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Problem Areas in the Anthropocene (The Human Age) and Their Reflections in Primary, Middle and High School Curricula

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Abstract

The current study aims to determine the extent to which current issues and anticipated problems in the Anthropocene are addressed in the learning outcomes of the curricula prepared by the Ministry of National Education (MoNE) for primary, middle, and high school levels (Anatolian High Schools). In addition, the study aims to describe the current state of the learning outcomes in these curricula in terms of guiding learners towards practical applications, developing original solutions, and actively participating in solving the problems humanity faces today and will face in the future in line with the concept of the Anthropocene and problem-centred curriculum designs. To do so, the study employed the content analysis method and analyzed the curricula of required courses at primary, middle and high school (Anatolian High Schools) levels that were in use in 2018. In the analysis of the data, categories based on various problem areas were developed, and the distribution and frequency of the curriculum outcomes across these categories were determined. Moreover, in order to explore the presence of problem areas in the learning outcomes, the latter were analyzed according to the criteria determined in line with problem-centred curriculum designs. It was found that the problem areas are addressed in the learning outcomes of middle school curricula to the greatest extent, followed by the learning outcomes in primary and high school (Anatolian High School) curricula. As the education levels progress, a consistent increase in the number of outcomes that fully address the problem areas is not observed. Among the outcomes at all levels of primary, middle and high school education (Anatolian High Schools), the most frequently addressed problem areas are *Traditions and culture at risk* and *Artificial intelligence and new technologies*. The problem areas that are least frequently addressed in the outcomes at all three levels are *Lack of decent work and opportunities* and *Migration*. The results suggest that various problem areas in the Anthropocene that affect the nature and humanity today and tomorrow should be

Keywords

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included in a balanced manner across all education levels and in the curricula of required courses suitable to all age groups. It is also recommended that curricula be designed in such a way as to train individuals who can foresee future problems, produce solutions to them and subsequently implement these solutions.

Introduction

The term "Anthropocene" or "Human Age" or "Age of Humans" was coined and popularized by the Dutch atmospheric chemist Paul Crutzen (Oldroyd, 2018). In 2000, Crutzen and biologist Eugene F. Stoermer coined the term "Anthropocene" for the current geological epoch to emphasize the central role of humanity in both geology and ecology. Although they first introduced the notion of the Anthropocene in the International Geosphere-Biosphere Programme (IGBP) bulletin (Crutzen & Stoermer, 2000), Stoermer had begun using the term Anthropocene informally in the 1980s. However, it was Nobel laurate Paul J. Crutzen, known for his work on ozone depletion that popularized the term (Trischler, 2016). When Crutzen presented his hypothesis in his article "The Geology of Humanity" in *Nature*, he suggested that humans had become a powerful geological force. To properly define this, he stated that it was necessary to define a new geological epoch and used the term "Anthropocene" (Crutzen, 2002). The word consists of the root "anthropo", meaning "human", with the standard suffix "-cene" for "age" in geological time. The Anthropocene is distinguished as a new age after or within the Holocene (New Age), which began with the end of the last glacial period approximately 10,000 years ago (CSIRO, IGBP, IHDB, SRC, & SEI, 2012).

Crutzen (2002) argues that humanity will continue to be a major environmental force for thousands of years to come unless a global catastrophe (an asteroid strike, a world war, or a pandemic) occurs. As for the onset of the "Anthropocene", Crutzen and Stoermer, although aware that alternative suggestions could be made, suggest the latter half of the 18th century, stating that the global effects of human activities have become increasingly and clearly noticeable over the last two hundred years (Crutzen & Stoermer, 2000). More specifically, Crutzen (2002) proposes the Industrial Revolution and James Watt's invention of the steam engine in 1784 as the turning points for the Anthropocene. Steffen, Broadgate, Deutsch, Gaffney, and Ludwig (2015) also support the idea that the Industrial Revolution is the starting point of the Anthropocene, based on the use of fossil fuel energy three centuries ago.

Crutzen (2002) states that an awareness of the global transformative role of humans began to be expressed in the early 1800s. In the 1990s, Turner II, Clark, Kates, Richards, Mathews, and Meyer (1993) described this age as "a world transformed by human action" in their work "The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere over the Past 300 Years". The last big idea to have emerge in the history of the Anthropocene is considered to be "sustainability", which outlines how the world should be used by humans (Kates, 2001).

When the symptoms of the Anthropocene (global warming, environmental pollution, drought, disasters, etc.) became impossible to ignore, the concerns felt by the public led to the mobilization of organizations such as the Intergovernmental Panel on Climate Change (IPCC). Also, the United Nations Framework Convention on Climate Change (Paris Agreement) was adopted in Paris on 22 April 2016 with the signature of 196 countries to come into effect as of 4 November 2016 (Uğur, 2021). During the Anthropocene, human activities have rapidly exceeded the carrying capacity of the earth. Climate change is now seen as the most pervasive existential threat and challenge emerging in this age (Oldroyd, 2018; Rockström, 2017). Other similar threats of our times include rising sea levels, air, water and soil pollution, depletion of fossil energy, minerals, fisheries, forests, soil and water, loss of biodiversity and global diseases (Oldroyd, 2018). According to Dukes (2020), the coronavirus pandemic, one of the

deadliest threats to humanity, has led to a more widespread acceptance of the Anthropocene historically and geologically.

Some scientists worry that naming a new geological epoch after "humans" would further encourage the already widespread anthropocentrism and diminish respect for the nature. Also, as those who are truly responsible for the environmental problems of the modern age are certain groups of people in industrial countries, it is believed that it is not fair to refer to all of humanity in the name of this age. On the other hand, it is stated that the Anthropocene is not about definitively endorsing the duality of nature and culture which has developed throughout the modern era, but about critically questioning the anthropocentrism that has emerged as a result (Leinfelder, 2013; Lloro-Bidart, 2015; Trischler, 2016). Looking at the Anthropocene from an optimistic perspective, Asafu-Adjave et al. (2015) stated that the evolving social, economic and technological powers of humans can be used to make life better for humans, stabilize the climate and protect the natural world. They see democracy, tolerance and pluralism as the keys to achieving a perfect Human Age. They emphasize that the discussions about our era are actually related to the most fundamental questions of societies (what will the future be like, how should we work and live, what will be the role of technology in our lives? etc.).

Today, the debate about the term Anthropocene, introduced by Crutzen and Stoermer, has gone beyond the scientific fields of biology and geology. As some scholars have complained, the term has become part of popular culture. When the term Anthropocene attracted media attention, it became a culturally debated topic and blurred the boundaries between science and society. In this context, especially political science, anthropology, sociology and philosophy have been the fields where the Anthropocene has been most intensely discussed as a cultural concept. The Anthropocene has also established itself as a powerful tool in the field of education, particularly for testing new methods of environmental education (Leinfelder, 2013; Lloro-Bidart, 2015; Trischler, 2016).

It is emphasized that eliminating negative human impact on the world should be a top priority in education systems in the Anthropocene. It is not easy for educators to cope with such expectations and problems as the collapse of human civilization, which has been predicted since the 1970s and is expected to happen in the near future; the drive to acquire wealth and power that could lead to the self-destruction of societies; the destruction of nature; and the misconception that there are technical solutions to extremely complex and rapidly growing social and ecological problems. Therefore, it is emphasized that educational programs suitable for the Anthropocene should be made the central part of education systems in order to prepare humanity for the future. It is stated that curricula should address how humans should relate to the planet to overcome the ecological crisis, how they can better relate to each other (such as promoting win-win cooperation, protecting mutual rights, and fulfilling duties), and how to foster skills that ensure human survival during difficult times, such as self-sufficiency and life skills. Curricula need to be reorganized in ways that pay attention to current and emerging problems facing communities, schools and children, that enable the transfer of past knowledge and practices, and that provide options for collaboratively constructing knowledge and taking action on problems. It is considered important for students to take part in school projects with different stakeholders, to conduct research for the public good and to produce knowledge that will build the future (Brennan, 2017; Oldroyd, 2018).

The effects of the Anthropocene, as noted, present as various global issues. In order to address these issues, international organizations have organized conferences that aim at education as well as the production of reports and action plans such as the United Nations Conference on the Human Environment (United Nations, 1973); UNESCO-UNEP Intergovernmental Conference on Environmental Education) (UNESCO, 1978); 1992 Rio de Janeiro World Summit (United Nations, 1993); Sustainable Development Goals Report (United Nations, 2016); Global Action Programme on Education for Sustainable

Development (UNESCO, 2018); European Union Green Deal (European Commission, 2019); Framework for the Implementation of Education for Sustainable Development (ESD) Beyond 2019 (UNESCO, 2019); Transforming Our World: The 2030 Agenda for Sustainable Development (United Nations, 2015). Within these action plans, the title of "education" is also included and goals for education are expressed. In the field of curriculum and instruction, the Anthropocene and its reflections on education have therefore attracted attention, and most recently, in 2022, the American Association for the Advancement of Curriculum Studies organized a conference titled "Curriculum Studies in the Anthropocene" (AAACS, 2022).

When the problems that the world is experiencing and will continue to do so in the Anthropocene are considered along with the suggestions made for education and curricula, problem-centred designs that focus on both the needs, expectations and problems of the individual and the society seem to be appropriate designs. In addition, it is thought that reconstructionism, chaos theory, complexity theory and open systems concepts (Ornstein & Hunkins, 2018), which are the basis of problem-centred designs, are compatible with the problems identified in the Anthropocene (Dukes, 2020; Oldroyd, 2018; Rockström, 2017; Uğur, 2021) and the suggestions for education systems in this age (Brennan, 2017; Oldroyd, 2018; European Commission, 2019; UNESCO, 2018; United Nations, 2015). In problem-centred program designs, the focus is on the problems experienced by individuals and the society. These designs aim to strengthen cultural traditions as well as address the unmet needs of the society and take social problems into account. In these designs, the organization of the curriculum depends largely on the nature of the problems to be studied (Ornstein & Hunkins, 2018). The aim is for students to solve problems and monitor social dynamics and issues in addition to learning the course topics. However, these are not enough. In addition, learners should be able to direct their thoughts to the future, understand the social consequences and relationships of events, and work constructively and cooperatively towards social development (Varış, 1996). The educational aims of the reconstructionist movement, which is at the core of problem-centred designs, are consistent with the impact of the Anthropocene on the world and the expectations from the education system in this age. The aims of the reconstructionist education movement include encouraging social reform, developing citizenship qualities, developing students' problem-solving capacities, developing awareness of social problems, fostering active participation in the solution of these problems, ensuring peace and happiness, continuity of consistent cultural values, use of the scientific method and critical thinking process, and supporting the adoption of a democratic way of life (Dane, 2022; Sönmez, 2020). The discourses from the fundamental theories of problem-centred designs, such as chaos and complexity theories, are also reflected in the processes of the Anthropocene (Kaçmaz, 2005; Nartgün & Çelik Yılmaz, 2021; Saydam & Kalağan, 2020; Tekel, 2006; Uçar, 2015; Yeşilorman, 2006). Learning is a complex process, and according to chaos theory, the effects of many variables need to be examined in understanding the components of teaching and learning (Davis, Smith, & Leflore, 2007). Likewise, Weichhart (2013) stressed that education is a dynamic system and within this system learning and thinking have non-linear processes. The success of an educational institution also depends on it having complex, rather than linear, feedback networks (Nartgün & Çelik Yılmaz, 2021). The concept of open systems, which is fundamental to problem-centred designs, encompasses complex systems that can possess a structure capable of deviating from the equilibrium (Comfort, 1994). Doll (1993) states that in open systems, the purpose of a program is to transform knowledge. Open systems are dynamic and evolutionary; they evolve through change. Curriculum development should be considered an open system. It should be viewed as a process, a journey, and not a destination (Ornstein & Hunkins, 2018). According to the open systems approach, schools are in constant interaction with their environment and must structure themselves to meet the challenges in the world around them (Lunenburg, 2017).

A review of previous studies in the field of Anthropocene and education shows that a network of researchers, educators, activists, artists and scientists from around the world is working on the Anthropocene (detailed information about this network and its work can be obtained from https://www.anthropocene-curriculum.org). It is stated that this network, established for Anthropocene studies, was born out of the "Anthropocene Program" initiative, which has been reflecting on the ways in which communities around the world understand and respond to the Anthropocene. The "Anthropocene Program" was launched in 2013 as a long-term initiative to research critical knowledge and education in the transition to a new geological epoch dominated by humans. The program was initiated by the House of World Cultures (Haus der Kulturen der Welt (HKW)) and the Max Planck Institute for the History of Science (MPIWG) as part of the "Anthropocene Project" and has developed into a collaborative network encompassing the entire globe. The overarching aim of the "Anthropocene Program" is to support interdisciplinary studies and activate collaboration between research and education. The mission of the program is to establish new forms of education which include various social, scientific and political restructurings (Max Planck Institute for the History of Science, 2023).

