excited, participating in the lesson willingly", "developing self-confidence" and "developing self-efficacy perception".

Being Happy, Enjoying, Having Fun

In the researcher diaries about the implementation process, the students said they had much fun in the lessons. The students' statements that they were happy, enjoyed, and fun about the application were evaluated within the scope of the activities carried out during the implementation. The students stated that they enjoyed and had much fun both in in-class activities and outside the classroom.

To evaluate this issue in a more in-depth manner, semi-structured interviews were conducted with the students after the implementation. In this direction, the students who participated in the application were asked what they thought about the Science lesson carried out together during the six weeks. When the answers given by the students were evaluated, all of the students had positive opinions about the application process. When the answers given by the students were assessed, it can be said that the activities based on multiple intelligences attracted the attention of the students in the lessons, and they enjoyed performing these activities; however, the students generally found it more beneficial to be taught with activities, and as a result of this benefit, they thought that their achievement in the course and their attitudes towards the course was positively affected. When the students' responses were evaluated in general, all of the students used positive keywords such as "fun", "beautiful", "enjoyable", and "instructive" for the application process. In this vein, lesson plans with activities based on multiple intelligences have given students positive attitudes towards the course and school. The findings obtained from the interviews conducted after the implementation process are in parallel with those obtained during the implementation process. In this vein, the students were happy about the implementation process, enjoyed the implementation process and had fun during the implementation process.

Feeling Excitement, Participating in the Lesson Willingly

In the researcher diaries about the implementation process, the students' interest and participation in the lesson are high. The students' statements about their excitement about the application and their willing participation were evaluated within the scope of the activities carried out during the implementation. Students' interest in the course increased continuously during implementation.

The practices, in line with the observation activities, carried out during the implementation and the dialogues established with the students, effectively increased the students' excitement about the lesson and their willingness to participate. After the implementation, semi-structured interviews were conducted with students, parents, and the classroom teacher to evaluate this issue further.

The parents of the students who participated in the application were asked to indicate whether their children shared anything about the application process carried out in science lessons. All parents stated that their children shared the process they went through in the science course with their families at home. When the answers given by the parents were evaluated, the students continuously shared the processes carried out within the scope of the application with their families with positive words and mostly of their own volition. This situation can be seen as an indicator of students' positive attitudes towards the course. The parents' evaluations of how the six-week implementation affected their children's interest and attitudes towards the science course revealed that the course implementation positively impacted the students' attitudes towards the science course, which the parents also observed.

The teacher of the class where the implementation took place also stated that the six-week implementation carried out with activities based on multiple intelligences positively affected students' attitudes towards the course. She thought this was due to the activities carried out during the implementation. In line with the opinions of the classroom teacher, it was revealed that the science application carried out with activities based on multiple intelligences positively affected the students' interest and attitudes towards the lessons because it allowed them to express themselves in different ways. The responses of the classroom teacher show that the students' attitudes towards the course are positive. Still, they also show that the students have an interest in and a positive attitude towards the activities. The findings from the interviews conducted after the implementation process parallel those obtained during the implementation process. In this direction, the students were excited about the application process and willingly participated.

Gaining Self-confidence

According to the results of the observations made during the implementation, it was understood that some students were worried about making mistakes due to lack of self-confidence. This created an obstacle for the students to put the information they learned about the subject into practice during the activity. During the activities, it was observed that some students took a more active role, and some preferred to keep themselves in the background. As a result of this observation, students were asked to control the activity processes of their friends through peer assessment.

Student observations continued during the control process. Students who lacked self-confidence started actively participating after this change in the activity process. In this vein, multiple intelligences have a self-confidence-enhancing effect on students. In addition, enabling students to express what they learned in different ways through peer assessment was a factor that increased their self-confidence.

Self-efficacy Perception Development

After the activities were carried out within the scope of the application, the students were asked to complete self-evaluation forms prepared to evaluate their learning each week. Within the scope of the form, the students were asked to assess their learning by choosing one of the following options: "I understood", "I understood it well enough to explain it to someone else", "I need to repeat it to understand it better", "I would like a friend to explain it to me individually" or "I would like my teacher to explain it to me individually".

The interviews were conducted with the students in an isolated environment, in line with their responses to the self-evaluation forms they filled out after each application. In this context, the students' responses to the evaluation forms they filled out about the subjects covered in the course during the applications and their reactions to the self-evaluation form were compared after each application.

