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GIS Integration into Geography Curriculum in Türkiye: A Case Study Evaluation

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Abstract. The integration of technology into education is a complex process with many dimensions, and there are many steps that need to be taken for this integration to be successful. One of the most important of these is the integration of information and communication technologies into the curriculum. The aim of this study is to shed light on the updates that can be made in the curriculum by examining the geography curriculum implemented in Türkiye and last revised in 2018 in terms of GIS integration, which is the first technology that comes to mind when the words geography and technology come side by side, and to present the steps of creating a GIS application for this learning outcome by restructuring a learning outcome within the scope of a case study. In the light of the findings obtained in this study, which was designed with the case study method, one of the qualitative research designs, it was concluded that GIS is included in only a few chapters in the geography curriculum, and there is only one learning outcome for which the use of GIS technology is recommended. According to this result, the restructured version of the learning outcome 10.4.1, which is the only learning outcome that is foreseen to be given GIS support in the geography curriculum, according to the understanding of learning with technology and a sample GIS application, is presented.
Keywords: GIS, Geography education, technology integration, technology, curriculum

GIS integracija į geografijos ugdymo programą Turkijoje: atvejo analizės vertinimas

Santrauka. Technologijų integravimas į švietimą yra sudėtingas daugiamatis procesas, todėl reikia atlikti daug žingsnių, norint, kad šis integravimas būtų sėkmingas. Vienas svarbiausių iš jų – informacinių ir ryšių technologijų integravimas į ugdymo turinį. GIS (geoinformacinės sistemos) technologija pasitelkiama dažniausiai, kai gretinamos geografijos ir technologijų sąvokos, todėl šio tyrimo tikslas – išsiaiškinti, kokius atnaujinimus galima įtraukti į ugdymo programą pagal GIS integracijos parametrus išanalizavus geografijos programą Turkijoje (programa paskutinį kartą peržiūrėta 2018 m.), ir pristatyti GIS taikymo kūrimo žingsnius geografijos dalyko siekiniams juos performuluojant pagal atvejo studijos aprėptį. Pristatomo tyrimo, kuriame taikytas kokybinis atvejo studijos metodas, radiniai leidžia daryti išvadą, kad GIS įtraukta tik į kelis geografijos ugdymo programos skyrius, be to, GIS technologija rekomenduojama tik vienam mokymosi siekiniui. Pagal šį rezultatą pateikiama patobulinta 10.4.1 mokymosi siekinio versija ir GIS diegimo pavyzdys – tik šis siekinys numato GIS integraciją į geografijos programą pagal technologijomis grįsto mokymosi sampratą.
Pagrindiniai žodžiai: GIS, geografijos ugdymas, technologijų integracija, technologijos, ugdymo programa

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Introduction

The emergence of developments that will change the era more rapidly than in the past causes the current era to be referred to by different names such as communication, information, internet, etc. Although the names are different, it is a common acceptance that people living in the current age are expected to be individuals who can use technology effectively while searching, organising and developing information. This acceptance also shapes education systems and the components of this system all over the world. However, technology integration in education has a cost, and naturally, it is not easy to provide this integration, especially for low-income people living in society (Welch&-Dooley, 2013; Welch, 2015). At this point, countries are trying to develop and implement projects that will cover the cost of the infrastructure and hardware dimensions of technology integration in education. One of these projects is the FATİH Project implemented in Türkiye. The FATİH Project aims to create equal opportunities in education by making the expensive hardware and infrastructure components required for technology integration into education available to students and teachers. To date, the project has installed interactive whiteboards in thousands of classrooms, distributed millions of computers to teachers and students, and provided internet infrastructure to all schools (MoNE, 2022).

Many different models have been implemented in the world from past to present for integrating technology into education. These can be generally divided into two main groups as "Technology-oriented technology integration models" and "Pedagogy-oriented technology integration models" (Kurt, 2013). As can be understood from their names, technology-oriented integration models focus on the integration of information hardware and software into the teaching process, while pedagogy-oriented models focus on the teacher without neglecting technologies such as hardware and software According to Kabakçı Yurdakul (2011), technology integration in education is a complex process that requires not only the acquisition of current technologies but also the consideration of various administrative, instructional and institutional variables. Although there are different definitions of technology integration in education in the literature, the common point of these definitions is the use of ICTs as a tool in gaining learning objectives (Koçak Usluel, Kuşkaya Mumcu&Demirarslan, 2007). One of the most important components of the FATİH Project, which is the biggest project implemented in Türkiye to integrate technology into education, is "Effective use of information technologies in curricula" (MoNE, 2022). Saban (2007) explains that one of the most important variables required for the successful integration of technology into education is the curriculum. It can be said that integrating curricula, one of the most important components of the education system, with information and communication technologies should be one of the first steps to be taken for technology integration in education. When integrating technology into the curriculum, it should be ensured that technology is a tool rather than a goal. In other words, technology integration in the curriculum should encourage teachers to teach with technology rather than to teach technology. This approach is also compatible with Dewey's understanding that the most effective learning is obtained by doing and experiencing. In teaching environments where the natural structure and individual differences

of the child are taken into consideration and the student is at the centre of education, lessons should be organised according to the student's interests and abilities. Students should not be made to memorise subjects, and practice should be emphasised rather than theory. Information should never be presented ready-made; students should be allowed to discover and think (Bender, 2005).