Mitchell and Stones (2022) suggested that curricula for the Anthropocene should be interdisciplinary and that ethics and values should be more visible in the curricula. Mitchell and Stones (2022) aimed to take into account issues related to mathematics education in order to see the impact of humans on the world and the Anthropocene. Coles (2019) also aimed to examine issues related to mathematics education in the Anthropocene. In the study, mathematics educators were asked how today's problems could be taken into account in mathematics classes; however, it was emphasized that the participants did not have an answer to this question. Research on the Anthropocene shows that it focuses more on environmental education issues (Benítez, Paredes, Collado-Ruano, Terán, & Ibarra, 2019; Cole & Malone, 2019; Erten & Köseoğlu, 2022; Ghilardi-Lopes, Kremer, & Barradas, 2019; Güngör Cabbar, 2020; Kamacı, 2021; Kopnina, 2014; Kouppanou, 2020; Kuşçuoğlu, 2022; Le Grange, 2019; Lloro-Bidart, 2015; Özdemir, 2021).

Purpose and Significance of the Study

The purpose of the current study is to determine the extent to which current issues and anticipated future problems in the Anthropocene are addressed in the learning outcomes of the curricula prepared by the Ministry of National Education (MoNE) for primary, middle and high school (Anatolian High School) levels. In addition, the study aims to describe the current state of the learning outcomes in these curricula in terms of guiding learners towards practical applications, developing original solutions, and actively participating in solving the problems humanity faces today and will face in the future related to the Anthropocene. More precisely, answers to the following research questions were sought:

1. What is the extent to which current and future problem areas are addressed in the learning outcomes of primary school curricula?
    1.1. How are the current and future problem areas identified in the learning outcomes of primary school curricula distributed across courses?
2. What is the extent to which current and future problem areas are addressed in the learning outcomes of middle school curricula?
    2.1. How are the current and future problem areas identified in the learning outcomes of middle school curricula distributed across courses?
3. What is the extent to which current and future problem areas are addressed in the learning outcomes of high school curricula (Anatolian High Schools)?
    3.1. How are the current and future problem areas identified in the learning outcomes of high school curricula (Anatolian High Schools) distributed across courses?

4. What is the distribution of the problem areas considered to be fully addressed in the learning outcomes of the curricula across all the levels?

Harari (2016) emphasized that it would be more appropriate to refer to the last 70 thousand years of the world as the Human Age, that although ecological revolutions and mass extinctions have occurred in every era, none of these occurred because of a particular species, and that humans have become the most important agents of change in global ecology. The UNESCO International Commission on the Future of Education (2021a) has argued that the current ways of organizing education and opportunities around the world are not sufficient to create peaceful societies and a liveable planet. It has been suggested that the question that should be asked for curricula should be changed from "How should curricula support economic growth?" to "How can curricula change the world for the better?" and that curricula should be structured accordingly (Mitchell & Stones, 2022).

In the current study, it is deemed important to determine how and to what extent current and future problems encountered at national and international levels in the Anthropocene are addressed in the curricula of the Ministry of National Education. The current study is noteworthy as it highlights the importance of considering both current and anticipated issues, aiming to contribute to the field by emphasizing the need for curricula that prepare the new generation for future challenges. The study is also important as it provides recommendations for incorporating the Anthropocene and problem-centred curriculum designs into curricula. In addition, comprehensive findings and results have been obtained by including the curricula of required courses at all levels in compulsory education and by focusing on all of the basic current and future problem areas in the Anthropocene. In this way, the study has been able to provide guidance for the curricula of all levels from primary to high school.

Method

The current study employed the content analysis method. Content analysis is a research method that uses a series of processes to draw valid inferences or conclusions from the text being analyzed (Weber, 1990). Content analysis is a type of research in which researchers analyze document content and communication patterns. Three of the most common types of content analysis research are: content analysis based on frequency determination, qualitative or out-of-frequency content analysis, and content analysis aimed at identifying the combination of two or more unit categories (Wallen & Fraenkel, 2013). In the current study, the curriculum documents of required courses at primary school, middle and high school (Anatolian High School) levels were examined with content analysis based on frequency determination in order to understand the extent to which current and future problems in the Anthropocene are addressed. The study was carried out in the following stages suggested for the content analysis method: determining goals, defining terms, determining units of analysis, determining relevant data, creating justifications, determining samples, creating coding categories, and analyzing data (Wallen & Fraenkel, 2013). Accordingly, the purpose of the study, its rationale and the questions to be answered were first determined. The basic terms of the study, Anthropocene, problem areas and problem-centred curriculum design, were then defined. The learning outcomes in the curricula of the required courses in all three levels were determined as the unit of analysis. In line with the purpose of the study and the research questions, the learning outcomes taken as the unit of analysis were examined by accessing the curricula.

Study Documents

In this study, the curricula of the required courses at primary, middle and high school (Anatolian High Schools) levels that came into effect in 2018 were accessed from the Ministry of National Education's website (https://mufredat.meb.gov.tr/) (MoNE, 2018). The curricula examined in the study were limited to the curricula of the required courses at primary, middle and high school (Anatolian High Schools) levels within the scope of compulsory education. At the high school level, Anatolian high schools are the most common with the highest number of students in Turkey (Number of Anatolian high schools in Turkey: 2,868, number of Anatolian high school students in Turkey: 2,040,501; General Directorate of Secondary Education, 2022). For this reason, high school curricula were limited to those

of the required courses of Anatolian high schools. In addition, the curricula were also limited as these are common curricula used for all students throughout Turkey. Since the elective courses that students choose can differ, the curricula of these courses were not included in the analysis. As a result, the curricula of the required courses for all the levels within the scope of compulsory education were reached. Table 1 lists the courses whose learning outcomes were examined in the curricula across the levels.

Table 1. Courses Whose Learning Outcomes in their Curricula Were Examined across the Levels

Courses Whose Learning Outcomes in their Curricula Were Examined at the Primary School Level (in alphabetical order)	**Courses Whose Learning Outcomes in their Curricula Were Examined at the Middle School Level (in alphabetical order)**	**Courses Whose Learning Outcomes in their Curricula Were Examined at the High School Level (Anatolian High Schools) (in alphabetical order)**
Foreign Language (English) (2nd-4th Grades)	Foreign Language (English) (5th-8th Grades)	Biology (9th-12th grades)
Human Rights, Citizenship and Democracy (4th Grade)	Guidance and Career Planning (8th Grades)	Chemistry (9th-12th Grades)
Life Studies (1st-3rd Grades)	Information Technologies and Software (5th-6th grades)	Foreign Language (English) (9th-12th Grades)
Mathematics (1st-4th Grades)	Mathematics (5th-8th Grades)	Geography (9th-12th grades)
Music (1st-4th Grades)	Music (5th-8th Grades)	Health Information and Traffic Culture (9th grade)
Physical Education and Play (1st-4th grades)	Physical Education and Sports (5th-8th grades)	History (9th-11th Grades)
Religious Culture and Moral Knowledge (4th grade)	Religious Culture and Moral Knowledge (5th-8th grades)	Mathematics (9th-12th Grades)
Science (3rd-4th Grades)	Science (5th-8th Grades)	Music (9th-12th Grades)
Social Studies (4th Grade)	Social Studies (5th-7th Grades)	Philosophy (10th-11th Grades)
Traffic Safety (4th Grade)	Technology and Design (7th-8th Grades)	Physical Education and Sports (9th-12th grades)
Turkish (1st-4th Grades)	Turkish (5th-8th Grades)	Physics (9th-12th Grades)
Visual Arts (1st-4th Grades)	Turkish Republic Revolution History and Kemalism (8th Grade)	Religious Culture and Moral Knowledge (9th-12th Grades)
	Visual Arts (5th-8th Grades)	Turkish Language and Literature (9th-12th Grades)
		Turkish Republic Revolution History and Kemalism (12th Grade)
		Visual Arts (9th-12th Grades)

As can be seen, the learning outcomes of the curricula of 12 courses at the primary school level, 13 at the middle school level, and 15 at the high school (Anatolian High School) level were examined.

Regarding the originality of the documents, the above-mentioned curricula were considered to be original since they were accessed from the official website of the Ministry of National Education (http://mufredat.meb.gov.tr/Programlar.aspx). Among the examined curricula, no learning outcomes corresponding to the problem areas could be determined in the Turkish (1st-8th grades) and Turkish Language and Literature (9th-12th grades) courses. The learning outcomes in the Turkish curriculum are designed for listening, reading, speaking and writing skills. The outcomes in the curriculum are expressed in quite general terms within the scope of these skills, and these outcomes are included in the curricula at different grade levels with the same expressions. The learning outcomes in the Turkish Language and Literature curriculum are also expressed in general terms under three main headings:

Reading (Understanding and Analyzing the Text), Writing, and Oral Communication. The grade levels to which the outcomes belong are not specified. For these reasons, it was not possible to examine the learning outcomes of these two courses according to problem areas. In addition, in the Technology and Design (7th-8th grades) course curriculum, five outcomes, and in the Information Technology and Software (5th-6th grades) course curriculum, 31 outcomes do not contain a concept related to a specific problem area; therefore, no connection could be established between any problem area and these outcomes.

Data Analysis

In this study, all the curricula of the required courses in the above-mentioned formal education levels were included in the analysis. Categories for the analysis of the data were developed based on publications in the field and by seeking expert opinions before starting the study. For this purpose, reports prepared by various international organizations identifying the problems encountered today and that may be encountered in the future were examined (such as World Economic Forum (WEF), 2022; Amnesty International, 2019; UNESCO, 2021b; United Nations Development Programme [UNDP], 2022; World Vision International, 2022). Among these reports, the one prepared by the United Nations Educational, Scientific and Cultural Organization (UNESCO) was chosen to serve as the main categories for the current study as it included a large-scale research study (UNESCO, 2021b). This comprehensive study was conducted by UNESCO in 2020 with approximately 15,000 participants from different parts of the world. The study sought to specify the most important future global problem that the world would need to struggle with. According to the results, potential issues in the future of the world were listed as follows: climate change and loss of biodiversity (67%), violence and conflicts (44%), discrimination and inequality (43%), lack of food, water and housing (42%), health and diseases (37%), freedom of expression (32%), lack of decent work and opportunities (28%), political participation and democracy (24%), migration (17%), artificial intelligence and new technologies (15%) and traditions and culture at risk (14%). The major problems were therefore used as categories in the analysis of data in the current study. Again, in the analysis of the data, the outcomes of the curricula chosen as the unit of analysis were examined, and the focus was on the content of the outcomes related to the problem areas mentioned above and taken as categories. The reason for focusing on the content of the outcomes was to determine whether the problems expressed under the categories were addressed in the outcomes of the primary, middle and high school (Anatolian High Schools) curricula. It was also examined whether the outcomes guided students towards gaining awareness of the problem being addressed, understanding the cause-effect relationships between the problem being addressed and others, seeking a solution to the problem, evaluating the problem, developing original suggestions as solutions, and actively participating in the solution to the problem, which are fundamental processes in problem-centred curriculum designs. In these designs, individuals are expected to develop suggestions for solving problems and take actions to do so. In addition to all this, the distribution of the outcomes for each level across the identified problem areas was analyzed along with whether these problem areas are fully or partially addressed in line with the objectives of problem-centred curriculum designs. Examples of the outcomes are provided in the study. The following criteria were developed by consulting experts to decide the cases where the problem areas were fully or partially addressed in the learning outcomes of the curriculum, in line with the objectives of the problem-centred program designs.

If the learning outcome examined in the curriculum	leads the learner to • seek for a solution to the problem, • discuss the solution of the problem, • make practices related to the problem, • analyse the problem, • evaluate the problem, • develop original suggestions for the solution of the problem, • actively participate in the solution to the problem	then it is considered that the problem area is **fully** addressed in the outcome.
If the learning outcome examined in the curriculum	leads the learner to • gain awareness of the problem, • make inferences about the problem and/or causes and effects of the problem, • discuss the causes and/or effects of the problem, • determine cause-effect relationships related to the problem	then it is considered that the problem area is **partially** addressed in the outcome.