After the first applications, additional worksheets were given to the students who answered "I need to repeat to understand better" to the self-assessment form. In addition, the answers given to the self-assessment form by the students who answered, "I would like a friend to tell me individually" and "I would like my teacher to tell me individually", were mostly correct. In the interviews conducted in light of this information, it was seen that the student who wanted his friend to explain to him individually liked to study with his friend. In contrast, the students who wished the teacher to explain to them individually preferred this option because they wanted to spend more time with the researcher.

When the answers given by the students to the self-assessment forms after the subsequent applications were evaluated, all of the students preferred the options "I understood" and "I understood well enough to tell someone else". When assessed with the answers given to the evaluation forms, this situation shows that the students objectively revealed their achievements. When the answers given to the self-assessment forms are compared with those of the previous weeks, it can be said that the students are aware of the improvement in their academic achievement.

When the students' responses to the self-assessment forms were evaluated weekly after the intervention, all of the students started to prefer the options "I understood" and "I understood well enough to tell someone else". When this situation is evaluated with the student's responses to the evaluation forms and the application process, the application significantly contributes to assessing students' learning.

The "affective dimension theme" revealed in the research process was analysed under four subthemes. According to the findings obtained within the scope of the subthemes of "being happy, enjoying, having fun", "being excited, participating willingly", "providing self-confidence", and "developing self-efficacy perception", all of the students had positive thoughts about the application process; within the scope of the activities, the students were happy about the application, enjoyed and had fun, were excited about the application process and participated willingly in the lessons and activities in the application process; the activities in the implementation process and the teaching methods and techniques used in the context of the activities had an effect that increased the self-confidence of the

students; as the implementation process continued, the students' self-efficacy perceptions within the scope of the course became more positive.

Skills Dimension Theme

This study analyzed the skills dimension under two subthemes: "associating with daily life" and "communication."

Associating with Daily Life

Within the scope of the research, the processes related to students associating the subjects learned in the course with daily life were evaluated through the application process, lesson observations and interviews. When the answers given by the students to the questions in the evaluation forms during the applications were assessed, it was seen that the answers that they associated the course subjects with their daily lives were intensive. The evaluation carried out within the scope of the activity included the following: "Why Do We Feed? The examples given by the students about the relationship between living life and nutrient content are mostly related to the effects of the foods we eat on our bodies. In this context, students answered why people are fed with examples from their own lives that they are fed to grow and develop and stay healthy. However, the answers reveal that the students adopt the necessity of foods from different food groups for our body's energy needs, weight control and a healthy life.

Communication

The classroom teacher was asked to evaluate which skills the students developed with the activities in the science course during the implementation. It was observed that the classroom teachers especially emphasized communication skills. The classroom teacher stated that apart from communication skills, she also observed that students' skills towards classroom rules increased. In line with the class teacher's evaluations, the application positively affected students' classroom skills, such as communication and harmony.

The "Skills Dimension Theme" revealed in the research process was analyzed under two subthemes. According to the findings obtained within the scope of the "associating with daily life" and "communication" subthemes, the examples given by the students within the scope of the activities and the answers they gave to the questions in the evaluation forms they filled out after the application was related to their daily lives; they associated the course subjects with their daily lives in improvisation activities, including sample events from daily life within the scope of the activities; the students were successful in solving real daily life problems given as homework; and they were able to use the problem-solving skills they acquired by transferring the subjects covered in the course to their daily lives. In addition, the activities had positive effects on students' communication skills.

Problems and Solution Dimension Theme

The research revealed two subthemes within the problems and solutions dimension: "task sharing" and

"willingness to express their thoughts."

Task Sharing

During the implementation, it was observed that all students volunteered to participate in activities that required volunteering. In this direction, the researcher tried to share tasks without discriminating between the students, considering the requirements of the observation activity carried out during the implementation process. In this direction, a routine was established with the progress of the implementation process. In line with this routine, students who want to participate in classroom activities will be assigned a task within specific rankings. In the sequencing, variations were made according to the position of the students' seats in the classroom. For example, they attempted to prevent students' complaints such as "I am always last" or "certain people always start first" by starting from the front row by the window or from the middle row first. Within the scope of the practices carried out in the classroom, first, the students' opinions about the assignments were taken, and then, they were asked to share their suggestions for the solution of the problem with the class. In this process, the researcher participated only as a listener to emphasize the students' thoughts. Other students evaluated the suggestions put forward by the students, and the rules related to task sharing in the activities were determined by the class and recorded in writing. After it was determined that all students agreed on the rules, the applications were carried out.