One of the most important technologies used in analyzing the human-space relationship, which is also at the center of geography, and in transferring the subject to students in detail, is GIS. GIS, which is used for the analysis, processing, and mapping of geographical events and facts, provides classification of information by using databases and statistical analysis. Thanks to these features, GIS is ahead of other technologies; its importance, need, and value are increasing day by day (Özgen&Çakıcıoğlu, 2009). Today, the latest studies on geography education in the world focus on issues such as the dissemination of different technology applications in secondary education, especially GIS applications. The number of student research projects carried out on GIS, which has practical benefits in terms of developing students' questioning and problem-solving skills such as understanding the cause-and-effect relationship between geographical events and phenomena, understanding the importance of the location they live in, and analyzing and synthesizing the information they enter into the database, is constantly increasing. In countries such as the USA, Canada, the UK, and the Netherlands, GIS-based student projects carried out by secondary school students and supported by institutions responsible for education are making waves across the country and providing important clues for the future of geography. It is seen that these studies focus on issues such as improving air, water, and soil quality, increasing agricultural production, the distribution of industrial areas, and their effects on society (Audet&Ludwig, 2000; ESRI, 2003; Van der Schee, 2006). This GIS-centered approach is also supported by the geography curricula implemented in these countries. According to the results of a growing number of studies, the inclusion of GIS in curricula contributes to the learning and/or development of students' critical, analytical, and communication skills (Kerski, 2001; Alibrandi, 2003; Bloom and Palmer-Moloney, 2004; Bednarz and Van Der Schee, 2006; Pang, 2006; Milson and Alibrandi, 2008). According to Artvinli (2009, 2010a), one of the reasons why we focus on GIS, especially in recent times, according to the traditional education approach, is that it can enable us to go beyond knowledge and present new approaches and levels of comprehension.

Since curricula are guidebooks that cover all activities related to the teaching of a course, the technologies to be used in teaching and how to use them in the process should be included in these guidebooks first. The most important technology that should be included in the geography course curriculum, which will guide teachers in the teaching of geography courses, is GIS. Because the basis of GIS is the "map", which is also the key to geography. In addition, it can be said that GIS is the only technology that will provide all of the map skills, geographical inquiry, perception of time, perception of change and continuity, and skills of preparing tables, graphs, and diagrams at the same time in the geography curriculum implemented in Türkiye. When the literature on the integration of

GIS into geography curricula is reviewed – Rød, Larsen & Nilsen (2010) emphasise in their study that the "learning with GIS" approach should be adopted in the integration of GIS into the geography curriculum in Norway and that integration should take place through evolution rather than revolution, and this should be done through the use of web-based GIS and/or free GIS data visualization tools. Goldstein and Alibrandi (2013), in their study investigating the effects of integrating GIS into the secondary school curriculum on student achievement, concluded that integrating GIS into the curriculum enables students to be involved in the learning process not only in geography but also in other courses and increases their digital literacy and intellectual capacity. Patterson, Reeve and Dan Page (2003) emphasized that academics and high school teachers can work together to create their own flexible curriculum for the integration of GIS into the curriculum and concluded that such GIS integration improves students' problem-solving and critical thinking skills. Sharpe and Best (2001) suggest that GIS activities to be integrated into the curriculum should be flexible enough to allow for implementation in different regions, include detailed and step-by-step instructions, and be flexible enough to be implemented in different timetables. Although integration models emerge differently in the studies conducted in different countries with the effect of the educational policies of the countries, the common point in all studies is that the integration of GIS into technology is built on the goals of learning with GIS and realizing projects with GIS, not for the purpose of teaching GIS. This integration of GIS technology into geography teaching is also compatible with constructivism, which is the basis of the curriculum. Students who learn with GIS and use GIS technologies in solving daily life problems are not passive; they are not part of a rote education in accordance with the pragmatist understanding of education, and they are enabled to explore and think by emphasising practice rather than theory (Dewey, 1913; Dewey, 2008). In addition, technology integration should be realised within a plan. Planning has important functions in terms of guiding technology integration into education and emphasising the focal point of the implementation. Plans guide the implementer in determining concrete steps (Saban, 2007). When planning technology integration, it should be considered at three levels: micro, medium and macro (Hew&Brush, 2007; Wang&Woo, 2007). Macro-level technology integration is defined as the integration of technology with the curriculum. Medium-level technology integration emphasises the integration of technology into the subject area within the course, and micro-level technology integration emphasises the integration of technology into one or more outcomes (Wang&Woo, 2007).

