DOKUZ EYLÜL UNIVERSITY
GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

THE USE OF GEOGRAPHICAL INFORMATION SYSTEMS AS A DECISION SUPPORT SYSTEM IN EDUCATION SECTOR

by
Burcu EŞKİ

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İZMİR

THE USE OF GEOGRAPHICAL INFORMATION SYSTEMS AS A DECISION SUPPORT SYSTEM IN EDUCATION SECTOR

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M.Sc THESIS EXAMINATION RESULT FORM

We have read the thesis entitled **"THE USE OF GEOGRAPHICAL INFORMATION SYSTEMS AS A DECISION SUPPORT SYSTEM IN EDUCATION SECTOR"** completed by **BURCU EŞKİ** under supervision of **ASSOC. PROF. DR. ÇİĞDEM TARHAN** and we certify that in our opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Science.

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ABSTRACT

Technological developments take place in all areas of life. Especially in this time called the digital age, there is a digital transformation. The impact of this transformation on education will be inevitable. Thematic maps will be created using the GIS system of this digital transformation experienced with this study, and these maps will help decision-makers in the decision-making process. In this context, the digital transformation processes of MEB and YÖK institutions in the field of education will be discussed and thematic maps will be produced in line with the data received from the institutions.

Keywords: GIS, Education, Digital Transformation

EĞİTİM SEKTÖRÜNDE COĞRAFİ BİLGİ SİSTEMLERİNİN KARAR DESTEK SİSTEMİ OLARAK KULLANIMI

ÖZ

Teknolojik gelişmeler hayatın her alanında kendini göstermektedir. Özellikle dijital çağ diye adlandırılan bu zamanda dijital bir dönüşüm söz konusudur. Yaşanılan bu dönüşümün eğitime etkisi kaçınılmaz olacaktır. Bu çalışma ile yaşanılan bu dijital dönüşümün CBS sistemi kullanılarak tematik haritalar oluşturulacak ve bu haritaların karar vericilere karar verme sürecinde destek olmasına yardımcı olacaktır. Bu bağlamda eğitim alanında MEB ve YÖK kurumlarının dijital dönüşüm süreçleri ele alınacak ve kurumlardan alınan veriler doğrultusunda tematik haritalar üretilecektir.

Anahtar kelimeler: CBS, Eğitim, Dijital Dönüşüm

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ABBREVIATIONS

BHEDSS	: The Beijing Higher Education Decision-Support System
EBA	: Eğitim Bilişim Ağı
GAPS	: Geographic Academic Policy Series
GIS	: Geographical Information System
İBB	: İstanbul Büyükşehir Belediyesi
IT	: Information Technologies
KVKK	: Kişisel Verilerin Korunması Kanunu
LGS	: Liselere Geçiş Sınavı
MAPS	: Mapping Academic Performance in Schools
MEB	: Milli Eğitim Bakanlığı
MEBBIS	: Milli Eğitim Bakanlığı Bilişim Sistemleri
NORMES	: National Office for Research on Measurement and Evaluation Systems
OGC	: Open GIS Consortium
ÖSYM	: Öğrenci Seçme ve Yerleştirme Merkezi
PTT	: Posta Telefon Telgraf
R&D	: Research and Development
TCDD	: Türkiye Cumhuriyeti Devlet Demiryolları
THY	: Türk Hava Yolları
TRT	: Türkiye Radyo ve Televizyon Kurumu
TÜİK	: Türkiye İstatistik Kurumu
UZEM	: Uzaktan Eğitim Uygulama ve Araştıma Merkezi
WEF	: World Economic Forum
WHO	: World Health Organization
YER-SİS	: Kentsel ve Kırsal Yerleşim Sistemleri
YÖK	: Yükseköğretim Kurulu

CHAPTER ONE
INTRODUCTION

The concept of digital can be expressed as the electronic processing of data with various combinations of 1s and 0s, resulting in a meaningful result. In the most basic sense, data turns into information; information becomes meaningful and creates knowledge, and knowledge opens the way to wisdom. Digital transformation, which is developing rapidly, can be expressed as "*the use of data by people by digital processing*." (Bozkurt et. al., 2021).

The word information plays an important role in modern society in the sense of transmitted information. The development and spread of computer networks and the emergence of information science as a discipline in the 1950s are proof of this. We can accept information as the basic condition of economic development, but what makes information especially important is its digital nature (Capurro & Hjorland, 2003).

Communication and information technologies can be used to share information in real time. However, for societies to compete in this emerging change, they need to develop, improve and be up to date in their capacities. The process of change and transformation, which continued to increase rapidly, especially at the beginning of the 21st century, has become noticeable. This transformation process is also referred to as digital transformation (Doğan, 2019).

With Industry 4.0, the cyber-physical systems used in the production phase in the industry are called the digital transformation process. With this concept, it can be said that technological developments and digitalization take place rapidly in many areas of life and its use is an inevitable element. With the realization speed of this process, the concept of "digital transformation" has emerged (Yılmaz, 2020).

While digital transformation is showing its impact rapidly in the fields of the civil and business world, this situation has also affected the education sector. The primary and secondary school systems have a critical role to play in preparing students for these

global economic realities and needs. Educational models should also be adapted to equip students with the skills necessary to create a more inclusive, harmonious and productive world (World Economic Forum([WEF], 2020).

In line with the rapid development of digital technology, individuals need to use various technical, cognitive and sociological skills to perform tasks and solve problems in digital environments. This competence is called digital literacy (Eshet, 2004).

Digital literacy can be expressed as using a digital device, using the digital environment effectively, creating the necessary materials in the digital environment, being able to read data on graphic screens, distinguishing the reality of information in the digital environment, access to digital information (Karabacak & Sezgin, 2019).

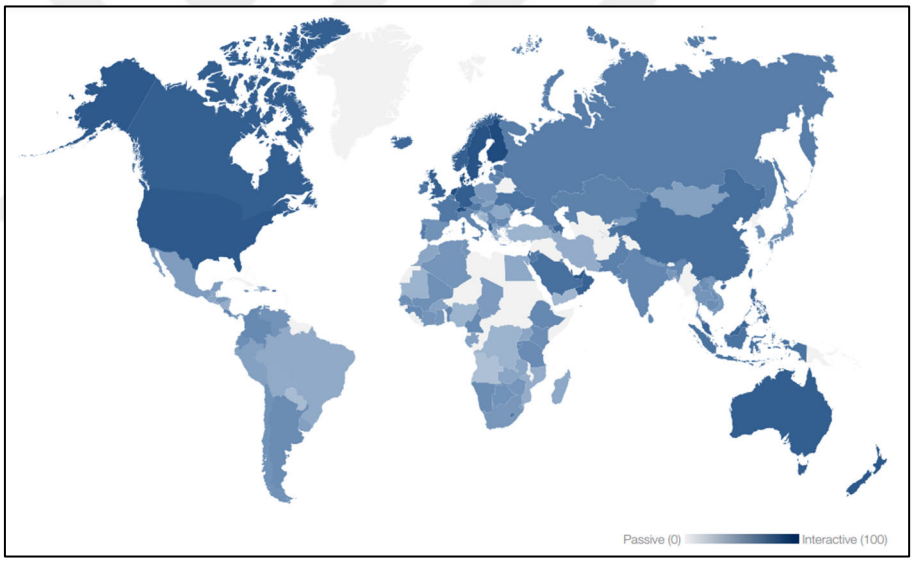

Figure 1.1 Style of teaching according to countries (WEF, 2020).

Most of today's school-age children will be working in new types of jobs that do not yet exist, and many of them have increased importance in both digital and social-emotional skills. The education system in developed and developing countries focuses directly on teaching and memorization, rather than encouraging the critical and individual thinking needed in today's innovation-driven economy. Figure 1.1 shows that most of the countries remain in the old system (light-coloured countries on the

thematic map) and only some developed countries use the new system (dark-coloured countries on the thematic map) (WEF, 2020).

The widely used standardized direct learning model has emerged as the need of the First and Second Industrial Revolutions. The Third and Fourth Industrial Revolutions introduced the automation of production and intangible input value creation. These new forces of growth have created major changes in the skills needed to contribute to the economy and in the way people work, raising questions about the adequacy of existing education systems to keep up with these changes (WEF, 2020).

Within the scope of this thesis, the analysis of the data in the field of education in Turkey was carried out with Geographical Information Systems. The current digital transformation projects in the field of education carried out in Turkey have been examined. Within the scope of digital transformation, the data obtained from official institutions based on provinces have been visualized as a thematic map. With the creation of GIS-based maps of the data, numerical changes in the field of education and the use of these maps by decision-makers in decision-making processes due to digital transformation have been discussed.