Willingness to Express Thoughts

During the implementation process, students' willingness to take the floor, participate in discussions and express their thoughts increased. In particular, with the observational studies conducted on the students' affective characteristics, it was concluded that activities involving multiple intelligences increased their willingness to participate in the lesson. In line with this result, almost all of the students showed their willingness to take the floor within the scope of the activities. Although this result is a desired behavioral change, the need for a particular order has emerged to prevent disrupting the activity process of the students' desire to express themselves. In this direction, discussion with the students, such as task sharing, determined these rules. However, it was observed that preventing students from expressing their thoughts, even though it was carried out within the standard rules framework, could adversely affect students' attitudes towards the course. In addition, the fact that the students expressed their thoughts at higher cognitive levels caused the answers they gave to the questions or the comments they put forward in activities such as brainstorming to be longer. This situation was especially prominent in activities based on multiple intelligences, and students gave shorter answers in classical question-answer activities. In this context, the researcher made arrangements in terms of time in the lesson plans to eliminate problems in expressing students' thoughts. After these arrangements, a significant improvement was observed in the problem situation.

The "Problems and Solutions Dimension Theme" revealed in the research process was analyzed under two subthemes. According to the findings obtained within the scope of the "task sharing" and "willingness to express their thoughts" subthemes, it was observed that students wanted to take part in all activities within the scope of the course because their interest in the course was high in the lessons carried out with multiple intelligence-based

activities. This situation caused the students to be more sensitive about task sharing in the activity processes and demanded that task sharing be performed relatively and transparently. However, although the increase in students' desire to take the floor, participate in discussions and express their thoughts is a desirable behavioral change, it has been revealed that these requests need to be placed in a particular order to avoid disrupting the activity process by considering the affective characteristics of the students.

Discussion and Conclusion

In the teaching, process carried out with activities based on multiple intelligences in the science course, a six-week teaching process was planned by preparing activities for different areas of intelligence within the scope of the "Our Food" unit, which is among the fourth-grade units of primary school. As a result of the data obtained from the course recordings made in this process, student products, evaluation and self-evaluation forms, and interviews with students, parents, and classroom teachers, five themes were revealed in the research: "Process dimension", "Cognitive dimension", "Affective dimension", "Skills dimension" and "Problems and solutions dimension".

Process Dimension: In this dimension, "The relationship between living life and nutrient contents", "The presence of water and minerals in all nutrients", "The importance of freshness and naturalness of nutrients for a healthy life", "Human health and balanced nutrition", "The negative effects of alcohol and cigarette use on human health" and "Taking responsibility for reducing smoking in the immediate environment" were found in the context of "Multiple Intelligence Theory-based teaching process". In this context, it was concluded that the lesson plans prepared are appropriate lessons that can help students achieve the relevant outcomes.

Cognitive Dimension: In this dimension, the themes of "understanding, comprehension, academic achievement" and "effective learning" were identified. In this context, it was concluded that the students understood the topics related to the unit, comprehended the information within the scope of the unit and acquired information in the context of the unit; therefore, their academic achievement increased.

Affective Dimension: Within the scope of this dimension, the themes of "being happy, enjoying, having fun", "feeling excitement, willing to participate in the activities", "gaining self-confidence", and "developing self-efficacy perception" were identified. In this context, it was understood that the students enjoyed the activities and were happy during the activities, participated willingly in the science course and activities, were excited about the application, gained self-confidence and developed self-efficacy perceptions within the scope of the activities carried out in the applications.

Skills Dimension: Within the scope of this dimension, the themes of "Associating with daily life" and "Communicating" were identified. In this context, it was concluded that students associated the subjects they learned with their daily lives, applied them in their daily lives, and gained the ability to communicate during the activities.

Problems and Solutions Dimension: In this context, the themes of "task sharing" and "willingness to express their thoughts" were identified. In this context, it was concluded that the activities carried out within the scope of the application attracted the attention of the students and increased their desire to participate in the lesson; this situation led the students to want to take part in every activity carried out, and the students emphasized concepts such as right and justice in issues related to task sharing. They wanted to speak more and express their thoughts in activities based on multiple intelligences.