As can be seen, the integration of GIS technology into geography teaching processes is extremely important in the geography curriculum implemented in Türkiye as well as in the whole world. In this context, the aim of this study is to shed light on the updates that can be made in the curriculum by examining the Geography Curriculum implemented in Türkiye and updated in 2018 in terms of GIS technology integration, to restructure the learning outcome 10.4.1, which is the only learning outcome recommended to be given with GIS support in the program, according to the understanding of learning with technology, and to present how to create an application created with GIS technology that can be used for this learning outcome step by step.

Method

In this study, case study methodology, one of the qualitative research methods, was used. The fact that the study is called a case study is due to the fact that it is limited only to the integration of GIS technology in the geography curriculum. What, how, and why questions were taken as the basis for determining the status of GIS integration in geography curriculum, and if it was provided, to determine whether there are sections on how to apply GIS applications and whether GIS technology is used in the realization of which acquisitions and how to apply GIS applications, and it was decided that the most appropriate method to answer these questions is a case study from qualitative research methods.

Data Source and Data Collection

The data source of this research is the geography curriculum which has been implemented in Türkiye since 2018. The data were collected in November 2022.
In this study, data were collected by "document analysis" method. A subject area progresses when the findings of previous studies are logically synthesised. In this sense, document analysis as a research methodology makes significant contributions to the conceptual, methodological and thematic development of different fields. In this framework, document analysis is generally defined as a systematic way of collecting and synthesising previous research (Baumeister & Leary, 1997; Tranfield, Denyer & Smart, 2003).

Analyzing the Data

While analyzing the data, the aims, perspective, assessment-evaluation approach, geographical skills, learning outcomes and the structure of the explanations of the 2018 Geography Curriculum implemented in Türkiye were analysed in terms of GIS technology integration, and the results obtained were presented in a holistic manner.

Findings

In this section, the findings obtained in line with the research purpose are presented.

Findings Related to GIS Integration in Geography Curriculum

In 2023, it was stated that the Geography Curriculum applied in secondary education institutions in Türkiye was prepared on the basis of constructivist learning theory and the first version started to be implemented in 2005, revised in 2011 and 2014 and finally in 2017. One of the most recent revisions is expressed as follows in the Geography Curriculum in force today: "The emphasis on the use of information and communication technologies, which are involved in every aspect of our lives, in Geography teaching and the relationship of learning outcomes with daily life has been increased." (MoNE, 2018). So, has the "emphasis on the use of information and communication technologies

in Geography teaching" been increased in the current geography curriculum compared to the geography curricula implemented in the past? In order to find the answer to this question, it should be examined whether there is a section on integrating technologies like GIS into geography teaching in the curriculum.

When the programme is analysed primarily in terms of technology integration, it is seen that the word technology appears for the first time in the "1.2.2. Competencies" section. In one of these competences, Mathematical competence and basic competences in science/technology, "..... competence in technology is seen as the application of knowledge and methodology in the context of meeting perceived human wants and needs". Competence in science and technology encompasses the ability to recognise changes resulting from human activities and the responsibilities of each individual as a citizen. "In addition, the fourth key competence, "Digital competence", covers the safe and critical use of information and communication technologies for work, daily life and communication. This competence is supported by basic skills such as access to information and the use of computers for the evaluation, storage, production, presentation and exchange of information, as well as participation in common networks and communication via the internet." (MoNE, 2018).

Another section in the curriculum where there is a statement about technology integration is "Geographical skills". Under the title of the ability to work in the field, the following statements about technology integration are given: "Determining the aims of the study to encourage students to observe the events and phenomena happening around them outside the classroom, designing a plan for research (collecting the necessary resources, materials before the research, scheduling, preparing the necessary materials in the field), using the necessary tools and technology, collecting and recording data in the field, analysing data, drawing conclusions, developing suggestions, writing reports will contribute to the development of this skill." (MoNE, 2018).