The thesis consists of five parts. In the first part, the introductory part of the thesis is included. In the second part of the thesis, a literature review on the studies of Geographical Information Systems, Decision Support Systems, Digital Transformation Industry 4.0 – Education 4.0 concepts in the education sector is included. In the third part of the thesis, the topic of digital transformation in Turkey is explained. In the fourth and final part of the thesis, the conclusion and general evaluation sections are included.

CHAPTER TWO
LITERATURE REVIEW

In this chapter, Geographical Information Systems, Decision Support Systems, Education 4.0, Industry 4.0 and Digital Transformation concepts have been examined.

2.1 Geographical Information System

The technology solves various problems and answers questions and accords with strategic management purposes about situation, location, direction, orientation, and pattern thus it has turned to an important tool for geographic information updating, generating, and disseminating. There is a relation with strategic information and use of commune resources. It is important to know, where services are required and where resources are spent. Therefore, Geographical Information System (GIS) is a fundamental tool to know what resources are and how to use them (Kalogeridis, 2002).

GIS is a computer based system which links non-geographic attributes data with graphic map features (Kaiser et al., 2003). GIS allows to represent statistical data not only as graphs-tables but also as maps (Dabbaa, 2018). Geospatial software enables users to perform spatial analysis, to manage data and to show the data on the maps. Also, GIS provide maps for users in order to realize decision making and to enhance data collection in the field (Kaiser et al., 2003). GIS has dynamic maps; thus, these maps are different from paper maps in term of allowing data to be analysed, interpreted, and manipulated. Reed & Bozin (2016) have mentioned that the same subject in their studies as "GIS is a geospatial learning technology that allows visualization and learning from dynamic maps".

GIS has been used a tool to demonstrate, analyse and query problem-based learning. Students who have different academic backgrounds use GIS for sharing data (Diana, 2009). GIS has the potential to support spatial thinking (National Research Council, 2006). Maps give different perspectives to solve spatial based problems and to

understand their spatial relations. GIS software visualizes objects and their attribute with multi-layered data sets (Diana, 2009).

During 1960s, Kerski (2008) has mentioned that a scientist called R. Buckminster Fuller who wrote about concept of a Digital Earth. Geographic analysis has been performed in the computer via GIS. People have learned using GIS softwares and how to model the earth with GIS. During 1980s, GIS were more developed (as GIS meatured, a greater emphasis was placed upon the education about the organizational and management aspects of GIS) around the World (Kerski, 2008). By the early 1990s, Geographical Information System become a part of Geographical Information Science. After 2000, spatial thinking has been highlighted. By 2008, nearly all-important universities have GIS courses. GIS began to use different disciplines such as geography, mathematics, history, Earth Science, biology, chemistry etc. GIS has been spreaded in universities with different topics like migration, history, climate, geographic topics etc. GIS gives student quickly move on the maps and analyse data. When the students start to ask about 'where' problems, GIS here play an important role and GIS has become an important tool for understanding Earth (Kerski, 2008).

Korucu (2012) has mentioned the importance of GIS. Nowadays, with technological developments, GIS has an important role in most disciplines such as both public and private sectors, and it is important for education. People who work in GIS should be trained. Korucu (2012) has also mentioned the types of GIS education programs in universities. Europe and the United States also starts to learn GIS in secondary education. Additionally, GIS could be learned via workshops and seminars, online distance GIS education, and GIS expert certificate.

Thematic maps have been designed to show a specific theme, for instance, social, physical, cultural, economic, political, and agricultural themes. Moreover, these thematic maps are also subjected in different scale geographic areas such as city, region, state, nation, and continent. Also, they used for education and school analysis. The statistical data has been represented via pie chart diagrams in thematic maps. Ratio comparison can be visualized on maps for any kind of data (Eray, 2012).

2.2 Decision Support System

It has become an indispensable part of organizations to use information and information systems. Information systems that provide decision-making, control and coordination help solve problems. ‘‘The information system can technically be defined as a set of interrelated parts that are organizing, storing, processing, collecting information, up to the decision-making support in organizations’’. The three main components of information systems are organization, management and technology as shown in Figure 2.1, and information systems can be used effectively with these components. (Önder, 2005)

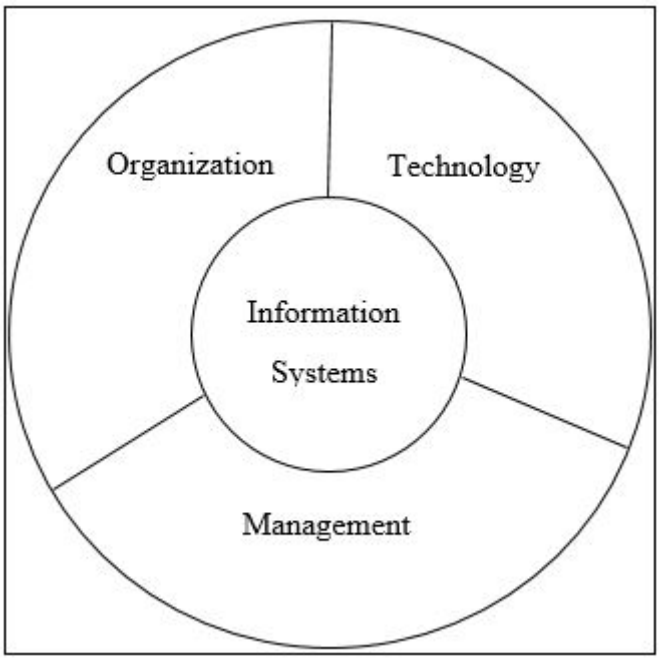

Figure 2.1 Information System components (Önder, 2005)

Working people, rules, policy and culture form an organization and serve different purposes by training experts in various functions as seen in Figure 2.1. (Önder, 2005).

Table 2. 1 Main organizational functions (Önder, 2005)

FUNCTION	GOAL
Sales and Marketing	Selling the organization's services and products
Production	Creating products and services
Finance	Managing the organization's finances
Accountancy	Holding financial resources of the organization
Human Resources	Improving workforce and retention of work resources

Organizations have various tiers and there are different types of managers at each level and they make different types of decisions. As seen in Figure 2.2, strategic decisions are made at the top level; the middle level fulfils the plan and program for the decision of the upper level and tactical-managerial decisions are made; while the lowest level performs daily activities and makes decisions at the knowledge level; and operational managers are involved in data generation and processing and make operational decisions. All levels are expected to respond quickly to creative solutions and their level needs different knowledge and information. (Önder, 2005; Tecim, 2020).

The development of information systems also benefits managers and management. There is an increasing relationship between management's rules and strategies and information systems. The rules, methods and management strategies in the organization as seen in Figure 2.3; works in relation to software, hardware, database and communication systems (Önder, 2005).

Basic information systems are divided into 6 groups:

- Data Processing Systems,
- Office Automation Systems,
- Management information systems,

- Decision Support Systems,
- Senior Management Support Systems,
- Artificial Intelligence and Expert Systems.

Decision support systems will be discussed in line with this thesis. How the institutions mentioned in chapter 3 benefit from Decision Support Systems to make effective and correct decisions by using Geographical Information Systems will be examined.

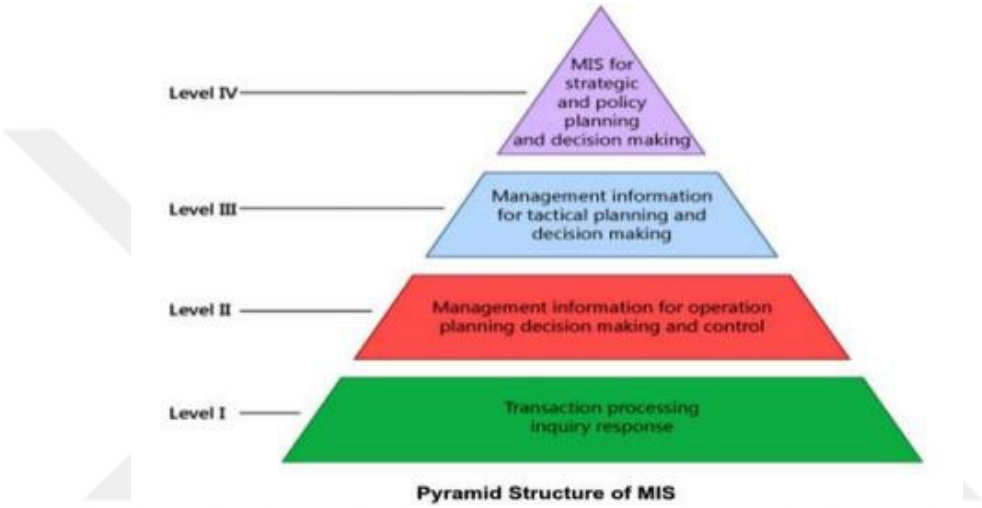

Figure 2.2 Management Information System pyramid (Qekaj-Thaqi, 2016)

Decision Support Systems are computer systems where data analysis is performed and visualized by using data sources to help a decision maker to make easier and correct decisions, and the final version is presented to the decision maker. (Erpul, n.d.).