As the curricula of the required courses across all three levels were examined for validity purposes, curriculum documents were analyzed to an extent that would allow generalization. In addition, necessary explanations were made in the method and findings sections so that the findings may be tested in other studies. Required ethical precautions were taken in the use of the data and care was taken not to harm the institutions to which the documents belong. Since the MoNE curricula were analyzed as documents in the study, a certificate was received from the Ankara University Ethics Committee stating that ethics committee approval was not required.

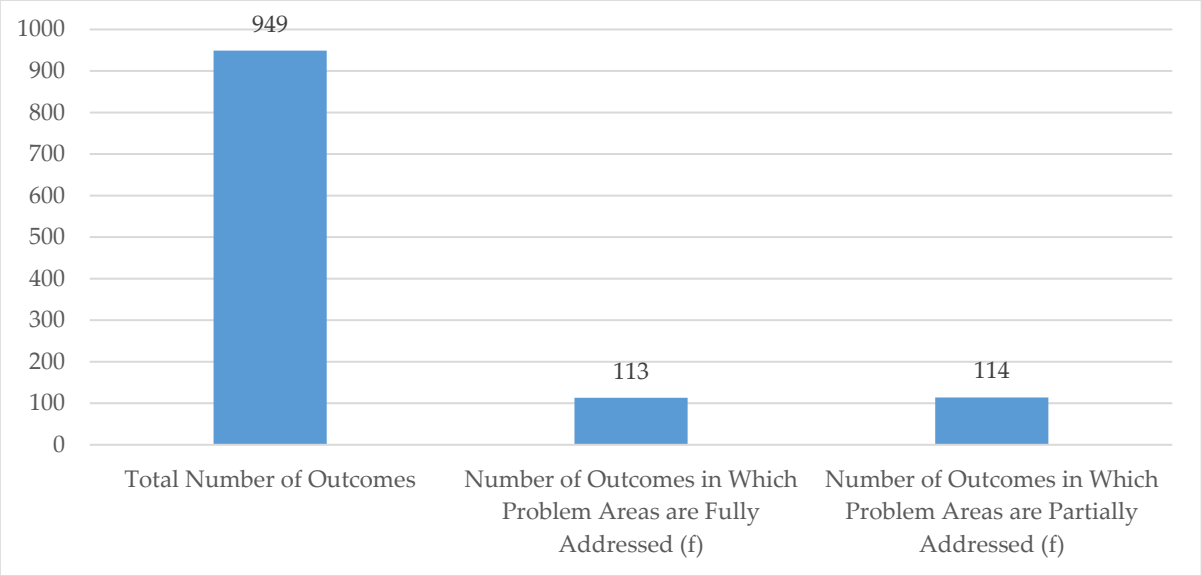
To establish reliability, the methods and stages of the study are explained here in detail. The results are presented by explicitly relating them to the data. The analyses were made by the researcher, and then opinions were received from field experts regarding the analysis of the curricula. The analyses made by the researcher and the different opinions expressed by the experts on the same analyses were discussed by the researcher and the experts together. The analyses were reviewed by the researcher. At the end of this process, an average of 85% consensus was achieved between the analyses made by the researcher and the opinions expressed by the experts on the same analyses. The analyses were deemed appropriate because the agreement rate calculated by using the intercoder reliability formula suggested by Miles and Huberman (1994) was above 70%.

Findings

The findings obtained in the current study are presented under three headings: The Extent to Which Current and Anticipated Problem Areas are Addressed in the Learning Outcomes of Primary School Curricula; The Extent to Which Current and Anticipated Problem Areas are Addressed in the Learning Outcomes of Middle School Curricula; The Extent to Which Current and Anticipated Problem Areas are Addressed in the Learning Outcomes of High School (Anatolian High School) Curricula. Under each heading, the extent to which current and future problems are addressed in the learning outcomes in the curricula of the required courses of the relevant level is presented with examples of outcomes and their distribution across the courses. The distribution of outcomes across problem areas is described using frequency, as a single outcome may correspond to multiple problem areas.

The Extent to Which Current and Anticipated Problems are Addressed in the Learning Outcomes of Primary School Curricula

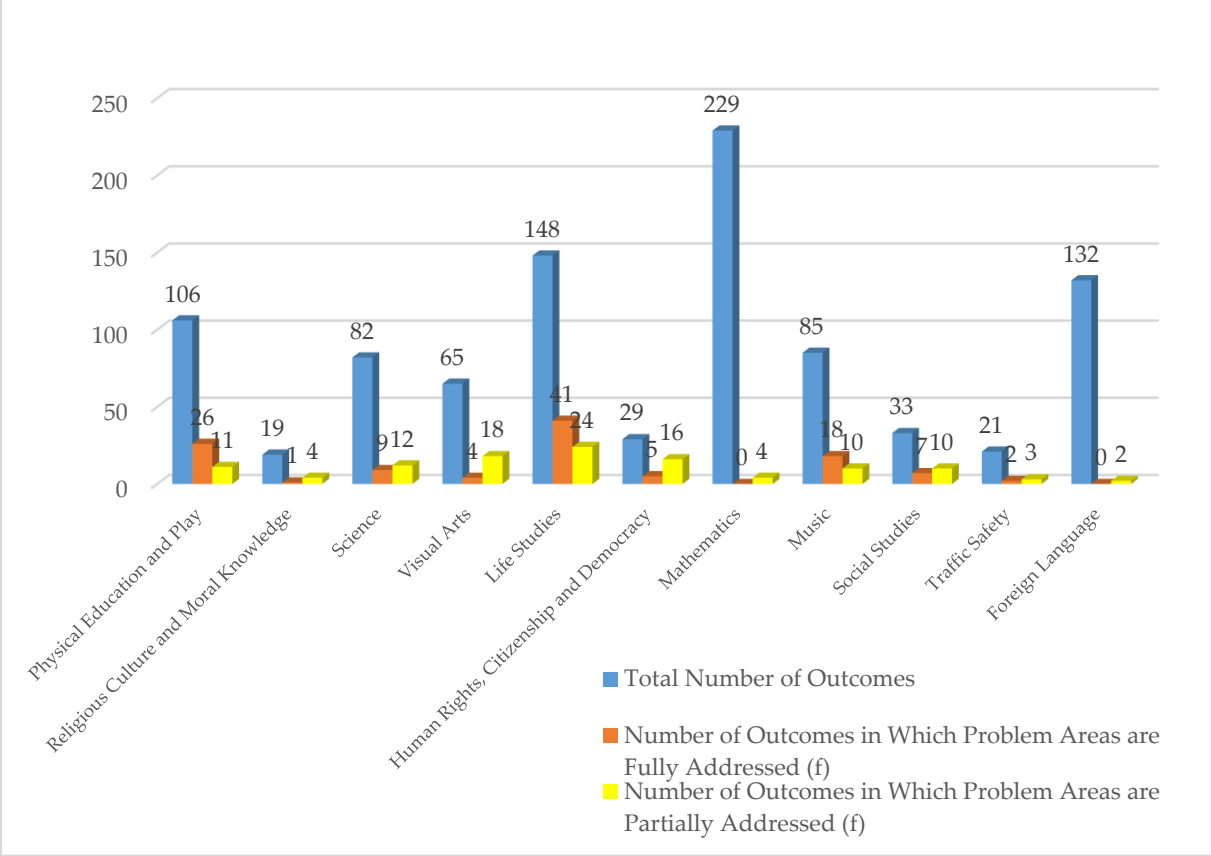
The learning outcomes of the curricula of Foreign Language (English), Human Rights, Citizenship and Democracy, Life Studies, Mathematics, Music, Physical Education and Play, Religious Culture and Moral Knowledge, Science, Social Studies, Traffic Safety, Turkish, Visual Arts, which are required courses at the 1st-4th grades of primary school (Board of Education, 2021), were examined. Consequently, it was determined whether the problem areas are fully or partially addressed in the learning outcomes of primary school curricula and which problem areas are addressed in the learning outcomes of each course. Graph 1 depicts the total number of outcomes examined in the curricula of primary school courses, whether the problem areas are fully and partially addressed in the outcomes, and the frequency of the outcomes (f).



Graph 1. Frequency of the Outcomes in Which Problem Areas are Fully or Partially Addressed in Primary School Curricula

According to Graph 1, there is a total of 949 outcomes examined in the curricula of primary school courses. The frequency of the outcomes in which the identified problem areas are fully addressed is 113, meaning that approximately in 12% of the outcomes, problem areas are fully addressed. It was therefore understood that the learner is guided towards researching and discussing solutions to a problem, analyzing and evaluating it, developing an original suggestion as a solution and implementing it in very few primary school level curriculum outcomes related to problem areas. The frequency of the outcomes in which the identified problem areas are partially addressed was 114, meaning that approximately in 12% of the outcomes, problem areas are partially addressed. Similarly, it was concluded that the learner is guided towards gaining awareness of the problem, determining and discussing its causes and effects, and determining cause-effect relationships with other problems in very few primary school level curriculum outcomes related to problem areas.

Graph 2 shows the distribution of the outcomes across the courses in primary school level curricula where problem areas are fully and partially addressed.



Graph 2. Distribution of the Outcomes across Primary School Courses Where Problem Areas Are Fully and Partially Addressed

According to Graph 2, the problem areas at the primary school level are mostly addressed in the learning outcomes of the following courses: Life Studies (f: 41), Physical Education and Play (f: 26), Music (f: 18) and Science (f: 9). In these courses, the number of outcomes where the problem areas are fully addressed is higher than the number of outcomes where they are partially addressed, except for the Science course, but in others the number of outcomes where the problem areas are partially addressed is higher. The smallest numbers of outcomes where the problem areas are fully addressed are in the following courses: Social Studies (f: 7), Human Rights, Citizenship and Democracy (f: 5), Visual Arts (f: 4), Traffic Safety (f: 2), Religious Culture and Moral Knowledge (f: 1). None of the outcomes in the Mathematics and Foreign Language (English) courses fully correspond to the problem areas identified for this study.

Table 2 presents the primary school level courses in which the problem areas are fully addressed and the frequency of outcomes in these courses.

Table 2. Primary School Level Courses Where Problem Areas Are Fully Addressed and Frequency of Outcomes in These Courses

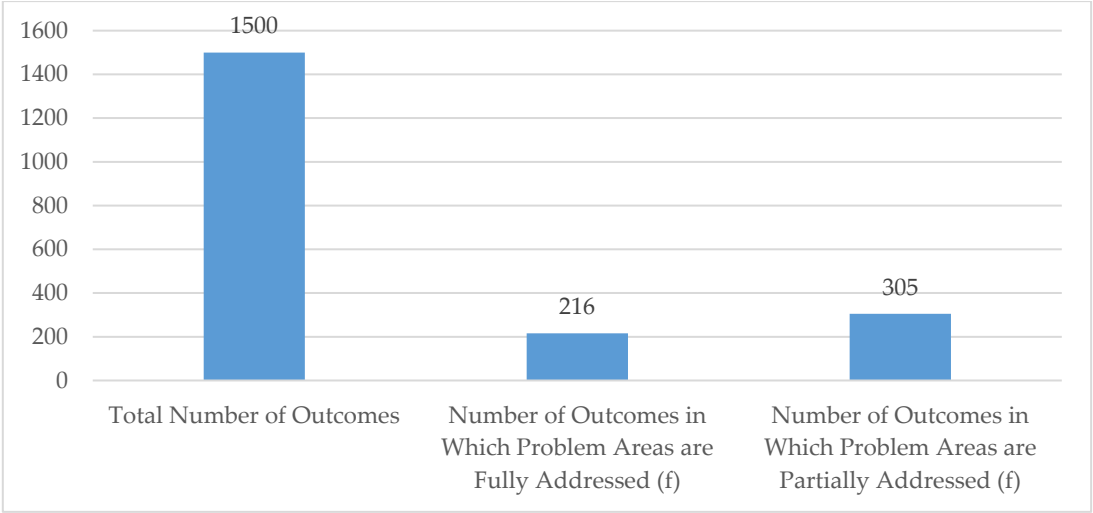
Current and Anticipated Problems	Courses	Frequency of Outcomes (f)	Total (f)
Traditions and culture at risk	Music	15	39
	Physical Education and Play	13	
	Life Studies	9	
	Visual Arts	1	
	Social Studies	1	
Health and diseases	Physical Education and Play	12	26
	Life Studies	10	
	Science	2	
	Religious Culture and Moral Knowledge	1	
	Traffic Safety	1	
Lack of food, water and housing	Life Studies	9	13
	Science	3	
	Social Studies	1	
Climate change and loss of biodiversity	Life Studies	5	9
	Science	4	
Discrimination and inequality	Human Rights, Citizenship and Democracy	4	9
	Social Studies	3	
	Life Studies	2	
Freedom of expression	Visual Arts	3	6
	Music	3	
Artificial intelligence and new technologies	Life Studies	2	5
	Social Studies	2	
	Physical Education and Play	1	
Violence and conflicts	Life Studies	2	3
	Human Rights, Citizenship and Democracy	1	
Lack of decent work and opportunities	Life Studies	1	2
	Traffic Safety	1	
Political participation and democracy	Life Studies	1	1