In the section of the issues to be considered in the implementation of the curriculum, the following statements about GIS technology integration are given in Article 5: "The Geography Curriculum supports the use of today's information-communication technologies in the teaching of geography subjects. The application of Geographical Information Systems (GIS) is suggested in some learning outcomes. Depending on the technical equipment and physical facilities in schools, the teacher can develop or implement GIS applications." (MoNE, 2018). In the Geography Curriculum, there is no other section on technology integration until the section where units, subjects and learning outcomes are given according to grade levels. In the sections that can be interpreted as technology integration, it is noticeable that this integration is not based on any technology-oriented or pedagogy-oriented model from the models previously defined in the literature, how to provide technology integration in the implementation of the programme, competencies and skills are not included in detail and the statements are quite vague.

When the section where achivements and explanations are given is analysed, the first section that can be considered as technology integration in geography teaching is "9.1.7. Explains the methods and techniques used in transferring information." "Geographical

Information Systems (GIS) and remote sensing techniques are included." which is the explanation given in sub-paragraph 'b' of the outcome. However, it is understood that information should be given about these technologies rather than the use of these technologies in geography teaching.

In the section where learning outcomes and explanations are given, the first learning outcome that requires the use of GIS in geography teaching processes is "10.4.1. Explains the causes and characteristics of disasters. Examples of the use of GIS and other spatial technologies in solving geographical problems are given." However, when the achivement is analysed, it is emphasised that examples should be given about how these technologies are used, not the integration of GIS or other technologies in the teaching of the subject.

As can be seen, when the achivements and explanations in geography curriculum are analysed, it is seen that no technology is included except for two learning outcomes, and in these two learning outcomes, only GIS technology is included. Of these two learning outcomes, only in outcome 10.4.1 it is explained that GIS will be integrated into the geography teaching process. In this learning outcome where GIS technology was included, the focus was on "teaching technology", which is one of the technology integration approaches that are no longer up-to-date. These findings do not coincide with the finding that GIS is given much more place in the geography curricula applied in developed countries in the world and that the understanding of "teaching with technology" is adopted.

Discussion, Conclusion and Recommendations

When the learning outcome and explanations were analysed, no section on the integration of GIS or other technologies and any component related to technology into the geography teaching process was found except for the above-mentioned learning outcome statements and explanations. When the geography curricula of developed countries in the world are analysed, it is seen that GIS is included more intensively and more accurately. For example, the UK geography curriculum includes the use of GIS technology to display, analyse and interpret locations and data (GSCE, 2023).

Below, the learning outcome 10.4.1 in the geography curriculum has been reinterpreted and revised according to the understanding of "teaching with technology" and how to create a GIS application example that can be used in the realisation of this learning outcome is given step by step.

For the successful integration of technology into education, instructors need to plan by considering the needs of the students, the content, and the facilities of the school and the classroom. For this reason, the plan presented in this study is exemplary and can be structured according to the variables mentioned. The first stage of technology integration should take place at the level of curriculum. For this reason, it is suggested that the explanation of the outcome statement "10.4.1.", which is the outcome statement related to the sample technology application presented in this study, should be re-evaluated within the scope of the understanding of "teaching with technology" and should be as in Table 1.

Table 1. *Restructuring the learning outcome 10.4.1. and explanations in the geography curriculum according to the "teaching with technology" approach*

The current version of learning outcome 10.4.1. in the 2018 geography curriculum	**The learning outcome 10.4.1. restructured according to the "learning with technology" approach**
10.4.1. Explains the causes and characteristics of disasters. Examples of the use of GIS and other spatial technologies in solving geographical problems are given.	10.4.1. Explains the causes and characteristics of disasters. An application is created in GIS environment in which students also enter data about the disasters occurring in the world.

In the attainment statement numbered 10.4.1 in the 2018 geography curriculum, both geographical problems, which are a more general phenomenon than the disasters that the main outcome focuses on, are mentioned, and it is emphasized to include examples using GIS, not teaching with GIS. As can be seen in the table above, the restructured attainment statement does not move away from the subject of disasters and ensures that students are actively involved in the process by using GIS in the teaching of this subject.

In this study, WEB GIS application, which can be called new generation GIS, was used rather than desktop GIS applications that can be described as traditional. WEB GIS which is a perfect combination of desktop GIS and the internet (Fu, 2016), uses cloud computing infrastructure, so it can perform more effectively the operations that classical GIS can do. The applications produced in WEB GIS can be shared by people with thousands of people at the same time, and can be accessed from anywhere on any device (phone, tablet, computer) at any time (ESRI, 2020). In WEB GIS, the functions of classical GIS software can be used (Şahin&Gümüşay, 2007), geographical data can be accessed over the internet, and analyses and interactive maps can be made through the browser without GIS software installed on the computer (Peng, 1999). With these features, WEB GIS can overcome the complexity of desktop GIS programmes. This can facilitate the learning and use of GIS by students (Baker, 2005).