According to this research, multiple intelligence theory applications in primary school science courses increase students' academic achievement in science courses. The results of many domestic and foreign studies also support this finding. Köroğlu et al. (2001) concluded that multiple intelligence theory applications significantly positively affected students' academic achievement in mathematics courses in their research on "measurements" among the subjects of sixth-grade mathematics courses. Balım et al. (2004) concluded that multiple intelligence theory applications within the scope of a science course for primary school eighth-grade students revealed a significant difference in favor of the experimental group regarding students' academic achievement in science courses compared to the traditional teaching process. Gürçay and Eryılmaz (2005) concluded in their research conducted for secondary school ninth-grade students within the scope of the Physics course that the teaching process based on the theory of multiple intelligences caused a significant difference in favor of the experimental group in terms of students' academic achievement in the Physics course compared to the traditional teaching process. Hamurlu (2007) conducted a study of ninth-grade secondary school students within the scope of an English course and concluded that teaching based on the theory of multiple intelligences increased students' achievement in the course. Işık et al. (2007) concluded that multiple intelligence-supported complex learning methods within the scope of a primary school third-grade mathematics course caused a significant difference in favor of the experimental group regarding students' academic achievement in mathematics courses. Yıldırım and Tarım (2008) concluded that multiple intelligence theory-supported teaching methods within the scope of mathematics courses for fifth-grade primary school students had a positive effect on students' course achievement and retention. Alaz (2009) found that the use of methods and techniques appropriate to the theory of multiple intelligences in the course revealed a significant difference in favor of the experimental group in terms of the academic achievement of the students compared to the lecture and question-answer methods. In his research conducted for sixth-grade primary school students within the scope of the "Matter and Heat" unit of science courses, Altınsoy (2011) concluded that teaching based on the theory of multiple intelligences positively affects students' course achievement compared to current teaching methods and techniques. Karabay et al. (2011), in their research in which 176 master's and doctoral thesis studies based on the theory of multiple intelligences in Türkiye were evaluated, concluded that multiple intelligence applications increased academic achievement in almost all of the studies examined. Gün (2012), in his research conducted within the scope of a social studies course for fifth-grade primary school students, concluded that the cascading teaching approach supported by the theory of multiple intelligences revealed a significant difference in favor of the experimental group in increasing students' academic achievement compared to the current program. Aydın (2015), in his research on the subject of "work analysis", which is among the subjects of the visual arts course for eighth-grade students in primary school, concluded that teaching based on the theory of multiple intelligences positively affected the academic achievement of students compared to teaching carried out with activities based on the practice program. Gülfirat Kıbrız (2016) concluded

that multiple intelligence theory applications had a positive effect on students' academic achievement in her research conducted within the scope of the "production, distribution and consumption" learning area in the fourth-grade social studies course in primary school. Şahan (2018) concluded in his research conducted within the scope of the Science course for primary school eighth-grade students that students who studied with activities based on the theory of multiple intelligences supported teaching model revealed a significant difference in academic achievement in favor of the experimental group compared to students who continued their education with traditional teaching processes. Kural (2020), in his meta-analysis study conducted within the scope of 44 studies published between 2006 and 2019, concluded that teaching processes based on the theory of multiple intelligences positively affect students' academic achievement compared to teaching processes in practice in official programs. Torreon and Sumayang (2021) concluded that multiple intelligence theory-based activities positively impacted the academic achievement of primary school sixth-grade students. Efe and Bakçı (2022) concluded that there is a significant relationship between multiple intelligence applications and science achievement as a result of their meta-synthesis research on 42 studies consisting of 10 master's theses, 1 doctoral thesis and 31 research articles based on multiple intelligence theory in Türkiye.

According to the results of studies in the literature, teaching based on the theory of multiple intelligences and using activities based on multiple intelligences in lessons positively affect students' academic achievement compared to methods and activities in traditional and existing programs. This situation supports the results of the research. In addition, this typical result obtained in studies carried out in different courses, units, and various grade levels and age groups revealed the importance of using teaching and activities based on the theory of multiple intelligences for all courses and all grade levels. In addition, because applying different methods, techniques, and approaches for student achievement supported by the theory of multiple intelligences significantly increases the effects of these methods, techniques, and strategies on academic achievement, they are also considered necessary.