According to Table 2, the three most common problem areas in the outcomes of primary school courses are *Traditions and culture at risk* (f: 39), *Health and diseases* (f: 26) and *Lack of food, water and housing* (f: 13). The problem area of *Traditions and culture at risk* is most frequently addressed in the outcomes of Music (f: 15) (*sample outcome: Mü.3.A.6. Plays games and sings songs and folk songs from his/her own culture*.), followed by Physical Education and Play (f: 13) (*sample outcome: PEP.1.2.3.2. Performs simple rhythmic folk dance steps belonging to our culture.).* The problem area of *Health and diseases* is most frequently addressed in the outcomes of Physical Education and Play (f: 12) (*sample outcome: PEP.1.2.2.4. Demonstrates balanced and regular eating habits while participating in games and physical activities*.), followed by Life Studies (f: 10) (*sample outcome: LS.1.3.3. Chooses foods and drinks that are beneficial for one's health.*). The problem area of *Lack of food, water and housing* is most frequently addressed in the outcomes of Life Studies (f: 9) (*sample outcome: LS.2.1.6. Takes care when using school resources and belongings*.), followed by Science (f: 3) (*sample outcome: S.4.6.1.1. Takes care to be economical in the use of resources.)*. These first three problem areas, which

are addressed in the outcomes of primary school courses, are followed by the problem areas of *Climate change and loss of biodiversity* (f: 9), *Discrimination and inequality* (f: 9), *Freedom of expression* (f: 6) and *Artificial intelligence and new technologies* (f: 5). The least frequently addressed problem areas in the outcomes are *Violence and conflicts* (f: 3) (*sample outcome: Life Studies-LS.3.4.5. Explains what to do and who to ask for help when someone threatens his/her safety.), Lack of decent work and opportunities* (f: 2) (*sample outcome: Life Studies-LS.3.1.10. Researches the professions he/she is interested in and their characteristics.)* and *Political participation and democracy* (f: 1) (*sample outcome: Life Studies-LS.3.1.8. Expresses his/her requests and needs related to school through democratic means in the school environment.).* The *Migration* problem area was not found in the outcomes of any course at primary school level. The Life Studies course was found to be the only course in which all problem areas were included, except for *Freedom of expression* and *Migration*. On the other hand, none of the outcomes in the Mathematics and Foreign Language (English) courses fully correspond to the problem areas identified for this study.

The Extent to Which Current and Anticipated Problems are Addressed in the Learning Outcomes of Middle School Curricula

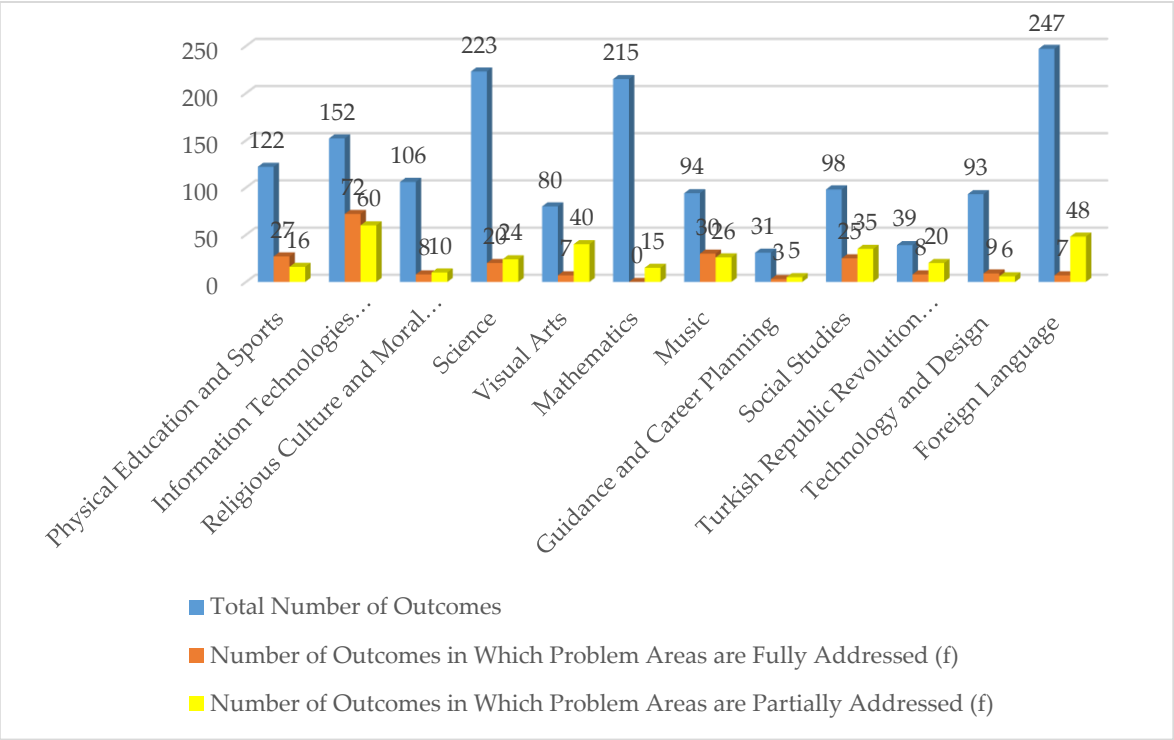
The learning outcomes were examined in the curricula of Foreign Language (English), Guidance and Career Planning, Information Technologies and Software, Mathematics, Music, Physical Education and Sports, Religious Culture and Moral Knowledge, Science, Social Studies, Technology and Design, Turkish, Turkish Republic Revolution History and Kemalism, Visual Arts, which are required courses at grades 5-8 in middle school (Board of Education, 2021). It was also determined whether the problem areas are fully or partially addressed in the learning outcomes of middle school curricula and which problem areas are addressed in the learning outcomes of each course. Graph 3 shows the total number of outcomes examined in the curricula of middle school courses, whether the problem areas are fully and partially addressed in the outcomes, and the frequency of the outcomes (f).



Graph 3. Frequency of the Outcomes in Which Problem Areas are Fully or Partially Addressed in Middle School Curricula

According to Graph 3, there is a total of 1500 outcomes examined in middle school curricula. The frequency of the outcomes in which the identified problem areas are fully addressed is 216, meaning that approximately in 14% of the outcomes, problem areas are fully addressed. Accordingly, it was determined that in very few of the middle school level curriculum outcomes related to problem areas, the learner is guided towards researching and discussing the solution to the problem, analyzing and evaluating the problem, developing an original suggestion for the solution of the problem and implementing it. The frequency of the outcomes in which the identified problem areas are partially addressed was found to be 305, meaning that approximately in 20% of the outcomes, problem areas are partially addressed. Accordingly, it was determined that in one fifths of the middle school level curriculum outcomes related to problem areas, the learner is guided towards gaining awareness of the problem, determining and discussing the causes and effects of the problem and determining cause-effect relationships with other problems.

In Graph 4, the distribution of the outcomes across the courses in the middle school level curricula where problem areas are fully and partially addressed is given in order to present the general situation regarding the courses.



Graph 4. Distribution of the Outcomes across the Middle School Courses Where Problem Areas Are Fully and Partially Addressed

According to Graph 4, the problem areas are mostly addressed at the middle school level in the outcomes of the courses of Information Technologies and Software (f: 72), Music (f: 30), Physical Education and Sports (f: 27), Social Studies (f: 25) and Science (f: 20). Except for the courses of Physical Education and Sports, Information Technologies and Software, Music, Technology and Design, the number of outcomes in which the problem areas are partially addressed is greater than the number of outcomes in which they are fully addressed. The smallest numbers of outcomes where the problem areas are fully addressed are in the following courses: Technology and Design (f: 9), Religious Culture and Moral Knowledge (f: 8), Turkish Republic Revolution History and Kemalism (f: 8), Visual Arts (f: 7), Foreign Language (English) (f: 7), Guidance and Career Planning (f: 3). In addition, none of the outcomes in the Mathematics course fully correspond to the problem areas identified for this study.

Table 3 presents the middle school level courses in which the problem areas are fully addressed and the frequency of outcomes in these courses.

Table 3. Middle School Level Courses Where Problem Areas Are Fully Addressed and Frequency of Outcomes in These Courses

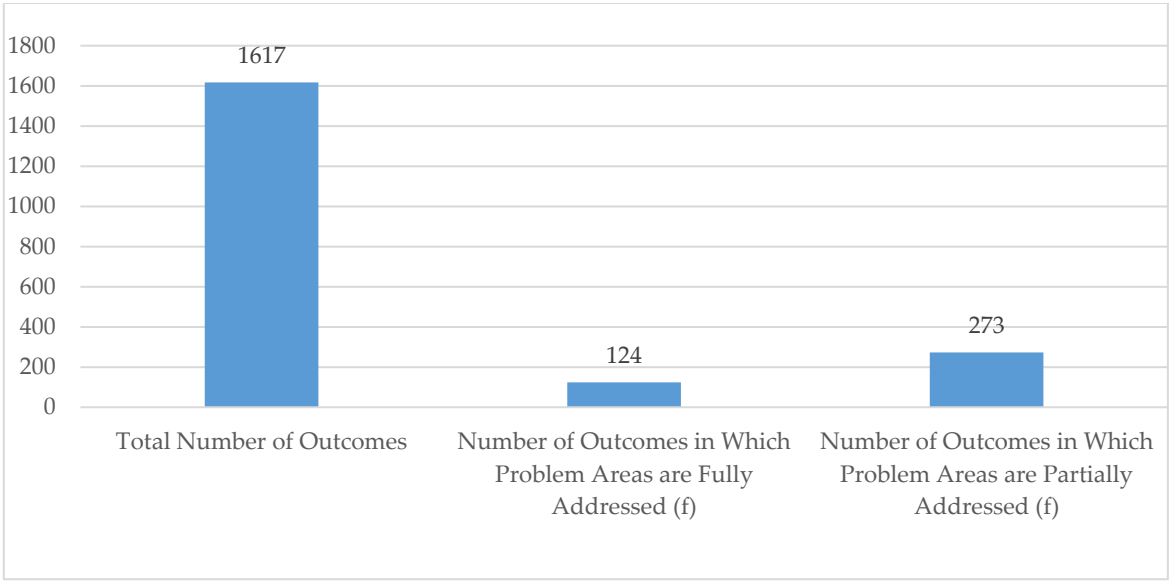
Current and Anticipated Problems	Courses	Frequency of Outcomes (f)	Total (f)
Artificial intelligence and new technologies	Information Technologies and Software	71	87
	Technology and Design	6	
	Music	4	
	Social Studies	4	
	Visual Arts	1	
	Foreign Language	1	
Traditions and culture at risk	Music	19	47
	Physical Education and Sports	13	
	Social Studies	7	
	Religious Culture and Moral Knowledge	6	
	Visual Arts	2	
Health and diseases	Physical Education and Sports	14	22
	Science	4	
	Guidance and Career Planning	2	
	Religious Culture and Moral Knowledge	2	
Climate change and loss of biodiversity	Science	7	14
	Foreign Language (English)	3	
	Social Studies	2	
	Technology and Design	2	
Lack of food, water and housing	Science	8	14
	Foreign Language	3	
	Social Studies	2	
	Technology and Design	1	
Freedom of expression	Music	7	12
	Visual Arts	4	
	Social Studies	1	
Political participation and democracy	Turkish Republic Revolution History and Kemalism	4	7
	Social Studies	3	
Lack of decent work and opportunities	Social Studies	3	5
	Science	1	
	Guidance and Career Planning	1	
Violence and conflicts	Turkish Republic Revolution History and Kemalism	4	5
	Social Studies	1	
Discrimination and inequality	Social Studies	1	2
	Information Technologies and Software	1	
Migration	Social Studies	1	1