Below, according to the description of the learning outcome 10.4.1 in geography curriculum, which was restructured according to "teaching with technology" approach, it is given how to develop a WEB GIS application related to natural disasters occurring in the world step by step. ArcGIS Online tool, which is the WEB GIS product of ESRI company, can be used to create the WEB GIS application in question.

With this application, students will be asked to process the points where these disasters occurred on the map to be created by using a news text about the main disasters that occurred in the world in 2020. This WEB GIS application can be created by following these steps:

1. Since the students will be asked to process the major disasters that occurred in the world in 2020 on a world map, first an empty point detail layer is created (Figure 1). Since the disasters occurred in different parts of the world, the map spread is adjusted to cover the whole world.

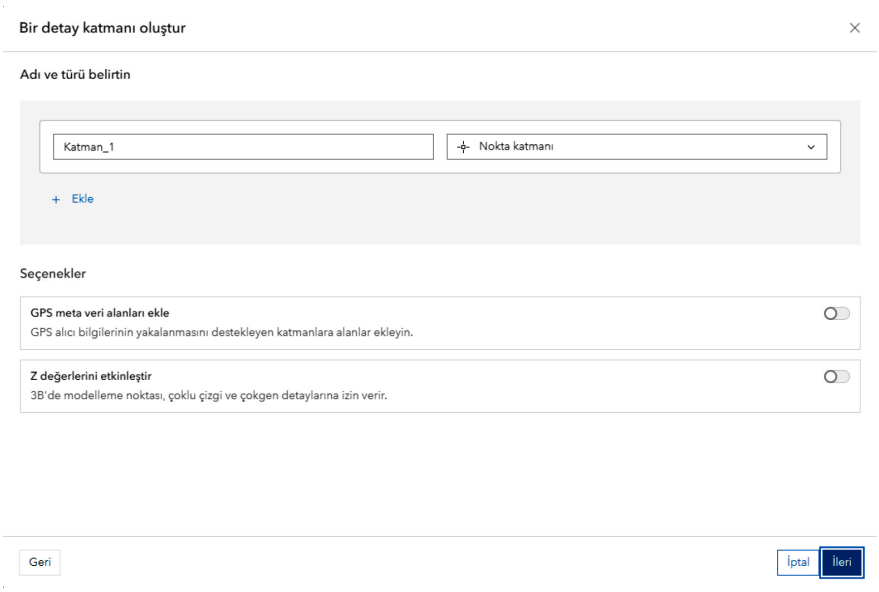

Figure 1. *Creating the detail layer*

2. After the point detail layer is created, the properties of this layer should be organised to allow students to enter data. For this, the field names that the student wants to enter related to disasters should be added to the data section of the layer created. (Figure 2). Fields such as disaster type, description, date of occurrence can be added as field names.

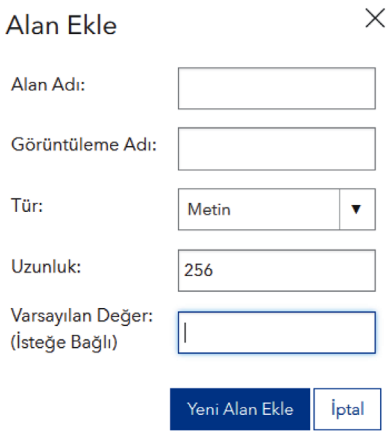

Figure 2. *Adding field names*

3. While structuring the disaster type field, subfield labels (earthquake, volcano eruption, etc.) and code values are determined for natural disasters according to their origins (Figure 3). Thus, while entering data, students can add data according to the type of disaster in the given news text.