Decision Support Systems have various benefits. We can list them as follows:

- Provides effective use to people
- Improves the decision-making process and provides a faster process
- Provides control
- Contributes to the decision maker's research ability
- Provides faster resolution of the problem.
- Facilitates communication
- Supports education
- Presents different and new evidence

- Provides an advantage in a competitive environment
- Thinks about problems and develops new perspectives
- Provides automated management
- Accelerates performance with innovations (Erpul, n.d.).

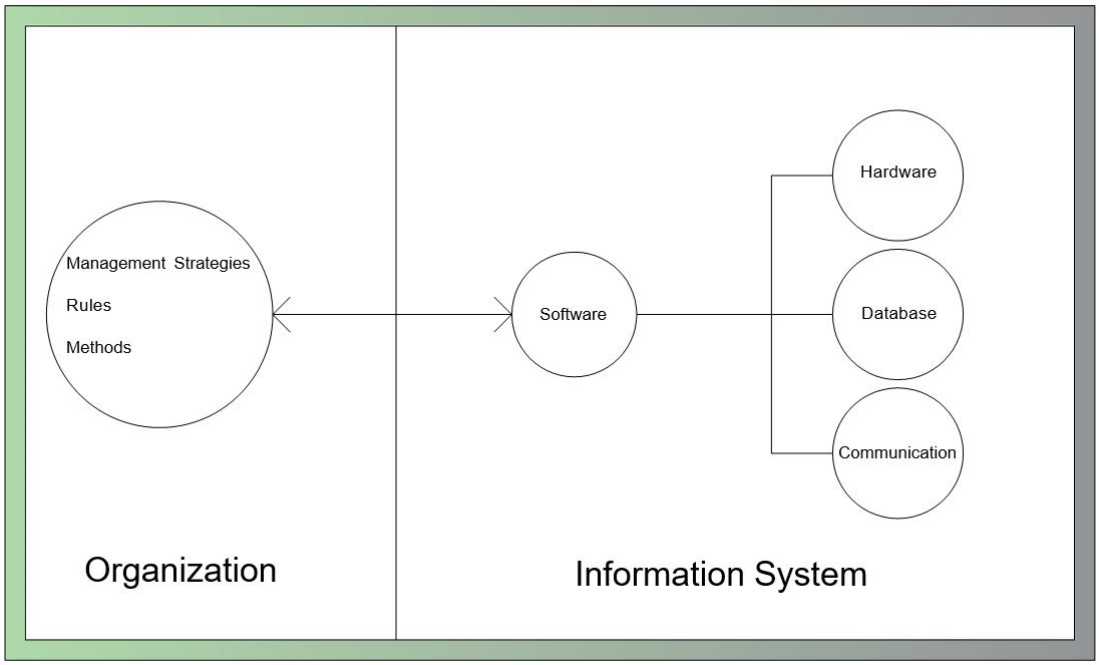

Figure 2. 3 Relation between organization and Information System (Önder, 2005)

There are a lot of GIS applications available, and many of them play important roles in government and private institutions in the decision-making process. Decision-making is a complex process. GIS applications can't make decisions for people but help them make decisions by offering a variety of results (Diah, 2005). Because GIS can show data together, it benefits to look at the decision-making process from a broad framework. GIS provides the opportunity to bring different sources together and analyse. For this reason, the ability of GIS to present and analyse all data together is of great importance in the decision-making process. GIS tests and evaluates various scenarios, and having different types of data in a single database also eliminates different results in the decision-making process (Shamsi, 2005)

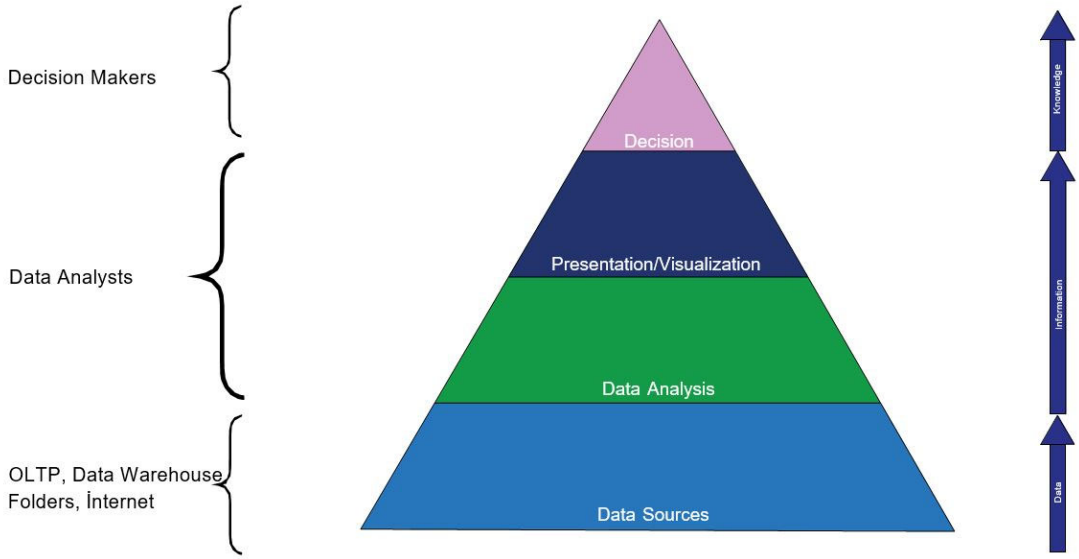

Figure 2.4 Decision support system decision process (Erpul,n.d.)

2.3 Educational Decision Support System

Educational management and planning have been used as a term in application of GIS in schools mapping. Mapping is a tool which used to show the relationship between the distribution of school and distribution of school-age population (Dabbaa, 2018) .

Attfield et al. (2001, p.10-12) have written that GIS's four important usage in educational planning and management:

- *it helps to make the presentation of data more attractive.*
- *translating data into maps helps in recognizing 'unexpected' situations, which need closer examination.*
- *considering geographical factors, the analysis becomes finer, more precise and the ensuing strategies probably more pertinent.*
- *assisting in prospective planning.*

Additionally, Hite (2011, p. 221-222) has stated that the usage of GIS as:

- *…expanded holistic representation and exploration of the context of schooling.*
- *increase public appeal and utility;*

- *extensive control of scale of complexity, and flexibility in how much data are displayed or explored at a given time, with changes in unit of analysis virtually limitless and immediate; and*
- *dynamic ability to facilitate 'what if' analysis, explotary inquiry, and creation of planning and management scenarios.*

Hite (2011, p.217-218) also has mentioned that school mapping is used to facilitate the six functions:

1. to constitute the required conditions to achieve universal primary and secondary education;
2. to raise attendance of female and other under-represented groups;
3. to encourage equal educational benefits between different regions and groups;
4. to enhance quality of education;
5. to optimise the use of human and capital resources; and
6. to arrange, rationalise and coordinate efforts at technical and professional education.

GIS is a simple, more precise and flexible spatial analysis tool for representing school and their geopolitical, social and physical context. Additionally, GIS provides geospatial perspectives to understand and plan those context (Hite, 2011).

To support decision makers and educational planners, the school mapping becomes art and science via geospatial databases and relational databases of educational, social, economic and demographic information for schools and educational administration. In order to perform effective planning, geospatial data written below should be reachable;

- all information such as school, students, teachers and resources,
- school location and other geographic features such as street, district, railroads etc.,
- building the management capacity and staff;
- all the data should be updated regularly (Al-Hanbali et al., 2003).

Furthermore, GIS experts should train and guide the stakeholders who are managing or using data in Education Decision Support System. Also, decision makers become more creative in finding alternative solutions (Al-Hanbali et al., 2003).

The educational decision support system is defined as the process that determines the timely achievement of the goals of educational action plans and future actions. Educational Decision Support System provides relevant, accurate, reliable and real-time information to researchers, administrators, policy makers, education planners and other data users (Aihua et al., 2009). GIS- based training decision support systems are available:

- The National Office for Research on Measurement and Evaluation Systems

Educators need GIS to distinguish between increases in educational data and spatial data sets and to be able to study the complex relationships between geographical aspects and other related variables. On The National Office for Research on Measurement and Evaluation Systems (NORMES) website, spatial data is visualized and analysed. NORMES contains two subsystems: Mapping Academic Performance in Schools (MAPS), aims for web-based research of educational achievement data; Geographic Academic Policy Series (GAPS), aims to show current situation with snapshots (Aihua et al., 2009).