According to Table 3, the first four problem areas most frequently addressed in the outcomes of the middle school courses are *Artificial intelligence and new technologies* (f: 87), *Traditions and culture at risk* (f: 47), *Health and diseases* (f: 22), *Climate change and loss of biodiversity* (f: 14) and *Lack of food, water and housing* (f: 14). The problem area of *Artificial intelligence and new technologies* is most frequently addressed in the outcomes of the course of Information Technologies and Software (f: 71) (*sample outcome:*

ITS.6.2.1.7. Develops precautions and strategies that can be used against cybercrimes.). The problem area of *Traditions and culture at risk* is most frequently addressed in the outcomes of the course of Music (f: 19) (*sample outcome: Mu.7.A.2. Sings our anthems that strengthen the sense of national unity and solidarity correctly.).* The problem area of *Climate change and loss of biodiversity* is most frequently addressed in the outcomes of the course of Science (f: 7) (*sample outcome: S.5.6.2.2. Provides suggestions for solving an environmental problem in the immediate vicinity or in our country.).* The problem area of *Lack of food, water and housing* is again most frequently addressed in the outcomes of the course of Science (f: 8) (*sample outcome: S.8.6.4.2. Designs projects for the economical use of resources.).* These first four problem areas, which are addressed in the outcomes of the middle school courses, are followed by the problem areas of *Freedom of expres*sion (f: 12), *Political participation and democracy* (f: 7). The least frequently addressed problem areas in the outcomes are *Lack of decent work and opportunities* (f: 5) (*sample outcome: Social Studies - SS.6.5.6. Researches the personality traits, skills, and educational process required by the professions he/she is interested in.), Violence and conflicts* (f: 5) (*sample outcome – Turkish Republic Revolution History and Kemalism - TRRHK.8.7.4. Analyzes the effects of the developments in the Second World War and the results of this war on Turkey.), Discrimination and inequality* (f: 2) (*sample outcome: Information Technologies and Software - ITS.5.2.1.3. Respects the rights of others in the online environment*.) and *Migration* (f: 1) (*sample outcome: Social Studies - SS.7.7.4. Develops suggestions for the solution of global problems with his/her friends (Global climate change, natural disasters, hunger, terror and migration issues are discussed.)).* The Social Studies course is the only course at the middle school level that addresses all the problem areas except for the problem area of *Health and diseases*. In addition, none of the outcomes in the Mathematics course fully correspond to the problem areas identified for this study.

The Extent to Which Current and Anticipated Future Problems are Addressed in the Learning Outcomes of the High School (Anatolian High School) Curricula

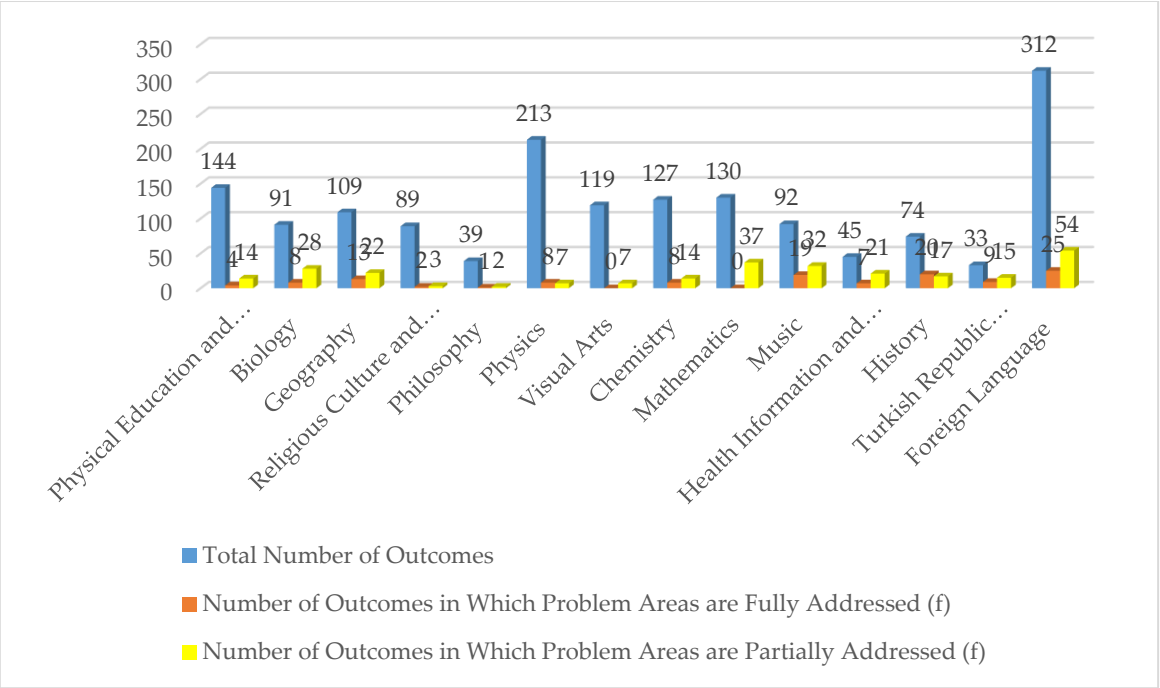
The learning outcomes in the curricula of Biology, Chemistry, Foreign Language (English), Geography, Health Knowledge and Traffic Culture, History, Mathematics, Music, Philosophy, Physical Education and Sports, Physics, Religious Culture and Moral Knowledge, Turkish Language and Literature, Turkish Revolution History and Kemalism, Visual Arts, which are required courses at the 9th-12th grades (Anatolian High School) (Board of Education, 2021), were examined. Accordingly, it was determined whether the problem areas are fully or partially addressed in the learning outcomes of the high school curricula and which problem areas are addressed in the learning outcomes of each course. In Graph 5, the total number of outcomes examined in the curricula of the high school courses, whether the problem areas are fully and partially addressed in the outcomes, and the frequency of the outcomes (f) are presented.



Graph 5. Frequency of the Outcomes in Which Problem Areas are Fully or Partially Addressed in High School Curricula

According to Graph 5, there is a total of 1617 outcomes examined in the curricula of the required courses at high school (Anatolian High School) level. The frequency of the outcomes in which the identified problem areas are fully addressed is 124, meaning that approximately in 8% of the outcomes, problem areas are fully addressed. It was once again the case that in very few of the high school level curriculum outcomes related to problem areas, the learner is guided towards researching and discussing the solution to the problem, analyzing and evaluating it, developing an original suggestion as a solution to the problem and implementing it. The frequency of the outcomes in which the identified problem areas are partially addressed was found to be 273, meaning that approximately in 17% of the outcomes, problem areas are partially addressed. Once again, the learner is guided towards gaining awareness of the problem, determining and discussing its causes and effects and determining cause-effect relationships with other problems in few of the high school level curriculum outcomes related to problem areas.

In Graph 6, the distribution of the outcomes across the courses in high school (Anatolian High School) level curricula where problem areas are fully and partially addressed is presented.



Graph 6. Distribution of the Outcomes across High School (Anatolian High School) Courses Where Problem Areas Are Fully and Partially Addressed

According to Graph 6, the problem areas are mostly addressed in the learning outcomes of the following courses: Foreign Language (f: 25), History (f: 20), Music (f: 19) and Geography (f: 13) at the high school (Anatolian High School) level. The smallest numbers of outcomes where the problem areas are fully addressed are in the following courses: Turkish Republic Revolution History and Kemalism (f: 9), Biology (f: 8), Chemistry (f: 8), Physics (f: 8), Health Information and Traffic Culture (f: 7), Physical Education and Sports (f: 4), Religious Culture and Moral Knowledge (f: 2), Philosophy (f: 1). Furthermore, the identified problem areas are not fully addressed in any of the learning outcomes of the Visual Arts and Mathematics courses. At high school level, in terms of the outcomes of all courses, the number of outcomes where the problem areas are partially addressed is greater than the number of outcomes where the problem areas are fully addressed, except in Physics and History.

Table 4 presents high school level courses in which the problem areas are fully addressed as well as the frequency of outcomes in these courses.

Table 4. High School Level Courses Where Problem Areas Are Fully Addressed and Frequency of Outcomes in These Courses

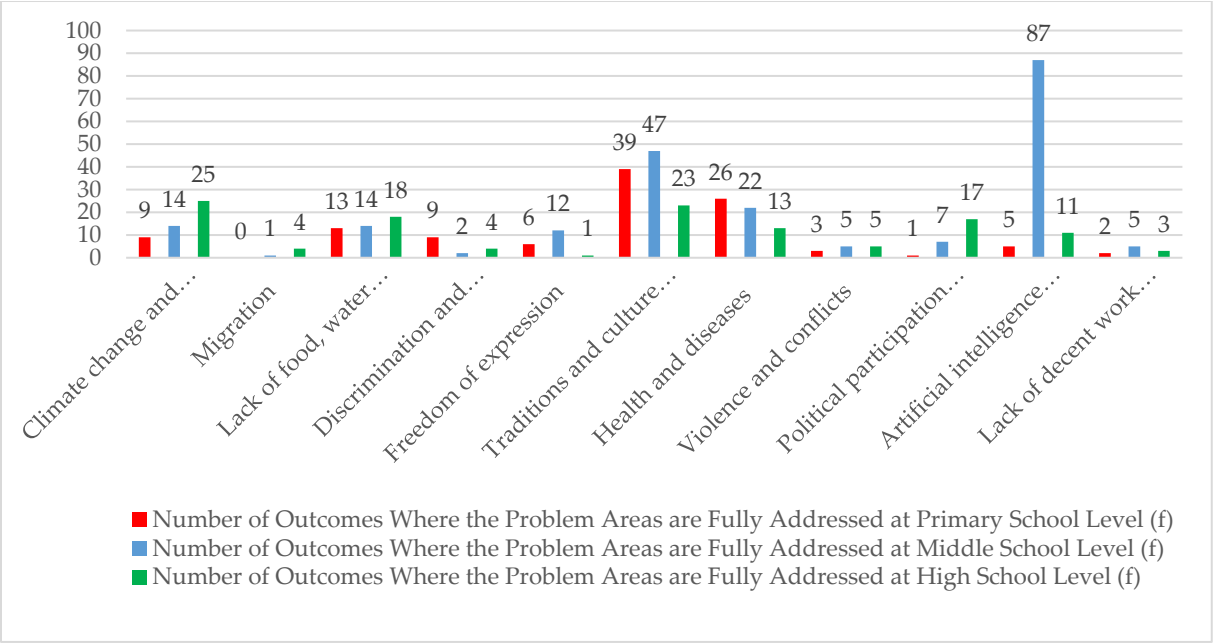
Current and Anticipated Future Problems	Courses	Frequency of Outcomes (f)	Total (f)
Climate change and loss of biodiversity	Geography	7	25
	Foreign Language (English)	4	
	Biology	5	
	Physics	4	
	Chemistry	4	
	Religious Culture and Moral Knowledge	1	
Traditions and culture at risk	Music	15	23
	History	4	
	Geography	2	
	Foreign Language (English)	2	
Lack of food, water and housing	Foreign Language (English)	5	18
	Chemistry	4	
	Geography	3	
	Physics	3	
	Biology	2	
	Religious Culture and Moral Knowledge	1	
Political participation and democracy	History	12	17
	Turkish Republic Revolution History and Kemalism	5	
Health and diseases	Health Information and Traffic Culture	5	13
	Physical Education and Sports	4	
	Foreign Language (English)	3	
	Biology	1	
Artificial intelligence and new technologies	Foreign Language (English)	4	11
	Music	4	
	Health Information and Traffic Culture	1	
	Biology	1	
	Physics	1	
Violence and conflicts	Turkish Republic Revolution History and Kemalism	4	5
	Health Information and Traffic Culture	1	
Discrimination and inequality	Foreign Language (English)	3	4
	History	1	
Migration	History	3	4
	Geography	1	
Lack of decent work and opportunities	Foreign Language (English)	3	3
Freedom of expression	Philosophy	1	1