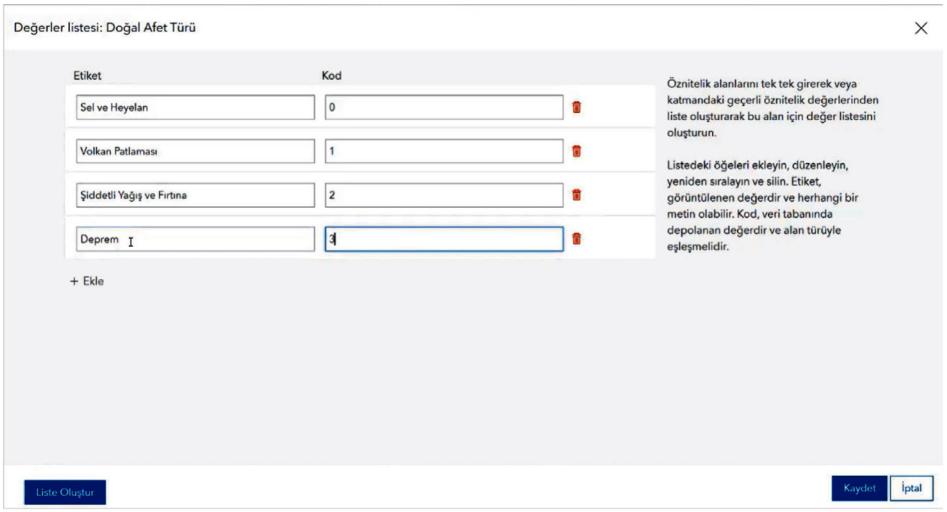

Figure 3. *Entering labels and codes*

4. After the step of adding the areas, the visualisation settings of the layer should be configured so that the details to be added by the students can be displayed on the map with different icons. For this, in the "Visualisation" tab, the appropriate icon is selected according to the type of disaster for each of the attributes named with different labels in Step 3 (Figure 4). Then, layer settings should be made open for data entry. For this purpose, the layer settings are saved by giving the necessary permissions to make the layer open to data entry by everyone who accesses it. At this stage, the sharing settings of the layer are changed to "everyone" and the layer is made suitable for data entry.

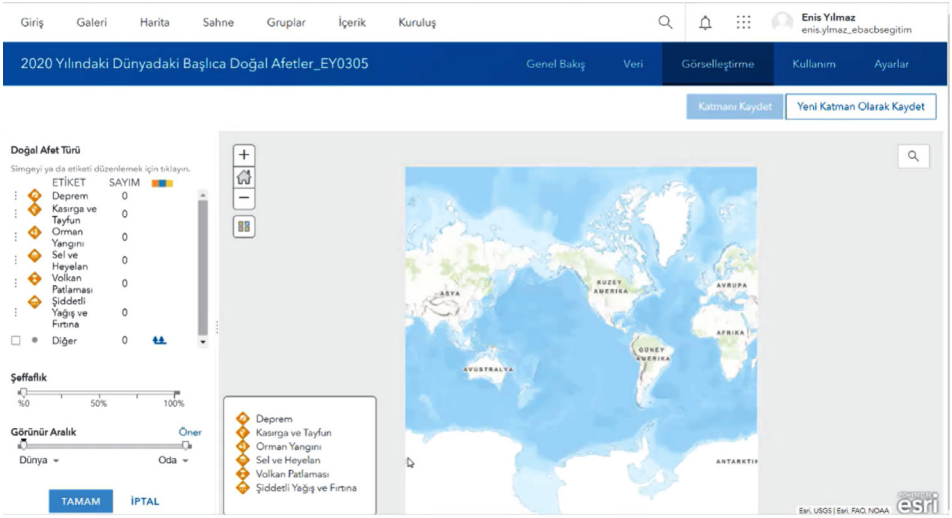

Figure 4. *Making visualisation settings*

5. After the detail layer suitable for data entry is created, this layer must be added to the map, the map must be saved and converted into an application. For this purpose, an empty map is opened, the previously saved layer is added to the map and the map is saved by entering the desired metadata (Figure 5).

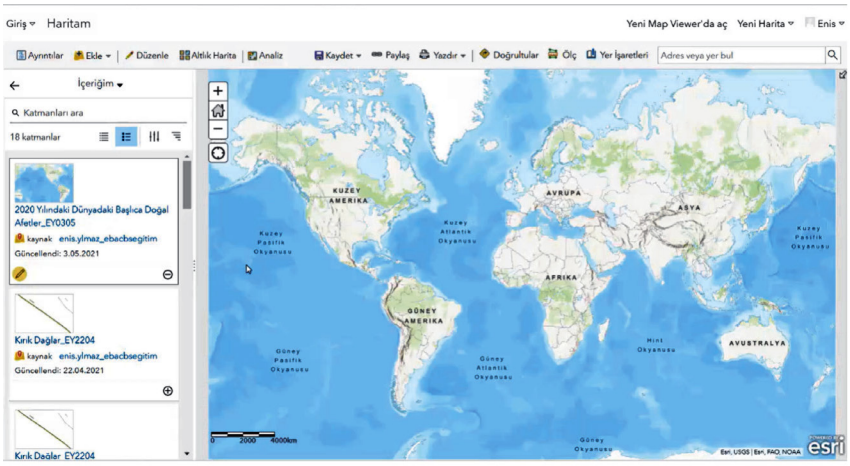

Figure 5. *Saving the map with added layers*

6. In order to turn our saved map, which has a layer where students can enter data, into an application that we can enrich by collecting data from our students, select the "Geoform" application under the "Collect/Edit Data" category from the "Share" tab and create the application.