- The Oregon State Board of Education Decision Support Pilot Project

Project founded in 2002 by the Oregon State Board of Education, the Oregon University System, and Oregon State University. The aim of the project is to show policy makers that GIS is another way to manipulate and display statistical and demographic data (Aihua et al., 2009).

- The Beijing Higher Education Decision-Support System (BHEDSS)

The system was developed by the Graduate School of Education at Peking University. The aim of the system is to provide higher education researcher, educational decision-makers and the public with an open information platform in the decision-making process. It provides both text-based and GIS-based queries, and provides a spatial perspective to the decision-making process with thematic maps. (Aihua et al., 2009).

2.4 Digital Transformation

According to Karoglu et al. (2020) mentioned digitalization in education in the process of transition to society 5.0, and included applications related to the subject of transformation in education and digital transformation from Education 1.0 to 4.0. In addition, within the scope of the study, studies and practices within the scope of digital transformation at the formal and informal levels in Turkey were conveyed. During the pandemic process, practices in education in Turkey were revealed and their effects on digital transformation in education were discussed.

Özen (2019) emphasized that education should be included in digital transformation due to its importance of education. It was mentioned that the EBA platform was made available to students and teachers in the digital transformation process of the Ministry of National Education. It has been stated that there are various digital data as content on the EBA platform and that this data should be used, shared and developed.

According to Bozkurt et al. (2021), in their study, it was mentioned that the transformation process of information and the transformation of data into information by processing is the most basic process. In the study, the concepts of digital society, digital transformation, digital education and digital competence were explained and it was concluded that human is at the center of the concepts of digital society and digital transformation. It has been suggested that tangible and intangible technologies in digital education should be used together as they complement each other, and it is also emphasized that “digital education can be operational with digital competence and literacy”.

In the studies of İ. Tonbuloğlu & B. Tonbuloğlu (2021), blended education is named as an education system formed by bringing together the positive aspects of traditional learning processes and distance learning processes. In blended learning, the transformative and improving effect of digital technology on the learning process is emphasized, not a tool.

In the study of Taşkıran (2017), an answer was sought to the question of how to adapt to the digital transformation process in higher education. Considering that this question can be answered, it is stated that a solution can be found by taking into account the studies carried out around the world and it will set an example in adapting to the digital transformation process in higher education in Turkey.

In his study, Parlak (2017) focused on what kind of developments, opportunities and practices in the field of education bring about in the digital age. It has been mentioned that there is a versatile and in-depth transformation in digitalization in the field of education, and this transformation has been described as the "Digital Revolution". It has been emphasized that educational opportunities in the digital age offer much more possibilities and opportunities. Based on these opportunities, educational practices in the digital environment were examined and systematized.

Alp & Levent (2020) stated in their study that there is a digital transformation in education with the rapid development of information and communication technologies. This study, it was aimed to measure the effect of digital transformation on students based on the thoughts of teachers. In line with the face-to-face survey conducted with 14 teachers, the students were considered as individuals who are at peace with technology, active on social media, materialistic, insatiable, bored easily and questioning. According to the teachers, it has been stated that information technologies have risks such as the deformation of moral values as well as benefits.

Kır (2020) was studied how the roles of teaching staff changed in the digital transformation process. As a result of the research, it was stated that there are many variables that affect the development of the roles of the instructors and that these variables are in line with enriching the learning environment, acquiring educational technologies with an institutional approach and professional development of the instructors.

Sezgin & Fırat (2020) stated in their study that a digital transformation has taken place with the Covid 19 pandemic and that this situation has led to a digital divide in socio-economically underdeveloped countries. Although the use of the internet and computers has increased in this process, it has been stated that the number of people who have problems accessing these systems is quite high. In this study, which deals with distance education and the digital divide in Turkey and the world, it was suggested that the internet should be accessible to everyone and that infrastructure and superstructure studies of broadband internet should be carried out to reduce the inequality of opportunity for individuals in education. In addition, it is stated among the suggestions that individuals gain digital competence and skills, which are the necessity of digital transformation.

Toprak et al. (2021) developed a digital research faculty model in their work. The model consists of five different components. The first component consisted of several topics such as online education, digital transformation, qualifications, accreditation and institutional evaluation. The second component included a new generation of offices and committees aligned with the new educational paradigm. The third component covered metrics related to digitization, stakeholder engagement, research faculty, alumni profile and governance model. The fourth component included communication with communication stakeholders. It has been stated that the fifth component is aimed at constructing the governance model that will embody and implement this new approach. It is stated that this model will have a structure parallel to international trends.

In the studies of Savaş et al (2021), it was stated that the factors such as the internet, technology, computers, and the game industry changed the perception and thinking styles of children. In some studies, it has been emphasized that today's students are called digital natives and that classical teaching techniques are insufficient. It was stated that new techniques should be used and that these should be used in the Information Technologies Fields of Vocational and Technical Anatolian High Schools. In this context, game learning digital material was designed and it was aimed to contribute digital game technologies to the education system.

2.5 Education 4.0

Education systems play an important role in defining values and norms that enable positive human interaction. With technology design and data analysis; people-cantered skills (collaboration, empathy, social awareness and global citizenship). This has a wide potential with Education 4.0, which is developing and changing with Industry 4.0. The change in education from Education 1.0 to Education 4.0 is shown in Figure 2.5.

Education 4.0 is defined as an experience-based education system that benefits from technological developments and meets the expectations of today's world, unlike rote learning (Yelkikalan et al., 2019). The training of manpower who designs develops, produces and uses this production is inevitable. With this new system, which is based on high-level thinking, critical, creative, scientific and analytical thinking is mentioned.

	Meaning is ....
"Download" Education 1.0	Dictated
"Open Access" Education 2.0	Socially constructed, usually with aid of Internet access
Knowledge Producing Education 3.0	Socially constructed and contextually reinvented knowledge
Innovation Producing Education 4.0	Built through selective individual and team-driven focused innovations practices
	Technology is .....
"Download" Education 1.0	Confiscated at the classroom door (digital refugees)
"Open Access" Education 2.0	Cautiously adopted open access (digital immigrants)
Knowledge Producing Education 3.0	Everywhere (digital natives in a digital universe) for ubiquitous knowledge construction and transmission
Innovation Producing Education 4.0	Always changing with the direct input of learners acting as a major source of tech evolution in the service of innovation production
	Teaching is done....
"Download" Education 1.0	Teacher to student
"Open Access" Education 2.0	Teacher to student and student to student (progressivism); Internet resources are a normal part of learning activities
Knowledge Producing Education 3.0	Teacher to student, student to student, student to teacher, people-technology-people (co-construction of knowledge)
Innovation Producing Education 4.0	Amplified by positive innovation feedback loops; ubiquitously and creatively 24/7 in all phases of living, learning, and working;
	Schools are located in.....
"Download" Education 1.0	In a building (brick)
"Open Access" Education 2.0	In a building or online (brick and click), but increasingly on the Web through hybrid and full internet courses
Knowledge Producing Education 3.0	Everywhere in the "creative society" (thoroughly infused into society: cafes, bowling alleys, bars,
Innovation Producing Education 4.0	In the globally networked human body, a continuously evolving instrument innovatively supplementing

Figure 2.5 Education revaluation framework (Diwan, 2017)

In Education 4.0, learning processes are mentioned in three main areas: 3R Recalling, Relating and Refining, which regulates understanding; 3I Inquiring, Interacting, and Interpreting that triggers research; 3P Participating, Processing and Presenting based on producing results (Ergin, 2019).

Education 4.0 has nine main trends (Hussin, 2018):

1. Learning can be done anytime and anywhere,

2. Learning will be personalized to individual students; they will meet and master more difficult tasks.

3. Students should be able to decide for themselves how they want to learn,

4. Students should be exposed to more project-based work,

5. Students will be exposed to more hands-on learning through field experience such as internships, mentoring

6. Students will be exposed to data interpretation in the following situations: applying their theoretical knowledge to numbers and using their reasoning skills to make inferences based on logic and trends from given datasets,

7. Students will be evaluated differently and traditional platforms for assessing students may become irrelevant or inadequate.

8. Students' opinions will be taken into account in the design and updating of the curriculum,

9. Students will become more independent in their own lives. Thus, it will force teachers to take on a new role as facilitators who will guide students through their learning processes.

Developing skills such as leadership, collaboration, creativity, digital literacy, effective communication, sensory intelligence, entrepreneurship, global citizenship, teamwork and problem-solving ability and ensuring the quality of skills will be considered as basic learning outcomes as well as knowledge. From this point of view, Education 4.0 should not be seen only as an education system. It will be inevitable to focus on factors such as critical analytical thinking, revealing innovations (innovation), efficiency, responsibility and multicultural knowledge sharing and career development (Öztemel, 2018).