According to another result of the study, applying multiple intelligence theory in primary school science courses positively affected students' interest in and attitudes towards science courses. Again, the results of many domestic and foreign studies support this finding. Bümen (2001) concluded that multiple intelligence theory applications supported by a review strategy caused a significant difference in favor of the experimental group in student attitudes in the research he conducted within the scope of the eighth-grade Citizenship and Human Rights course. Balım et al. (2004) concluded that multiple intelligence theory applications within the scope of a science course for eighth-grade primary school students increased students' interest in the course and caused them to exhibit positive behaviors. Hamurlu (2007) concluded that teaching based on the theory of multiple intelligences positively affected students' attitudes towards the course in the research he conducted within the scope of the English course for secondary school ninth-grade students. Üngören (2007) conducted a study of seventh-grade elementary school students within the scope of the "Force, Motion and Energy" unit of the science course and found that the activities prepared based on the theory of multiple intelligences positively affected students' attitudes towards the course. Yıldırım and Tarım (2008) concluded that multiple intelligence theory-supported teaching methods increased students' interest in courses within the scope of mathematics courses for fifth-grade primary school students. Kutluca et al. (2009) concluded that the activities prepared based on the theory of multiple intelligences positively affected students' attitudes towards the course in their research on "polygons"

among the subjects of the seventh-grade mathematics course. Beyazıt (2009), in his research conducted within the scope of a sixth-grade science course in primary school, revealed that activities based on the theory of multiple intelligences increased students' attitudes towards the course compared to traditional activities. Atik (2010) conducted a study of fourth-grade primary school students within the scope of a science course and concluded that the course carried out with activities based on the theory of multiple intelligences positively affected students' behavior of participating in classroom activities and attitudes towards the course. Baş (2010) conducted a study of sixth-grade primary school students within the scope of a foreign language course and concluded that teaching based on the theory of multiple intelligences positively affected students' attitudes towards the course. Altınsoy (2011) conducted a study of sixth-grade primary school students within the scope of the "Matter and Heat" unit of the science course and concluded that teaching based on the theory of multiple intelligences positively affected students' attitudes towards the course compared to the current teaching methods and techniques. Karabay et al. (2011), in their research in which 176 master's and doctoral thesis studies based on the theory of multiple intelligences in Türkiye were evaluated, concluded that the studies that concluded that multiple intelligence applications had a positive effect on students' attitudes were intensive. Gün (2012), in his research conducted within the scope of a social studies course for fifth-grade primary school students, concluded that the cascading teaching approach supported by the theory of multiple intelligences revealed a significant difference in favor of the experimental group in increasing students' attitudes and interests towards the course. Aydın (2015), in his research on the subject of "artefact analysis", which is among the subjects of visual arts courses for primary school eighth-grade students, concluded that teaching based on the theory of multiple intelligences positively affects students' attitudes towards the course. Kural (2020), in his meta-analysis study conducted within the scope of 25 studies published between 2006 and 2019, concluded that teaching processes based on the theory of multiple intelligences positively affect students' academic achievement compared to teaching processes in practice in official programs. Nasri et al. (2021) concluded in their study conducted for primary school eighth-grade students that the multiple intelligence theory-oriented STEM program positively affected students' attitudes towards the course compared to the traditional STEM program. Efe and Bakçı (2022), as a result of their meta-synthesis research on 42 studies consisting of 10 master's theses, 1 doctoral thesis and 31 research articles based on the theory of multiple intelligences in Türkiye, concluded that in-class applications with activities prepared with the theory of multiple intelligences positively increased the attitude towards science.

According to the results of the literature, activities based on the theory of multiple intelligences positively affect students' interest and attitudes towards lessons. This situation supports the research's results. However, this typical result obtained in the studies carried out in different courses and units, as well as in various grade levels and age groups, reveals the importance of including more activities based on the theory of multiple intelligences in all courses and all grade levels in the curriculum.

Among the other researchers reached in the literature, Talbot (2004) concluded in his research on foreign language teaching that activities based on the theory of multiple intelligences positively improve students' foreign language skills compared to traditional methods. Lin and Xie (2009) concluded that multiple intelligence theory applications significantly favored the experimental group in students' development of an actual design project compared to traditional teaching practices. Çayır (2011) concluded that multiple intelligence theory applications

positively affected the development of students' reading comprehension and writing skills in research conducted within the scope of a primary school fourth-grade Turkish course. Torreon and Sumayang (2021) researched sixth-grade primary school students and concluded that multiple intelligence theory-based activities improve students' abilities and skills in many areas.

According to the results of the literature, activities based on the theory of multiple intelligences contribute to students' developing different skills. This study saw that activities based on multiple intelligences theory contributed to the learning products. In this context, it was understood that activities based on multiple intelligences theory contributed to verbal knowledge, mental skills, and attitudes.

Notes

This article is derived from Muhammet Fatih Doğan's PhD dissertation entitled "Applications of Multiple Intelligence Theory in Primary School Science Course: An Action Research", conducted under the supervision of Mehmet Gültekin.

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