According to Table 4, the first five problem areas most frequently addressed in the outcomes of the courses at high school (Anatolian High School) level are *Climate change and loss of biodiversity* (f: 25), *Traditions and culture at risk* (f: 23), *Lack of food, water and housing* (f: 18), *Political participation and democracy* (f: 17), *Health and diseases* (f: 13). The problem area of *Climate change and loss* of *biodiversity* is most frequently addressed in the outcomes of the Geography course (f: 7) (*sample outcome: 9.4.2. Evaluates the*

changes that occur in the natural environment due to human influence in terms of their results.). The problem area of *Traditions and culture at risk* is most frequently addressed in the outcomes of the Music course (f: 15) (*sample outcome: 9.A.6. Performs sample works from Turkish music genres.*). The problem area of *Lack of food, water and housing* is most frequently addressed in the Foreign Language (English) course (f: 5) (*sample outcome: E12.8.W1. Students will be able to write an email/a letter of complaint to a local authority about an environmental problem to suggest solutions.),* followed by the Chemistry course (f: 4) (*sample outcome: 9.5.2.2. Suggests solutions for reducing the effects of chemical pollutants that harm the environment.).* The problem area of *Political participation and democracy* is most frequently addressed in the outcomes of the History course (f: 12) (*sample outcome: 11.4.4. Evaluates the effects of the coups that took place between 1876 and 1913 on Ottoman political life.).* The problem area of *Health and diseases* is most frequently addressed in the Health Information and Traffic Culture course (f: 5) (*sample outcome: 1.1.2. Analyzes the effects of environmental factors on individual and community health.),* followed by the Physical Education and Sports (f: 4) (*sample outcome: 11.2.1.1.1. Performs regular physical activities to improve physical fitness.).* These five problem areas, which are most frequently addressed in the outcomes of high school courses, are followed by the problem areas of *Artificial intelligence and new technologies* (f: 11) and *Violence and conflicts* (f: 5). The following problem areas are addressed least frequently in the learning outcomes of high school curricula: *Discrimination and inequality* (f: 4) (*sample outcome: Foreign language (English) - E12.3.S1. Students will be able to make suggestions about improving human rights*.), *Migration* (f: 4) (*sample outcome: History - 10.1.2. Analyzes the socio-cultural effects of Turkish migrations to Anatolia.), Lack of decent work and op*portunities (f: 3) (*sample outcome: Foreign language (English) - E11.1.R1. Students will be able to analyze different job ads from newspapers/websites to match them with CVs.), Freedom of expression* (f: 1) (*sample outcome: Philosophy - 11.5.4. Evaluates sample thoughts and arguments from 20th-century philosophy from a philosophical perspective.).* Moreover, it was determined that seven of the eleven problem areas are addressed in the outcomes of the Foreign Language (English) course. The Foreign Language (English) course is where the highest number of problem areas is addressed at high school level. On the other hand, none of the identified problem areas are fully addressed in the learning outcomes of the Visual Arts and Mathematics courses, while the problem area of *Freedom of expression* is only addressed once in the learning outcomes of the Philosophy course.

Distribution of the Current and Anticipated Problem Areas across the Learning Outcomes in the Curricula of All Levels

General findings regarding the distribution of the current and anticipated problem areas across the learning outcomes in the curricula of primary, middle and high school (Anatolian High School) levels are presented in Graph 7.



Graph 7. Distribution of the Outcomes Where the Problem Areas are Fully Addressed across the Levels

According to Graph 7, the most frequently encountered fully-addressed problem area in the outcomes of all levels is *Artificial intelligence and new technologies* (f: 87). The most frequently addressed problem areas in the outcomes at primary, middle and high school (Anatolian High School) levels are *Traditions and culture at risk* (f: 109) and *Artificial intelligence and new technologies* (f: 103), followed by *Health and diseases* (f: 61), *Climate change and loss* of *biodiversity* (f: 48) and *Lack of food, water and housing* (f: 45). The problem areas that are least frequently addressed in the outcomes at all three levels are *Lack of decent work and opportunities* (f: 10) and *Migration* (f: 5). In addition, the *Migration* problem area could not be identified in any of the outcomes in primary school curricula. Again, the *Migration* problem area was identified to be addressed only once in the outcomes of the middle school curricula, the *Freedom of expression* problem area was identified to be addressed only once in the outcomes of the high school curricula and the *Political participation and democracy* problem area was identified to be addressed only once in the outcomes of the primary school curricula.

Discussion, Results and Suggestions

In the current study, which aimed to determine the extent to which the current and anticipated problem areas are addressed in the learning outcomes of the curricula prepared by the Ministry of National Education for primary, middle and high schools, it was concluded that the number of outcomes that fully address the problem areas does not increase from primary school to high school. It was also found that the highest number of problem areas is addressed in the outcomes of middle school curricula, followed by the outcomes of primary and high school curricula. As the level of education progresses, no regular increase can be seen in the number of outcomes addressing the problem areas. In order to prepare the new generation for the future, curricula should be organized in such a way to ensure that the distribution of outcomes related to various problem areas at each level is balanced and the scope of the problem areas expands as the levels progress, in accordance with the characteristics of the age group.

The problem area most frequently addressed in the outcomes of middle school curricula is the problem area of *Artificial intelligence and new technologies*. This may be attributed to the fact that the problem area of *Artificial intelligence and new technologies* is addressed in the outcomes of the Information Technologies and Software course, which is a middle school course. The problem area of *Artificial intelligence and new technologies* was found to be somehow addressed in approximately 47% of the outcomes of this course.

The most frequently addressed problem areas in the outcomes of all levels are *Traditions and culture at risk* and *Artificial intelligence and new technologies*. On the other hand, the problem areas that are least frequently addressed in the outcomes at all three levels are *Lack of decent work and opportunities* and *Migration*.

When the primary school level curriculum outcomes were examined, it was found that only 12% of the outcomes at this level fully address the current and anticipated problem areas. The outcomes in the curricula of the primary school courses Life Studies, Physical Education and Play, Music and Science were found to address the problem areas to the greatest extent, respectively. However, the number of learning outcomes that address problem areas in these courses was approximately one-fourth of the number of all the learning outcomes or even less. Among primary school courses, the problem areas are least fully addressed in the learning outcomes of the Social Studies, Human Rights, Citizenship and Democracy, Visual Arts, Traffic Safety and Religious Culture and Moral Knowledge courses. All problem areas other than *Freedom of expression* and *Migration* were found to be addressed in the Life Studies course outcomes. The Life Studies course is the only course at primary school level whose outcomes were found to address all the problem areas except for two. The main reason for this may be that the Life Studies course is designed to help children first understand themselves, providing an integrated approach that includes social sciences, science, art, thought and values. The course aims to give primary school students an understanding of the world and environment in which they live and to equip them with knowledge, skills, attitudes and values related to life (Parker, 2011; Tay, 2017). On the other hand, none of the outcomes of the Mathematics and Foreign Language (English) courses at primary school level were found to fully address the problem areas. This may be due to the fact that the topics covered in the Mathematics course and the skills covered in the Foreign Language (English) course are not based on the problem areas addressed in this study. The primary school Mathematics course curriculum is a program consisting of four learning areas: Numbers and Operations, Geometry, Measurement and Data Processing (MoNE, 2018) and the primary school Foreign Language (English) course curriculum is a program based on developing listening, speaking, reading and writing skills of English in students (MoNE, 2018). However, in every course at primary school level, problem areas can be included in accordance with the content and nature of the course, and students can be directed to produce solutions to problems and actively participate in solution finding processes.

The three most frequently addressed problem areas in the outcomes of primary school courses are *Traditions and culture at risk*, *Health and diseases* and *Lack of food, water and housing*. The problem areas that are least frequently addressed in the outcomes of primary school courses are *Violence and conflicts*, *Lack of decent work and opportunities* and *Political participation and democracy*. The *Migration* problem area could not be associated with the outcomes of any course at primary school level. At primary school level, it can be ensured that all problem areas are addressed in the learning outcomes in a balanced manner, appropriate to the age groups of the students, and the learning outcomes can be adjusted accordingly.

When the outcomes of middle school level curricula were examined, it was found that only 14% of the outcomes at this level fully address the current and anticipated problem areas. The outcomes in the middle school curricula of the Information Technologies and Software, Music, Physical Education and Sports, Social Studies and Science courses were found to address the highest number of problem areas, respectively. However, the number of the outcomes addressing problem areas in these courses was approximately one third or less of the total number of the outcomes, except in the Information Technologies and Software course. Among middle school courses, the problem areas are least fully addressed in the learning outcomes of Technology and Design, Religious Culture and Moral Knowledge, Turkish Republic Revolution History and Kemalism, Visual Arts, Foreign Language (English), Guidance and Career Planning. In addition, all the problem areas except the *Health and diseases* problem area were found to be addressed in the learning outcomes of the Social Studies curriculum. The Social Studies course is the only course at middle school level whose outcomes address all the problem areas except for one. This may be due to the fact that the Social Studies course needs to have a

curriculum that integrates knowledge and methods from social and human sciences in order to train effective citizens who can make informed decisions and solve problems in the country and the world (Öztürk, 2015). On the other hand, at middle school level, as was the case in primary school level, none of the Mathematics course outcomes could be fully associated with the problem areas.

Among the problem areas, those most frequently addressed in the learning outcomes of middle school courses are *Artificial intelligence and new technologies*, *Traditions and culture at risk*, *Health and diseases*, *Climate change and loss of biodiversity* and *Lack of food, water, and housing*. Among the problem areas, the ones least frequently addressed in the learning outcomes of middle school courses are *Lack of decent work and opportunities*, *Violence and conflicts*, *Discrimination and inequality* and *Migration*. At middle school level too, it can be ensured that all problem areas are addressed in the learning outcomes in a balanced manner, appropriate to the age groups of the students, and the learning outcomes can be adjusted accordingly.

When the outcomes of high school (Anatolian High School) level curricula were examined, it was seen that only 8% of the outcomes at this level fully address the current and anticipated problem areas. At high school (Anatolian High School) level, the learning outcomes addressing the problem areas are fewer compared to those at the other levels. Among high school (Anatolian High School) courses, the problem areas are most fully addressed in the learning outcomes of the Foreign Language (English), History, Music and Geography courses, respectively. However, the number of the learning outcomes addressing the problem areas in these courses, except for the History course, is less than a quarter of the total learning outcomes. Among high school (Anatolian High School) courses, the problem areas are least frequently addressed in the learning outcomes of the Turkish Revolution History and Kemalism, Biology, Chemistry, Physics, Health Information and Traffic Culture, Physical Education and Sports, Religious Culture and Moral Knowledge and Philosophy courses. None of the learning outcomes in the Visual Arts and Mathematics courses could be fully associated with the problem areas. At primary school, middle school and high school (Anatolian High School) levels, the learning outcomes of the Mathematics course could not be fully associated with the problem areas. Moreover, at high school (Anatolian High School) level, the number of the learning outcomes where the problem areas are partially addressed is higher than the number of the learning outcomes where the problem areas are fully addressed in all the courses except for Physics and History.

Among the problem areas, the ones most frequently addressed in the learning outcomes of high school (Anatolian High School) courses are *Climate change and loss of biodiversity*, *Traditions and culture at risk* and *Lack of food, water and housing*. Among the problem areas, the ones least frequently addressed in the learning outcomes of high school (Anatolian High School) courses are *Discrimination and inequality, Migration, Lack of decent work and opportunities* and *Freedom of expression*.

While discussing the results regarding the problem areas, a limitation was imposed and the discussion was conducted on the two least and most frequently addressed problem areas at all three levels. At all three educational levels, the problem areas least frequently addressed in the learning outcomes are *Lack of decent work and opportunities* and *Migration*. The problem area of *Lack of decent work and opportunities* is ranked seventh among all the problem areas identified in the research conducted by the United Nations Educational, Scientific and Cultural Organization (UNESCO). In the report, this problem area is used to refer to providing fair and liveable income, safe conditions, workplace safety, equal opportunities, non-discrimination, access to freedom-enhancing jobs and career development, as well as organizing decisions that affect the lives and well-being of workers and equipping them with the right skills through education to maintain their employment (UNESCO, 2021b). According to the report by the Organisation for Economic Co-operation and Development (OECD), young people generally need financial knowledge and skills from an early age to be able to operate in the complex financial environment they are likely to encounter before reaching adulthood. Young generations are not only faced with the likelihood of dealing with complex financial products, services and markets but also encounter more financial risks, digital financial services and digital tools compared to their parents. Schools are have an important role in improving financial literacy and reducing financial literacy-

related inequalities across all demographic groups. Financial literacy performance is strongly associated with mathematics and reading performance in school. In addition, it is thought that a good basic education on the basic subjects related to financial literacy can also benefit students with financial issues, financial services and digital tools (OECD, 2019). In a study examining 79 curricula for financial literacy at primary, middle and high school levels, Güvenç (2017) found that primary school curricula include more financial literacy-related outcomes compared to the other levels, with Social Studies and Mathematics coming to the fore among the subjects. He also noted that while the outcomes include knowledge on saving, budgeting and conscious consumerism, these anticipated outcomes are far from meeting the individual's daily needs. It is recommended that the problem area of *Lack of decent work and opportunities*, which is addressed in the current study, should be addressed in all grades and classes in a way appropriate to the age group in line with its national and international importance, and that curricula should be organized in such a way as to contribute to the education of generations who can produce solutions to this problem area and implement these solutions.