With Education 4.0, new technologies come to the fore and these will be used both in the creation of education systems and will be a part of the system for the learning of the student. The new technologies mentioned in general are as follows:

1. Big data analytics

2. Implanted technologies

3. Cloud Computing

4. Mobile internet

5. Internet of Things

6. Information automation

7. Advanced robot technologies

8. Autonomous devices

9. Next generation genes (Geneology)

10. Energy storage and renewable energy

11. 3D printing

12. Advanced and clever materials

13. Unmanned vehicles

14. Bitcoin and Blockchain technologies (smart contract creation, information security, confidentiality technology) (Öztemel, 2018).

2.6 Industry 4.0

18th century the industrial revolution, which is called a turning point in the world with the transition from human and animal power to the use of steam machinery, was seen as the first step of industrialization and entered the literature as Industry 1.0; With the use of the steam engine, compromise in the division of labour and the introduction of electricity into production, the transition to the 2nd Industrial Revolution was rapid and the invention of various machines by using electricity brought mass production. This period, which is considered to be the end of the 19th century and the beginning of the 20th century, is called Industry 2.0; In this period, which is called the 1970-1990 modern industrial period, the world started to digitalize and electronics, information and communication technologies developed. During this period, it was called Industry 3.0; With the use of artificial intelligence, robot technology and the active use of 3D printers, production started to be done in homes and in this period when situations such as analysis and evaluation of big data are experienced, we come across as Industry 4.0. (Berktaş & Oraklıbel, 2021). Figure 2.6 shows the visualized version of Industry transformation.

Yelkikallan, et. al (2019). defined Industry 4.0 as a phenomenon that revolutionized production by integrating cloud computing, the internet of things, data integration and other technological developments into production. Industry 4.0 should not be considered as technologically advanced applications. It is emphasized that Industry 4.0 can be applied successfully with eight main areas. These; "standardization, management of complex systems, a comprehensive provision of broadband infrastructure for industry, safety and security, work organization and design, training and continuing professional development, the establishment of the regulatory structure and resource efficiency".

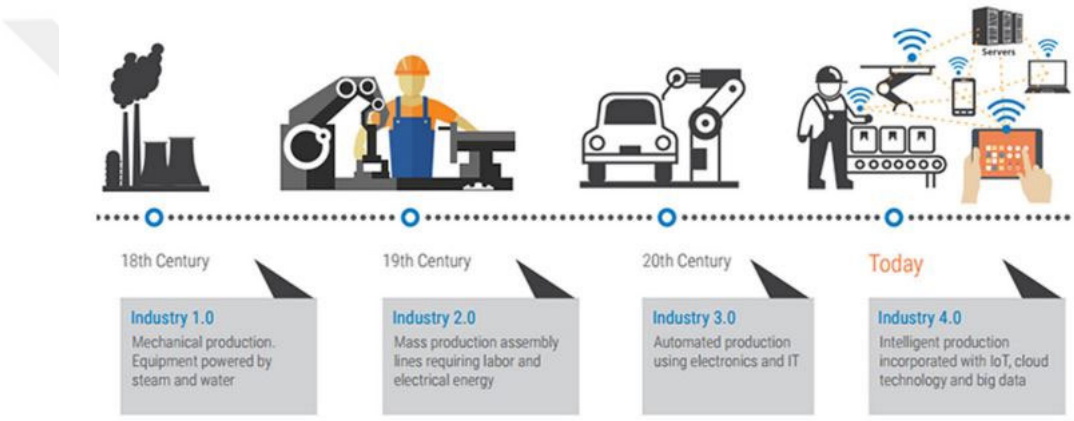

Figure.2.6 Industry revaluation (Oztemel & Gursev, 2019)

Industry 4.0 is defined as the intelligent production period in which animate and inanimate objects can be communicated and interacted with internet connections. In this period of digitalization, a system in which physical life is integrated into virtual life is mentioned. (Özsoylu, 2017).

Industry 4.0, which includes automation systems, production technologies and data exchange, can be grouped under three important headings:

- Speed: industrial developments are progressing at a rapid pace, and each new product leads to newer ones.
- Broadness and Depth: While developments are taking place as the digital revolution, it causes profound changes in every field from society to individual.

• System Effect: It involves a holistic transformation, although it causes system change from companies to sectors and even countries (Özsoylu, 2017).

CHAPTER THREE
DIGITAL TRANSFORMATION IN TURKEY

In the third chapter, the digital transformation studies implemented in the fields of education and training in Turkey are included. In this context, Ministry of National Education (MEB) EBA Project, Digital Transformation Project in Higher Education, YÖK Big Data Project, MEB-Basarsoft 'YEĞİTEK' Project. Urban and Rural Settlement Systems in Turkey (YER-SİS), ATLAS project, Turkish Statistical Institute (TÜİK) training data and open data applications of local governments are explained. Geographic Information Systems-based thematic maps were created with the data obtained from TÜİK and YÖK.

3.1 Ministry of National Education Digital Transformation Projects

3.1.1 MEB Educational Informatics Network (EBA)

Educational Informatics Network (EBA) were carried out to support distance education. It is a social education platform created by the General Directorate of Innovation and Educational Technologies of the Ministry of Education and offers a reliable and personalized learning environment for all grade levels from pre-school to 12th grade. It offers course content compatible with the curriculum and personal and professional development content to users. (Milli Eğitim Bakanlığı [MEB], 2022a).

There are more than 1,700 lessons and over 40,000 rich, reliable and interactive content. More than 5,000 books and more than 240,000 questions are offered to teachers and students in EBA. It offers a customized interface for each student and offers content suitable for student performance with its smart suggestion system. Through EBA, teachers and students can interact with each other. In the Figure 3.1, interface of EBA can be seen. There are daily lesson programs with categories such as students, teachers, parents, professional development and academic support. (MEB, 2022a).

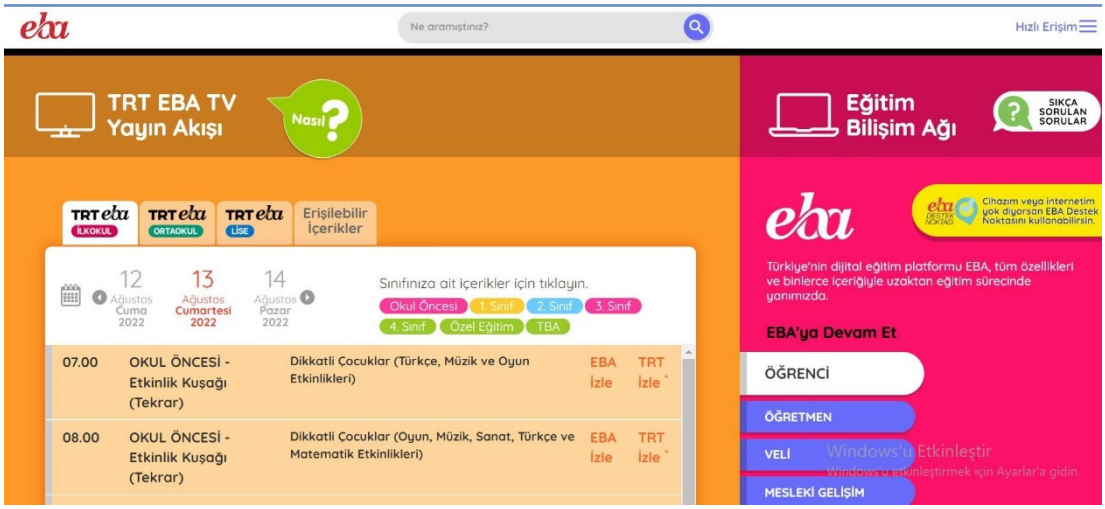

Figure 3.1 Interface of EBA (MEB, 2022b)

3.1.2 MEB-Başarsoft 'YEĞİTEK' Project

A WEB-based software was developed for the MEB Education Decision Support System, with a study between Başarsoft and the Ministry of National Education, to analyse teachers, students and schools, and to determine the needs, using MapInfo technologies. According to this software;

On the basis of Turkey;

- "Number of teachers, distribution of teachers according to their branches
- Number and distribution of students by gender, class, type of school.
- School success percentages (ÖSYM, LGS)
- School inventory information (number of classrooms, number of laboratories.)
- Population projections and capacity estimations can be made".

The schools in the MEBBIS database are geographically placed in the system and the school information is associated with the data in the MEBBIS system. In this way, thematic analyzes of schools in Turkey can be made. More information can be obtained, not limited to statistical data. The analyzes to be made will be spatial and can be done in a shorter time. Up-to-date data and maps will be prepared (Başarsoft, 2004). In Figure 3.2, an example of the project interface is shown.