The link of this application created by using GIS technology can be shared with the students and can be used in the geography teaching process in accordance with the explanation of outcome 10.4.1 which is restructured according to "teaching with technology" approach. Thanks to this application, it will be ensured that students can benefit from GIS and other spatial technologies in solving geographical problems as stated in the outcome description in the current geography curriculum, and that they will be directly involved in the process of adding data in accordance with the "constructivism" approach in the curriculum and become producers of knowledge and use technology in this process.

Integrating technology into curricula in order to create effective and efficient learning environments is one of the most important and necessary tasks to be done while integrating technology into education. Therefore, geography curriculum should support and guide the effective inclusion of technology in the geography teaching process with all its dimensions.

When the geography curriculum implemented in Türkiye is analysed in terms of GIS technology integration, it is understood that it does not adopt any of the technology integration models mentioned in the literature. In the programme, in the titles of competencies, skills and issues to be considered in the implementation of the programme

related to the integration of technology into education, there are statements about the use of technology in teaching processes independently of each other, but in the learning outcomes and explanations section, which is the place where it should be explained how these will take place, there is no learning outcome or explanation statement suitable for the teaching with technology approach. For this reason, the sections on technology integration before the outcomes and explanations section have become ambiguous.

The first stage to be addressed in technology integration in education is the "macro" level of curricula. Accordingly, geography curriculum should be reviewed and revised in terms of technology integration, and the competencies and skills, outcomes and outcome descriptions in the programme should be harmonised with each other in terms of technology integration. While ensuring this harmonisation, the opportunities provided by the FATİH Project, which is a technology integration project implemented in Türkiye, should be taken into consideration, and technology integration should not be left to the initiative of geography teachers who graduate from teacher training institutions with different levels of technology knowledge. For this purpose, especially in the acquisitions and acquisitions explanations, expressions suitable for the "teaching with technology" approach rather than the "teaching technology" approach should be included, and guidance documents should be created to support geography teachers on how to create activities with the technology component. In these guidance documents, the number of activities related to GIS, which is the first technology that should come to mind when the words "geography" and "technology" come together, should be increased, but other technologies should not be ignored. However, these changes in the curriculum are not sufficient. Because for a teacher, the curriculum is not just a booklet that presents the whole of the relationships addressed in terms of purpose, content, method, teaching-learning process and evaluation dimensions (Artvinli, 2010b). In order to ensure the successful integration of these technologies into geography teaching processes, teachers also should be provided with the necessary software, hardware and infrastructure support and the number of in-service trainings should be increased and online professional working groups should be established where all geography teachers in Türkiye could share knowledge and experience on technology integration.

Bibliography

Alibrandi, M. 2003. *GIS in the classroom*. Portsmouth, New Hampshire: Heinemann

Altun, T. (2007). Information and communications technology (ICT) in initial teacher education: What can Türkiye learn from range of international perspectives? *Journal of Turkish Science Education, 4*(2), 44.

Artvinli, E. (2009). Geography teacher's approaches to geographic information systems (GIS). *Balıkesir University Journal of Social Science Institute, 12*(22), 40–57.

Artvinli, E., (2010a). The contribution of Geographic Information Systems (GIS) to geography education and secondary school students' attitudes related to GIS. *Kuram ve Uygulamada Egitim Bilimleri, 10*(3), 1277–1292.

Artvinli, E. (2010b). Coğrafya öğretim programının uygulanmasının önündeki engeller ve fırsatlar *Education Sciences, 5*(4), 1966–1983. Retrieved from https://dergipark.org.tr/tr/pub/ nwsaedu/issue/19822/212254

Audet, R., Ludwig, G. (2000). *GIS in schools*. California: ESRI.

Baumeister, R. F., & Leary, M. R. (1997). Writing narrative literature reviews. *Review of General Psychology*, 1, 311–320. https://doi.org/10.1037/1089-2680.1.3.311

Baker, T. R. 2005. Internet-based GIS mapping in support of K-12 education. *Professional Geographer, 57*(1), 44–50.

Bednarz, S. W., and J. Van Der Schee. 2006. Europe and the United States: The implementation of geographic information systems in secondary education in two contexts. *Technology, Pedagogy and Education , 15*(2), 191–205.

Bender, M. T. (2005). A new interpretation about John Dewey's opinions of education. *Gazi Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, *6*(1), 13–19.

Bloom, E., and L. J. Palmer-Moloney. 2004. Meeting the challenge: Integrating geographic technology into today's social studies classroom. *Meridian: A Middle School Computer Technologies Journal, 7*(1): 1–5.

Dewey J. (1913). *Interest and effort in education*. Cambridge: H. Miffın.