The *Migration* problem area is ranked ninth among the eleven problem areas in the research conducted by UNESCO. In this research, participants stated that they were most concerned about the human rights of immigrants and refugees within the scope of this problem area. In addition, according to UNESCO's report, participants highlighted the importance of education and proposed education as a solution to these problems (UNESCO, 2021b). According to the OECD report (2016), the number of refugees in the world reached 16.1 million at the end of 2015. Migration is considered as an important dimension of globalization that will become more important in the future. It is also highlighted as a problem area that societies need to find solutions for the migration issue at the international level, with the rapid rise of people seeking to escape wars (OECD, 2016). As for Turkey, according to 2023 data from the Republic of Türkiye Ministry of Interior Presidency of Migration Management, the number of foreigners with a residence permit in Turkey is approximately 1.3 million. In addition, the number of Syrians who migrated from Syria to Turkey under temporary protection is approximately 3.5 million (Presidency of Migration Management, 2023). It is recommended that the problem area of *Migration,* which was found to be scarcely addressed in the curricula at all education levels and will affect future generations on both global and local scales, should be addressed and individuals should be trained to find solutions to this problem.

In the current study, while examining the curricula, focus was also placed on the problem areas that are most frequently addressed in the learning outcomes of the curricula. Among the problem areas with the most frequent full coverage in the learning outcomes across all educational levels are *Traditions and culture at risk* and *Artificial intelligence and new technologies*. Although *Traditions and culture at risk* is the most frequently addressed problem area across all educational levels examined in the current study, it is ranked last among the eleven problem areas in the research conducted by UNESCO to identify expected global issues for the future. In the research by UNESCO, participants mostly indicated that globalization leads to cultural heritage and identity loss and that young people are not interested in their own cultural heritage. Participants also suggested that the solution for this problem area should first be to integrate issues related to culture and heritage into curricula (UNESCO, 2021b). Globalization opens up new hopes for cultural development, brand new opportunities for intercultural dialogues and contacts, new spaces for creativity, change and innovation; but on the other hand, it also creates new challenges and risks. For example, there is a tendency toward cultural homogenization strengthened by the global circulation of goods and services, including the reduction of cultural diversity, the rapid disappearance of specific cultural knowledge, languages and traditions and urban and demographic pressures on cultural heritage (UNESCO, 2000). Rzayeva (2020) stated that as a result of the industrial revolution and the influence of cultural globalization driven by communication and technological developments, local cultures are falling under the influence of global culture. People are being directed towards a single culture, leading to a world where people are increasingly wearing the same brands, eating the same foods and listening to the same music, resulting in a phenomenon of homogenization. In Turkey, there are also studies examining the transmission of culture in relation to the problem area of *Traditions and culture at risk*, particularly within the context of courses such as Life Studies (Şahin,

2019; Yıldırım, 2021), Turkish (Melanlıoğlu, 2010), Social Studies (Gürel & Çetin, 2018; Şahin, 2019) and History (Yazar & Yazar, 2018). Ültanır (2003) stated that cultural elements to be passed on to younger generations are rarely distinctly defined under specific disciplinary hearings, but rather are spread throughout the objectives and content of most curricula and even appear in additional materials prepared by teachers within the curriculum framework. In addition, among the basic and prominent functions of education is to ensure the socialization of individuals and the transfer of culture to the new generation (Erden, 1998; Tezcan, 2021). In the current study, the factors mentioned above may have been effective in the fact that the problem area of *Traditions and culture at risk* is the most frequently encountered topic in the curricula of all levels.

Another problem area that is most frequently addressed in the outcomes of all three levels is the problem area of *Artificial intelligence and new technologies*. However, this problem area is not fully addressed in the learning outcomes of primary school and high school (Anatolian High School) curricula, though it is ranked among the top areas of full coverage in middle school curricula. In the research conducted by UNESCO to determine expected global problems for the future, the problem area of *Artificial intelligence and new technologies* is ranked tenth among the eleven problem areas. Participants identified several sub-issues under the problem area of *Artificial intelligence and new technologies*, including online privacy and control, ethical issues, forms of cyber warfare and conflict, new crimes such as hacking and identity theft and a lack of transparency regarding how personal data is used and developed (UNESCO, 2021b). In the current study, the problem area of *Artificial intelligence and new technologies* is fully addressed in the learning outcomes of the Information Technologies and Software course at middle school level. The inclusion of application-based outcomes related to technology in this course may have increased the frequency of coverage of this area in the learning outcomes. In the study conducted by Debbağ and Fidan (2019), the Information Technologies and Software course curriculum was examined in terms of technological literacy. In the study, five dimensions were determined regarding technological literacy: the foundations of technology, the impact of technology on human life, applicability, production and design, evaluation and sustainability. The reflections of the dimensions "applicability", "evaluation and sustainability" in the learning outcomes of the Information Technologies and Software course curriculum are inadequate, while the reflections of other dimensions are found to be partially adequate. Karademir, Öztürk, and Alper (2014) evaluated the Information Technologies and Software course curriculum in the context of student competency criteria determined by international organizations operating in the field of educational technology. Accordingly, it was determined that in the Information Technologies and Software course curriculum, emphasis is given to basic information technologies skills in order for students to gain basic level knowledge and skills, and that higher level skills such as creativity are highly correlated with the outcomes. In these studies, it can be stated that the Information Technologies and Software course has been found to be partially sufficient or sufficient in terms of including technological literacy and information technologies skills. According to the OECD report (2022), artificial intelligence must be part of the solution to the accomplishment of global sustainability goals. Artificial intelligence-supported innovations can contribute to finding the solutions needed by countries to achieve their global sustainability goals, ranging from energy efficiency to the discovery and scaling of clean technologies. It is noted that artificial intelligence forms the basis for some of the most promising technological solutions to today's global challenges, including climate change and environmental sustainability. In addition, artificial intelligence-enabled technologies can increase economic efficiency and welfare. According to the report of the Turkish Informatics Association (2020), artificial intelligence applications began in the 1960s with human efforts to create machines that think, learn and solve problems like themselves. These applications have been used in many areas of the production and service sectors in recent years. For example, it is used in many areas such as social development and progress, manufacturing and production industry, environment, energy and use of natural resources, aviation and space, education, health, agriculture, finance, defence, security and cyber security, and its use is becoming even more widespread. West and Allen (2018) also emphasized in their report that the world is on the verge of revolutionizing many sectors through artificial intelligence and data analytics. It has been stated that artificial intelligence technologies used in areas

such as finance, national security, health services, transportation and smart cities provide significant economic and social benefits. The areas for the use of artificial intelligence technologies were also specified in the European Parliament Newsletter, where the results of a survey were also shared. According to the newsletter, although 61% of Europeans have a positive view of artificial intelligence and robots, 88% stated that these technologies require careful management (News European Parliament, 2020). In addition to the correct and ethical use of artificial intelligence technologies that exist today and are expected to become increasingly widespread in the future, there is a need to educate the new generation on the problems that may arise in this field and their potential solutions. Therefore, it would be appropriate to include this problem area not only in the Information Technologies and Software course curriculum, but also in the curriculum of each level in a way that will serve the relevant course.

As a result, in line with the findings and results obtained in the current study, it is recommended that various problems in the Anthropocene, which currently affect the nature and humanity and will continue to do so in the future, should be included in the curricula of all levels and courses in a balanced and age- appropriate manner. Raising awareness alone through curricula will not be sufficient for these problem areas. Curricula should be organized to prepare individuals who can foresee future problems, generate solutions to them and implement these solutions, as aimed by problem-centred curriculum designs.

This study describes the extent to which various problem areas are addressed in the learning outcomes of required courses across all educational levels. In future research, textbooks may be examined in addition to curricula, observations may be conducted in school and classroom environments, and opinions may be gathered from students and teachers who are directly affected by the curriculum. It may also be useful to evaluate how problem areas are addressed at various educational levels based on these data.

References

American Association for the Advancement of Curriculum Studies. (2022). Curriculum studies in the Anthropocene. Retrieved from http://www.aaacs.org/

Amnesty International. (2019). Global survey report. Retrieved from https://www.amnesty.org/en/wp-content/uploads/2021/05/ORG1009002019ENGLISH.pdf

Asafu-Adjaye, J., Blomquist, L., Brand, S., Brook, B. W., DeFries, R., Ellis, E., … Teague, P. (2015). An ecomodernist manifesto. Retrieved from http://www.ecomodernism.org/manifesto-english

Benítez, F. F., Paredes, M. E. R., Collado-Ruano, J., Terán, E. F. H., & Ibarra, G. D. L. (2019). Environmental education program in Ecuador: Theory, practice, and public policies to face global change in the Anthropocene. *Ensaio: Avaliação e Políticas Públicas em Educação*, *27*, 859-880. Retrieved from https://www.scielo.br/j/ensaio/a/7KS6gWqBCgHLfSPBn9HsS6m/?lang=en&format=html

Board of Education. (2021). İlköğretim kurumları (ilkokul ve ortaokul) haftalık ders çizelgesi'nde değişiklik yapılması. Retrieved from http://ttkb.meb.gov.tr/meb_iys_dosyalar/2022_01/19093950_ilkogretim-hdc-karar-ve-eki-2022-2023.pdf

Brennan, M. (2017). Struggles for teacher education in the age of the Anthropocene. *Journal of Education, 69*, 43-65.

Cole, D. R., & Malone, K. (2019). Environmental education and philosophy in the Anthropocene. *Australian Journal of Environmental Education*, *35*(3), 157-162.

Coles, A. (2019). A mathematics curriculum in the Anthropocene. In M. Graven, H. Venkat, A. A. Essien, & P. Vale (Eds.), *43rd Annual Meeting of the International Group for the Psychology of Mathematics Education Volume 2 Research Reports* (pp. 161-168). Pretoria, South Africa: PME.

Comfort, L. K. (1994). Self-organization in complex systems. *Journal of Public Administration Research and Theory: J-PART*, *4*(3), 393-410.

Commonwealth Scientific and Industrial Research Organization (CSIRO), Globaïa, International Geosphere-Biosphere Programme (IGBP), International Human Dimensions Programme on Global Environmental Change (IHDB), Stockholm Resilience Centre and Stockholm Environment Institute (2012). *Welcome to the Anthropocene*. Retrieved from https://www.anthropocene.info/about.php

Crutzen, P. J. (2002). The Anthropocene: Geology of mankind. *Nature, 415*, 23.

Crutzen, P. J., & Stoermer, E. F. (2000). The "Anthropocene". *Global Change Newsletter, 41*, 17-18.

Dane, K. (2022). What is reconstructionism in education?. Retrieved from https://www.owlgen.in/what-is-reconstructionism-in-education/

Davis, E. J., Smith, T. J., & Leflore, D. (2007). *Chaos in the classroom: A new theory of teaching and learning*. USA: Carolina Academic Press.

Debbağ, M., & Fidan, M. (2019). Bilişim teknolojileri ve yazılım dersi öğretim programının teknoloji okuryazarlığı boyutları açısından incelenmesi. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi*, 50, 22-50.

Doll, W. E. Jr. (1993). *A post-modern perspective on curriculum*. New York: Teachers College Press.

Dukes, P. (2020). *Minutes to midnight: History and the Anthropocene era from 1763.* Anthem Press.

Erden, M. (1998). *Öğretmenlik mesleğine giriş*. İstanbul: Alkım Yayınları.

Erten, S., & Köseoğlu, P. (2022). Ortaokul fen bilimleri kitaplarında "Sıfır Atık Projesi". *Milli Eğitim Dergisi*, *51*(234), 1085-1110.

European Commission. (2019). The European green deal. Brussels. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019DC0640&from=EN

General Directorate of Secondary Education. (2022). *Okul türleri.* Retrieved from https://ogm.meb.gov.tr/meb_iys_dosyalar/2022_12/06121413_okul_turleri.pdf

Ghilardi-Lopes, N. P., Kremer, L. P., & Barradas, J. I. (2019). The importance of "Ocean Literacy" in the Anthropocene and how environmental education can help in its promotion. In N. P. Ghilardi-Lopes & F. Berchez (Eds.), *Coastal and marine environmental education* (pp. 3-17). New York: Springer.