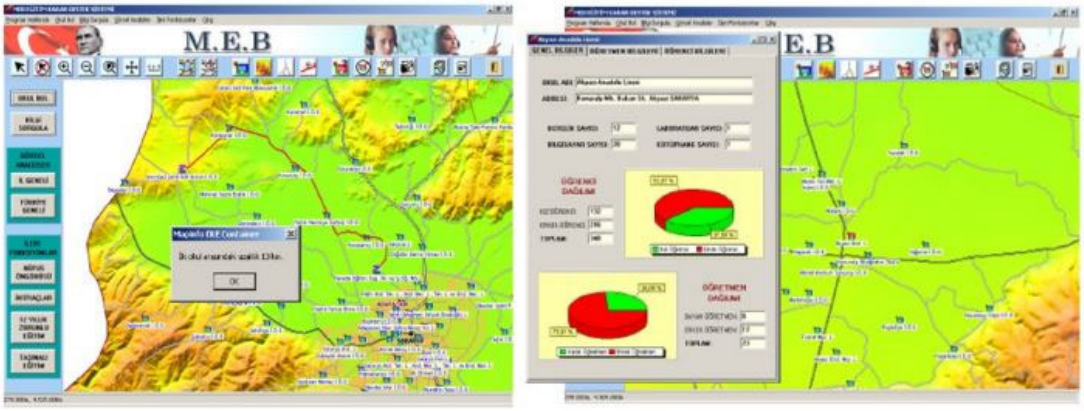

Figure 3.2 MEB Başarsoft project interface (Başarsoft, 2004)

3.2 YÖK Digital Transformation Project in Higher Education

Within the scope of the Digital Transformation in Higher Education project, which was launched in December 2018, courses on digital education skills were given to students and lecturers at pilot universities and steps were taken toward digitalization. "Learning and Teaching in Higher Education in the Digital Age" courses were given to the instructors for 6 weeks. The "Digital Literacy" course has been added to the 2019-2020 Spring Semester curriculum. It is stated that subjects such as "internet technologies, portable technologies, social networks, technology, society and people, information ethics, technology and lifelong learning, cloud computing, technologies of the future" will be explained in the digital literacy course. (Yüksek Öğretim Kurulu [YÖK], 2022a).

3.2.1 YÖK Big Data Project

With the digital transformation process, an enormous amount of digital data is produced. With the speed, variety and size of this produced data, the concept of "big data" has emerged. It has been observed that big data can significantly increase the efficiency of decision mechanisms. The processing and transformation of big data into

information to make it meaningful and support decision-makers can also be achieved with data analytics and artificial intelligence technologies.

Big data can provide several benefits in higher education. Analyses are made with every information that can be obtained from big data, modelled with artificial intelligence and inferences can be made with meaningful information. In fact, using big data and information systems, students' research, the pages they click; or covers various data such as courses taken, grade point averages, and absenteeism. A meaningful conclusion can be drawn by combining these data. Career planning can be made by determining the area of interest from the pages used by the student. Likewise, with these data, unsuccessful students can be identified, the reason for failure can be revealed through analysis, an example can be set for other students to be trained and the success of students can be increased.

With this project, it is actually to ensure that various data at hand come together and make meaningful results. With these results, it is aimed to create a system that adapts to more successful individuals, students who are guided in line with their own goals and competencies, and the developing and changing infrastructure and content of the digital world. (YÖK, 2022b).

3.3 Public Institutions Digital Transformation Projects

3.3.1 Urban and Rural Settlement Systems in Turkey (YER-SİS)

"The YER-SİS system aims to define the current settlement system in Turkey and the relations between settlements within the framework of new dynamics. Data sharing is carried out in cooperation with institutions such as MEB, YÖK, ÖSYM, TÜİK, Ministry of Health, Ministry of Transport and Infrastructure, Information Technologies and Communication Authority, TCDD General Directorate, THY General Directorate, General Directorate of Highways and PTT. There are reports and maps of these data by creating data sets on subjects such as education, health, transportation and communication. (Sanayi ve Teknoloji Bakanlığı, 2022). Using the

spatial data feature, school locations in Turkey can be displayed on the map. To be an example within the scope of this study, the map example in the YER-SİS system is shown in Figure 3.3.

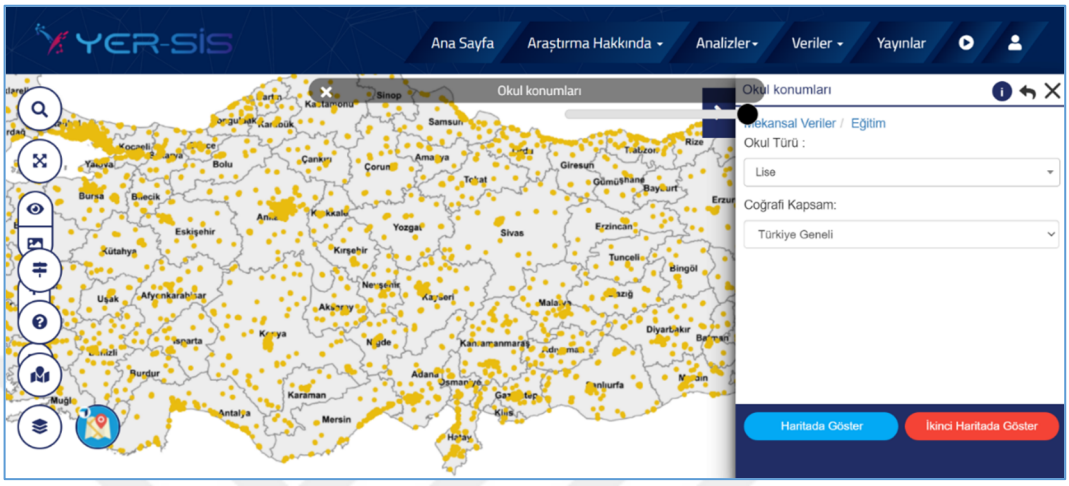

Figure 3.3 High school locations in Turkey in YER-SİS (T.C. Sanayi ve Teknoloji Bakanlığı, 2022)

3.3.2 ATLAS

ATLAS application is an open-source web application that displays geographic data services together. Geographical data produced by the Ministry of Environment, Urbanization and Climate Change and 2 and 3-dimensional data are presented on the web with this application. Turkey's National Geographic Data Portal can be accessed via “atlas.gov.tr” and geographic data of various institutions and subjects can be accessed. ATLAS application takes place in the Open GIS Consortium (OGC) standards, where Geographic Information Systems standards are determined. (T.C. Çevre Şehircilik ve İklim Değişikliği Bakanlığı, 2022).

The map in Figure 3.4 shows the school map in Turkey produced from the Basic ATLAS application. Since each point is clicked, the school information in that region is displayed on the right information screen in the application.