Dewey, J. (2008). *School and society* (Translation: H. Avni BAŞMAN- Preparing for publication: Selahattin KAYMAKÇI), Ankara: Pegem.

Esri (2003). *Making community connections*. Redlands: CA ESRI.

Esri (2020). ArcGIS for Server 101 Understanding architecture, deployment, and workflows Retrieved from https://www.esri.com/~/media/Files/Pdfs/news/arcuser/0313/arcgis101.pdf

Fu, P. (2016). *Getting to know Web GIS second edition*. Esri Press.

Goldstein, D. & Alibrandi, M. (2013) Integrating GIS in the middle school curriculum: ımpacts on diverse students' standardized test scores. *Journal of Geography, 112*(2), 68–74, https://doi.org/ 10.1080/00221341.2012.692703

GSCE (2023). National curriculum in England: geography programmes of study. Retrieved from https://www.gov.uk/government/publications/national-curriculum-in-england-geography-programmes-of-study

Hew, K. F., & Brush, T. (2007). Integrating technology into k-12 teaching and learning: current knowledge gaps and recommendations for future research. *Education Technology Research and Development,* 55, 223–252.

Kabakçı Yurdakul, I. (2011). Examination of pre-service teachers' technopedagogical competencies in terms of information and communication technologies. *Journal of Hacettepe University Faculty of Education*, *40*, 397–408.

Kerski, J. 2001. A national assessment of GIS in American high schools. *International Research in Geographical and Environmental Education, 10*(1), 72–84.

Koçak Usluel, Y., Kuşkaya Mumcu, F. & Demiraslan, Y. (2007). Information and communication technologies in the learning-teaching process: Teachers' views on the integration process and barriers. *Journal of Hacettepe University Faculty of Education, 32,* 164–178.

Kurt, A. A. (2013). Conceptual and theoretical perspectives on technology ıntegration in education. In I. K. Yurdakul (Ed.), *Instructional Technologies and Material Design Based on Technopadagogical Education* (pp. 1–38). Ankara: Anı.

Milson, J., and M. Alibrandi. (2008). *Digital geography*. Charlotte, North Carolina: Information Age.

MoNE (2018) Geography Lesson Curriculum (9,10,11 and 12th Classes), Ankara.

MoNE (2022). FATIH Project, Retrieved from http://fatihprojesi.meb.gov.tr/about.html

Özgen, N. & Çakıcıoğlu, R. (2009). Coğrafi bilgi sistemlerinin cbs coğrafya eğitiminde kullanımı ve dersin hedeflerine ulaşma düzeyine etkisi. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi, 10*(1), 81–90. Retrieved from https://dergipark.org.tr/en/pub/kefad/issue/59520/855971

Pang, A. 2006. *Geographical Information Systems in Education*. Singapore: Ministry of Education, Educational Technology Division. http://iresearch.edumall.sg/ iresearch/slot/u110/litreviews/gis.pdf

Patterson, M. W.,Reeve, K. & Page, D. (2003) Integrating geographic ınformation systems into the secondary curricula. *Journal of Geography, 102(*6), 275–281, https://doi.org/ 10.1080/00221340308978559

Peng, Z. (1999). An assessment framework for the development of ınternet GIS. *Environment and Planning B: Planning and Design, 26*(1), 117–132. https://doi.org/10.1068/b260117.

Saban, A. (2007). *School technology planning and coordination*. Ankara: Pegem.

Sharpe, B. & Best, A. C. (2001). Teaching with GIS in Ontario's secondary schools. In D.R. Green (ed.) *GIS: A Sourcebook for Schools*, 73–86. London: Taylor & Francis.

Şahin, K. ve Gümüşay, M. Ü. (2007). İnternet tabanlı coğrafi bilgi sistemleri ve orman yangınlarında kullanılması. *Harita Dergisi,* 138, 69–83.

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management,* 14, 207–222. https://doi.org/10.1111/1467-8551.00375

Van der Schee, J. (2006). Geography and New Technologies. In J. Lindstone and M. Williams, (eds.) *Geographic Education in a Changing World. IGU Commission on Geographical Education* (pp.185–193). Springer, The Netherlands.

Wang, Q., & Woo, H. L. (2007). Systematic planning for ICT integration in topic learning. *Educational Technology & Society, 10*(1), 148–156.

Welch, M. M. (2015). *Technology in pre-K: Fostering a community of digital participants* (Unpublished doctoral dissertation). Georgia State University, Atlanta, GA.

Welch, M. M., & Dooley, C. M. (2013, May). Digital equity for young children: A question of participation. *Learning and Leading with Technology, 40*(7), 28–30. Retrieved from http:// www.learningandleading-digital.com/learning_ leading/201305?pgD31#pg30