Güngör Cabbar, B. (2020). İlkokul dördüncü sınıf öğrencilerinin ağaç kavramına karşı metaforik algıları. *Anadolu Journal of Educational Sciences International*, *10*(1), 189-208.

Gürel, D., & Çetin, T. (2018). Sosyal bilgiler dersi ve kültür aktarımında edindiği rol üzerine bir inceleme. *AJELI-Anatolian Journal of Educational Leadership and Instruction*, *6*(2), 22-40.

Güvenç, H. (2017). Öğretim programlarımızda finansal okuryazarlık. *İlköğretim Online*, *16*(3), 935-948.

Harari, Y. N. (2016). *Homo deus yarının kısa tarihi* (P. N. Taneli, Trans.). İstanbul: Kollektif Kitap.

Kaçmaz, G. (2005). *Kaos teorisi ve sosyolojisi: toplumların denetlenmesinde yeni bir adım* (Unpublished master's thesis). İstanbul University, İstanbul.

Kamacı, F. (2021). *Türkiye'de okullarda çevre eğitimi çerçevesinde ortaöğretim öğrencilerinin çevre sorunlarına yaklaşımı: Karasu örneği* (Unpublished master's thesis). Sakarya University, Sakarya.

Karademir, T., Öztürk, H. T., & Alper, A. (2014). *Bilişim teknolojileri ve yazılım dersi kazanımlarına uluslararası bir bakış*. 8. Uluslararası Bilgisayar ve Öğretim Teknolojileri Sempozyumu, Edirne.

Kates, R. W. (2001). Queries on the human use of the Earth. *Annual Review of Energy and the Environment*, *26*(1), 1-26.

Kopnina, H. (2014). Future scenarios and environmental education. *The Journal of Environmental Education*, *45*(4), 217-231.

Kouppanou, A. (2020). Environmental education and children's agency at the time of the Anthropocene. *Journal of Philosophy of Education*, *54*(4), 944-959.

Kuşçuoğlu, A. (2022). *6 yaş ve üzeri çocuk kitapları için sürdürülebilirlik kavramı çerçevesinde bir örnek uygulama* (Unpublished master's thesis). Hacettepe University, Ankara.

Le Grange, L. (2019). The Anthropocene: Becoming-imperceptible of (environmental) education. *On Education: Journal for Research and Debate*, *2*(4), 1-6.

Leinfelder, R. (2013). Assuming responsibility for the Anthropocene: Challenges and opportunities in education. *RCC Perspectives*, *2*, 9-28.

Lloro-Bidart, T. (2015). A political ecology of education in/for the Anthropocene. *Environment and Society*, *6*(1), 128-148.

Lunenburg, F. C. (2017). Organizational structure and design. *Journal of Educational Leadership and Policy Studies*, *1*(1), 21-43.

Max Planck Institute for the History of Science. (2023). Anthropocene curriculum. Retrieved from https://www.anthropocene-curriculum.org/

Melanlıoğlu, D. (2010). Kültür aktarımı açısından Türkçe öğretim programları. *Eğitim ve Bilim*, *33*(150), 64-73.

Miles, M. B., & Huberman, A. M. (1994). *An expanded sourcebook: Qualitative data analysis.* Thousand Oaks, CA: Sage.

Ministry of National Education. (2018). Öğretim programları. Retrieved from http://mufredat.meb.gov.tr/Programlar.aspx

Mitchell, D., & Stones, A. (2022). Disciplinary knowledge for what ends? The values dimension of curriculum research in the Anthropocene. *London Review of Education*, *20*(1), 23.

Nartgün, Ş., & Çelik Yılmaz, D. Ç. (2021). Eğitim sistemini etkileyen değişimlerin kaos teorisi bağlamında incelenmesi: Yükseköğretim kurumlarına giriş sınavlarındaki değişikliklerin yarattığı kelebek etkisi. *MSGSÜ Sosyal Bilimler Dergisi*, *1*(23), 105-126.

News European Parliament. (2020). What is artificial intelligence and how is it used?. Retrieved from https://www.europarl.europa.eu/news/en/headlines/society/20200827STO85804/what-is-artificial-intelligence-and-how-is-it-used

OECD. (2016). *Perspectives on global development 2017: International Migration in a Shifting World.* Paris: OECD Publishing. Retrieved from https://www.oecd-ilibrary.org/development/perspectives-on-global-development-2017_persp_glob_dev-2017-en

OECD. (2019). *PISA 2021 financial literacy analytical and assessment framework.* Retrieved from https://www.oecd.org/pisa/ sitedocument/PISA-2021-Financial-Literacy-Framework.pdf

OECD. (2022). *Measuring the environmental impacts of artificial intelligence compute and applications the AI footprint.* Retrieved from https://www.oecd-ilibrary.org/docserver/7babf571-en.pdf?expires=1676458198&id=id&accname=guest&checksum=B83E89AA9C6421E55BE01DFBE269125A

Oldroyd, D. (2018). Leading education in the Anthropocene epoch. In R. Dorczak (Ed.), *Leading and managing for development* (pp. 52-59). Krakow: Jagiellonian University Institute of Public Affairs.

Ornstein, A. C., & Hunkins, F. P. (2018). *Curriculum: Foundations, principles, and issues*. Londra: Pearson Education.

Özdemir, O. (2021). Bir sürdürülebilirlik eğitimi modeli: Schumacher koleji. *Muğla Sıtkı Koçman Üniversitesi Eğitim Fakültesi Dergisi*, *8*(2), 725-732.

Öztürk, C. (2015). Sosyal Bilgiler: Toplumsal yaşama disiplinlerarası bir bakış. In C. Öztürk (Ed.), *Sosyal bilgiler öğretimi: Demokratik vatandaşlık eğitimi* (pp. 1-31). Ankara: Pegem Akademi Yayıncılık.

Parker, W. C. (2011). *Social studies in elementary education* (14th ed.). Londra: Pearson Prentice Hall.

Presidency of Migration Management. (2023). Güncel veriler (ikamet izinleri, geçici koruma). Retrieved from https://www.goc.gov.tr/

Rockström, J. (2017, February 17). *WEF 2017: Beyond the Anthropocene* [Video]. Youtube. Retrieved from http://www.stockholmresilience.org/research/research-news/2017-02-16-wef-2017-beyond-the-anthropocene.html

Rzayeva, S. (2020). Küreselleşmenin kültürel akışları ve somut olmayan kültürel miras üzerindeki etkiler. *Motif Akademi Halkbilimi Dergisi*, *13*(29), 33-52.

Saydam, S., & Kalağan, G. (2020). Kamu yönetiminin son paradigması: Kaos teorisi. *Uluslararası Yönetim İktisat ve İşletme Dergisi*, *16*(3), 657-674.

Sönmez, V. (2020). *Eğitim felsefesi* (16th ed.). Ankara: Anı Yayıncılık.

Steffen, W., Broadgate, W., Deutsch, L., Gaffney, O., & Ludwig, C. (2015). The trajectory of the Anthropocene: The great acceleration. *The Anthropocene Review*, *2*(1), 81-98. doi:10.1177/2053019614564785

Şahin, V. (2019). Kültürel coğrafya bakımından hayat bilgisi ve sosyal bilgiler ders programlarına bir yaklaşım. *Milli Eğitim Dergisi*, *48*(222), 173-183.

Tay, B. (2017). Hayat Bilgisi: Hayatın bilgisi. In B. Tay (Ed.), *Etkinlik örnekleriyle hayat bilgisi öğretimi* (pp. 1-43). Ankara: Pegem Akademi Yayıncılık.

Tekel, S. (2006). Yönetim ve organizasyon bilimi açısından karmaşıklık teorisi. *Journal of Istanbul Kültür University, 2*, 223-229.

Tezcan, M. (2021). *Eğitim sosyolojisi.* Ankara: Anı Yayıncılık.

Trischler, H. (2016). The Anthropocene. *NTM Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin*, *24*(3), 309-335. Retrieved from https://link.springer.com/article/10.1007/s00048-016-0146-3

Turkish Informatics Association. (2020). *Türkiye'de yapay zekanın gelişimi için görüş ve öneriler.* Retrieved from https://www.tbd.org.tr/pdf/yapay-zeka-raporu.pdf

Turner II, B. L., Clark, W. C., Kates, R. W., Richards, J. F., Mathews, J. T., & Meyer, W. B. (Eds.). (1993). *The Earth as transformed by Human action: Global and regional changes in the biosphere over the past 300 years*. Cambridge: Cambridge University Press.

Uçar, S. (2015). Kaos teorisine felsefi bir bakış. *Kutadgubilig: Felsefe Bilim Araştırmaları, 27,* 293-307.

Uğur, A. (2021). Antroposen: İklim krizi mi yoksa uygarlık krizi mi?. *Reflektif Sosyal Bilimler Dergisi*, *2*(3), 557-579.

UNESCO. (1978). Tbilisi Declaration (1977). Retrieved from https://www.gdrc.org/uem/ee/tbilisi.html

UNESCO. (2000). UNESCO in a globalizing world. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000119581

UNESCO. (2018). Global action programme on education for sustainable development. Retrieved from https://www.oneplanetnetwork.org/knowledge-centre/projects/global-action-programme-gap-education-sustainable-development-esd-0

UNESCO. (2019). *Framework for the implementation of education for sustainable development (ESD) Beyond 2019.* Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000370215.locale=en

UNESCO. (2021a). *Reimagining our futures together a new social contract for education report from The International Commission on the Futures of Education*. Paris: UNESCO. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000379707.locale=en

UNESCO. (2021b). *The world in 2030: Public survey report.* Paris: UNESCO. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000375950.locale=en

United Nations. (1973). *Report of the United Nations conference on the human environment.* New Yok: United Nations. Retrieved from https://digitallibrary.un.org/record/523249

United Nations. (1993). *Report of the United Nations Conference on Environment and Development.* New Yok: United Nations. Retrieved from https://www.un.org/en/conferences/environment/rio1992

United Nations. (2015). *Transforming our world: the 2030 agenda for sustainable development.* Retrieved from https://sdgs.un.org/publications/transforming-our-world-2030-agenda-sustainable-development-17981

United Nations. (2016). *Sustainable development goals: 17 goals to transform our world*. Retrieved from https://www.un.org/en/exhibits/page/sdgs-17-goals-transform-world

United Nations Development Programme. (2022). *İnsani gelişme raporu 2021/2022* (A. Bıçaksız, Trans.). New York: UNDP.

Ültanır, G. (2003). Eğitim ve kültür ilişkisi eğitimde kültürün hangi boyutlarının genç kuşaklara aktarılacağı kaygısı. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi*, *23*(3), 291-309.

Varış, F. (1996). *Eğitimde program geliştirme: teoriler ve teknikler* (6th ed.). Ankara: Alkım Kitapçılık Yayıncılık.

Wallen, N. E., & Fraenkel, J. R. (2013). *Educational research: A guide to the process*. New York: Routledge.

Weber, R. P. (1990). *Basic content analysis* (2nd ed.). Thousand Oaks, CA: Sage.

Weichhart, G. (2013). The learning environment as a chaotic and complex adaptive system. *Systems: Connecting Matter, Life, Culture and Technology, 1*(1), 36-53.

West, D. M., & Allen, J. R. (2018). *How artificial intelligence is transforming the world.* Retrieved from https://www.brookings.edu/research/how-artificial-intelligence-is-transforming-the-world/

World Economic Forum. (2022). Global risks report 2022. Retrieved from https://www.weforum.org/publications/global-risks-report-2022/

World Vision International. (2022). 5 global crises the world can't ignore in 2022 (by James East). Retrieved from https://www.wvi.org/fragile-context/5-crises-the-world-cant-ignore-in-2022

Yazar, S., & Yazar, İ. (2018). Ortaöğretim Türk kültür ve medeniyet tarihi öğretim programının (2017) kültür aktarımı ve çoklu ortam uygulamaları açısından incelenmesi. *İlköğretim Online*, *17*(1), 1-13.

Yeşilorman, M. (2006). Kelebek kanadını kimden yana çırpıyor? Birleştirilmiş bilimin kıyısında kaos ve sosyal bilimler. *Journal of Istanbul Kültür University*, *4*(3), 77-86.

Yıldırım, G. (2021). Somut olmayan kültürel mirasın eğitim programlarına yansıması: Hayat bilgisi öğretimi. *Uluslararası Sosyal ve Eğitim Bilimleri Dergisi*, 16, 231-247.