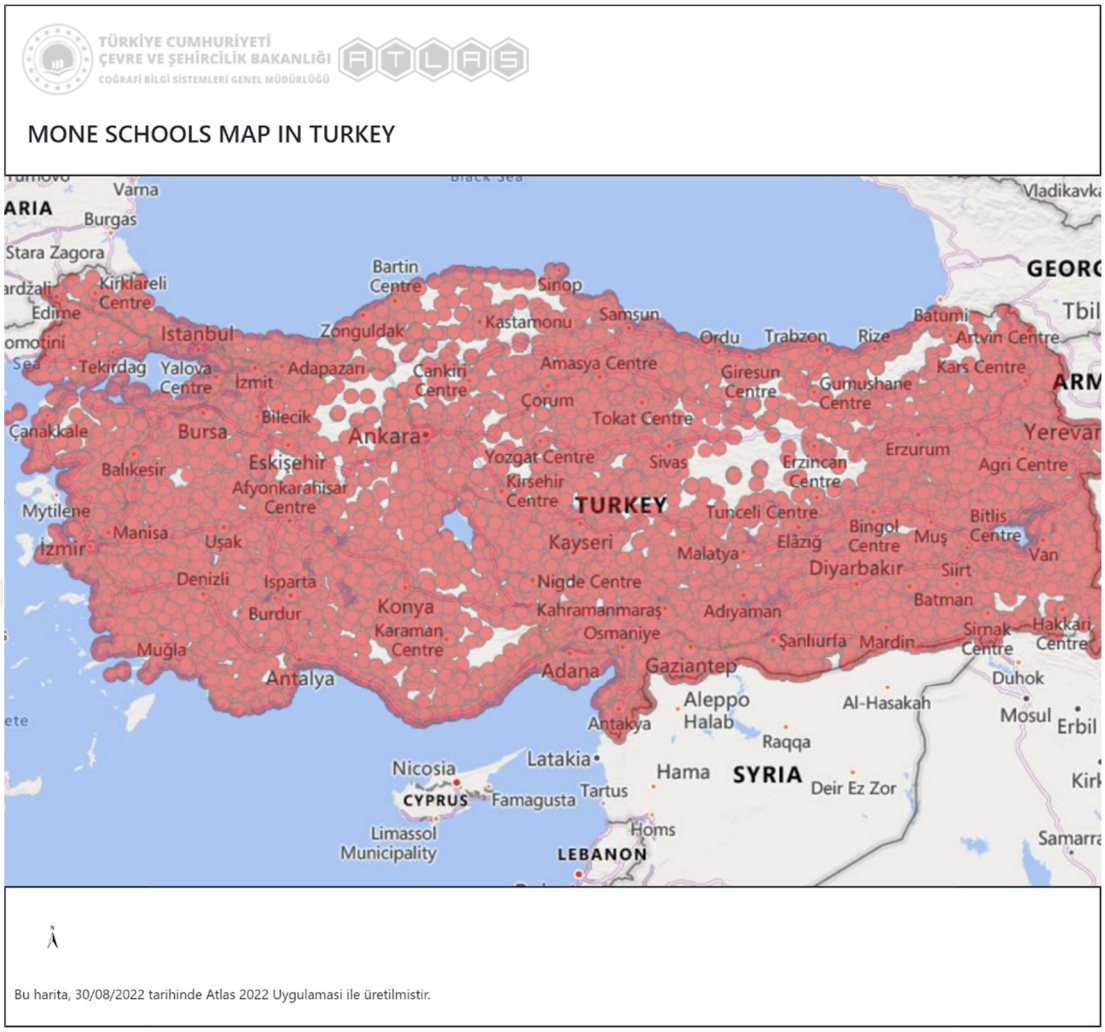

Figure 3.4 Basic ATLAS school map in Turkey (T.C. Çevre Şehircilik ve İklim Değişikliği Bakanlığı, 2022)

3.3.3 TÜİK

The Turkish Statistical Institute evaluates, analyses and publishes statistical data on the topics listed below (Türkiye İstatistik Kurumu [TÜİK], 2022a). At https://cip.tuik.gov.tr/, statistical data are mapped with the geographic data portal. The Figure 3.5 shows an example map in the field of education.

- ✓ Justice and Election
- ✓ Science, Technology and Information Society
- ✓ Environment and Energy
- ✓ International Trade
- ✓ Education, Culture, Sports and Tourism
- ✓ Ek Economic Confidence
- ✓ Inflation and Price Income, Living, Consumption
- ✓ Poverty
- ✓ Construction and Housing Employment, Unemployment and Wages
- ✓ Population and Demographics
- ✓ Health and Social Protection
- ✓ Industry
- ✓ Agriculture
- ✓ Trade and Service
- ✓ Transportation and Communication
- ✓ National Accounts

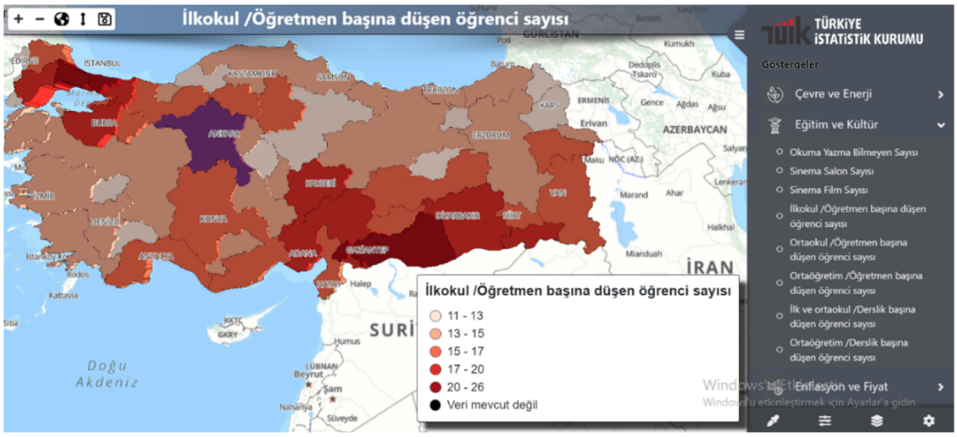

Figure 3.5 Number of students per primary school / teacher (TÜİK, 2022b)

3.3.4 Şeffaf Ankara

The "Şeffaf Ankara" platform, which is called the first and only downloadable map-based open data sharing in the world, contains data from various municipal activities and the dynamics of the city. With this platform, …*Because Big Data is completely based on the analysis of real data, it helps to make the right decisions in many different areas such as reducing costs, preventing fraud and crime, operational efficiency, labour savings, predictive maintenance and service development in line with expectations, especially in government institutions...*(T.C. Ankara Büyükşehir Belediyesi, n.d.). The thematic map showing the important points of the city from the datasets available from the address "seffaf.ankara.bel.tr" is shown in the Figure 3.6.

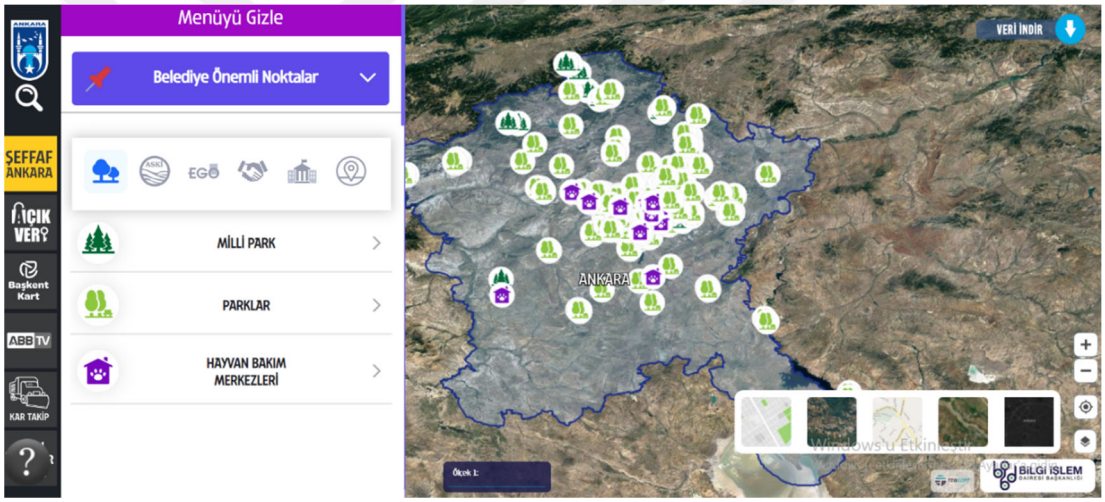

Figure 3.6 Important points of the municipality on the *'Şeffaf Ankara'* platform (T.C. Ankara Büyükşehir Belediyesi, n.d.).

3.3.5 Istanbul Metropolitan Municipality (İBB) Open Data Portal

It is an open data portal that shares the data owned and shared by IBB affiliated organizations, subsidiary companies, other public and private companies within the scope of Personal Data Protection Law (KVKK). There are various data sets of 41 different organizations affiliated to İBB (İBB, 2022).

3.3.6 İzmir Open Data Portal

It is an open data portal where data about Izmir is published. it consists of 160 data sets related to 29 organizations. Of these 29 organizations, there are 17 data sets containing geographical data by the Department of Maps and GIS. One of the 17 data sets is the educational institutions located in Izmir (İzmir Büyükşehir Belediyesi, 2022).

3.4 Distance Learning

Distance learning: it can be defined as an effective method that supports the progress of individuals at their own learning pace by eliminating the limits of time and space, and presents training, training materials and resources to the participants in an electronic environment. (Telli & Altun, 2020).

Distance learning first started in the Boston newspaper in 1728 with a study called "Steno Lessons". In the 19th century, "Composition by Letter Lessons" were given to women at the University of Sweden. In this century, distance learning applications were also made in Sweden, England and the United States. In 1843 started teaching by letter at the University Correspondence College. The first educational radio broadcast started in America in 1920 and then continued in other countries. Between 1932 and 1937, the first educational television broadcast was made at IOWA University. “British Open University” was opened in 1960 (Arat & Bakan, 2011).

With the development of information and communication technologies, education lessons have started to be held via video conference over computers. Virtual universities providing distance learning were established in the UK in 1995 and in the USA in 1997. The Open Learning Agency of Australia (OLA) provides open learning to some universities in it. United Kingdom Open University (UKOU) is one of the UK's largest distance learning universities. (Arat & Bakan, 2011).

When we look at the history of distance learning in Turkey, it was carried out by the Ministry of Education of the Letter Teaching Centre in 1960. In 1975, the Experimental Higher Teachers' Board was established to train teachers in the field of science and mathematics. The Common Higher Education Institution operated between 1974-1979 to train people at the associate degree level. Open Education Faculty was established in 1982 (Arat & Bakan, 2011).

Changing and developing technological advances outside the traditional education system have also started to be used in the education system and have brought along new searches. This new search is considered an internet-based distance education system. The advantages of this education system can be listed as follows:

- Sustainability to a large audience without space problems,
- Configuring education in international standards,
- Allowing flexible and objective measurement-evaluation,
- Enriching the content visually and audibly with the opportunities provided by technology,
- Providing working people with the opportunity to train while they work,
- Less cost of education (Odabaş, 2003).

The Covid-19 outbreak broke out in December 2019 and was declared a pandemic by the World Health Organization (WHO) in March 2020 (WHO, 2020). To prevent the spread of the Covid-19 epidemic, countries have started to apply strict rules and closed down. In addition to this, measures such as working from home practices, flexible working or closing the institutions completely were taken. This led to the closure of universities and schools. There has been a transition to distance learning (Bozkurt, 2020).

In Figure 3.7, the country representation of school closures in the world between February 2020 and July 2020 is shown on the map. There is statistical information that the education of 9 out of 10 students was interrupted during the Covid period.

Figure 3.7 Open status of schools around the world in the Covid-19 pandemic (Bozkurt, 2020)

3.5 Covid-19 and Education in Turkey

Approximately 25 million students in Turkey have been affected by the Covid 19 pandemic. As seen in Table 3.1, the distribution in terms of gender and education level is seen. According to the table, we can say that men are more affected than women. The Ministry of National Education and Higher Education Institutions switched to the distance learning process during the pandemic process. The transition status of these institutions in this process will be examined separately.

3.5.1 MEB

Technological developments that we encounter with an increasing momentum today, especially with the Covid 19 pandemic, from health to social life; it has had to move into our lives faster in various fields from economy to education. When we look at Turkey, especially in the field of education, the first Covid 19 case was seen in Turkey on March 11, 2020, and schools were closed. A distance education decision was taken by the Ministry of National Education on March 23, 2020, and an effort was made to ensure that education was not disrupted. Lessons began to be broadcast through some channels of the Ministry of National Education's digital education platform Educational Information Network and Turkish Radio and Television Corporation (TRT). In this process, the EBA infrastructure was strengthened and the

course contents were prepared and presented to the students in a short time. (MEB, 2022c).

Tablo 3.1 Student population affected by the interruption of education due to the Covid-19 outbreak in Turkey (Bozkurt, 2020)

Total affected students:		24.901.925	
Total affected female students:		11.817.880	
Total affected male students:		13.084.045	
Level of Education	**Female**	**Male**	**Total**
Pre-school	632.944	693.179	1.326.123
Primary education	2.421.515	2.550.915	4.972.430
Secondary education	5.450.541	5.953.844	11.404.385
Higher education	3.312.880	3.886.107	7.198.987

Vocational and technical education about the pandemic process came to the fore and R&D studies produced "respiratory device, video laryngoscopy, air sterilization machine, non-contact thermometer, surgical mask production machine, intensive care bed and sampling unit" products. (Özer & Suna, 2020).

In addition, in this process, the psychological health of the students was given importance and a psychosocial support program was prepared. An open helpline for students and parents has been established. Content production has also been increased for students with special educational needs, and content with sign language on EBA has been increased. In addition, the "Özelim Eğitimdeyim" mobile application was developed for special education students. (Özer & Suna, 2020).

MEB High School Transition System (LGS) postponed the exam date from June 7 to June 20, 2020, and it was decided that every student should enter the school where they were educated as exam venues to prevent mobility. Although there may be a digital literacy difference in this exam, the distance learning period is not included in the exam curriculum. In addition, "canlı dersler" was implemented for students to interact with their teachers. (Özer & Suna, 2020).

3.5.2 YÖK

On March 18, with the YÖK Pandemic Period Distance Education Applications Roadmap, studies were carried out in 5 areas to provide uninterrupted lessons to students

- *"Legislation,*
- *Infrastructure,*
- *Human Resources,*
- *Contents,*
- *Practice".*

Legislation: Distance Learning Procedures and Principles legislation has been amended so that universities can carry out distance learning activities during this period.

Infrastructure: There are Distance Education Application and Research Centres (UZEM) in 123 universities. With the coordination of YÖK, the infrastructure of the universities with lack of infrastructure has been resolved in line with their needs.

Human Resources: Within the scope of the Digital Transformation Project, some lecturers and students were given training. To support this process, upon request, the preparations for the Learning and Teaching in Higher Education in the Digital Age course in the digital environment have been completed.

Contents: Tools and guides were shared to develop content. The courses of the universities in the digital environment were brought together by creating a pool and made available for open access.

Practice: Universities were able to realize synchronous and asynchronous courses (YÖK,2022c).

The decisions taken by YÖK following the transition to digital education on March 23, 2020, will be mentioned below in chronological order.

On March 25, the YÖK Courses Platform was opened to the access of universities. In the spring semester of the 2019-2020 academic year, it has been decided that students at the associate, undergraduate and graduate levels can freeze their

registration upon request. Some exam dates have been postponed. It has been decided that these applications can be carried out both remotely and in the summer period in education models that require practice. Higher education institutions would be able to decide which courses to teach remotely. With the decision to be taken as a result of the special evaluation of higher education institutions, nursing program students would be able to do their internship with protective equipment or with distance education. Likewise, internships of Pharmacy and Dentistry students were left to the evaluation of higher education institutions. In this process, video conference meetings were held with the deans and rectors of various departments. On April 22, 2020, the decisions regarding the practical training of senior medical students (interns) were notified to the universities. (YÖK,2022d).

3.6 GIS-Based Educational Analysis

Within the scope of this thesis, the data received from TUIK and YÖK are shown in Table 3.1 with the number of students studying at the higher education level by male and female breakdown, and in Table 3.2 by the number of illiterate students by male and female breakdown, in addition to the number of graduations according to education level at the basic education level. Table 3.1 consists of the number of students enrolled in associate, undergraduate, graduate and doctoral programs in the 2021-2022 academic year in line with the data received from YÖK. Table 3.2 consists of people over the age of 6 who graduated from primary school, primary school, secondary school and vocational school equivalent to secondary school, and vocational school equivalent to high school and high school, as of 2021, in line with the data obtained from TUIK.

In the data obtained from YÖK, there were separate university-based data according to the type of education in universities (primary education, secondary education, distance education and open education), but the data were combined on a provincial basis in order to display on a province basis. Open education is available at associate and undergraduate level in Istanbul, Eskişehir and Erzurum, and only at undergraduate level in Ankara.

Thematic maps were created within the scope of the project with the data in Table 3.1 and Table 3.2 in QGIS 3.22.10 version. The province map of Turkey was taken as the base map. The data was converted from excel format to csv format and added to the QGIS application. The attribute table in the base map and the data table in csv format are connected with the city name, which is common with the link command. Respectively, each column is rated separately from the symbology part. It has been shown in 8 different classes by using the Natural Break (Jenks) mode, taking into account the differences that will occur as the grading range.

Figure 3.8 and Figure 3.9 are thematic maps of the number of students enrolled in an associate degree program, male and female, respectively. We can say that the number of women enrolled in the associate degree program is higher than the number of men. In addition, when we look at the densest provinces, Eskişehir is the province with the highest number of both men and women, while Erzurum and Istanbul have the highest number of registered students. The reason for this can be interpreted as the open education program in these three provinces.

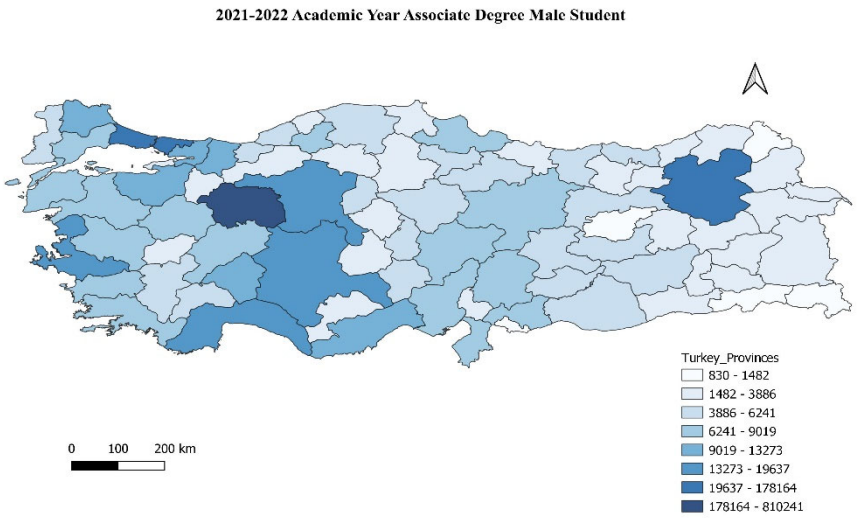

Figure 3.8 Map of 2021-2022 academic year associate degree male student

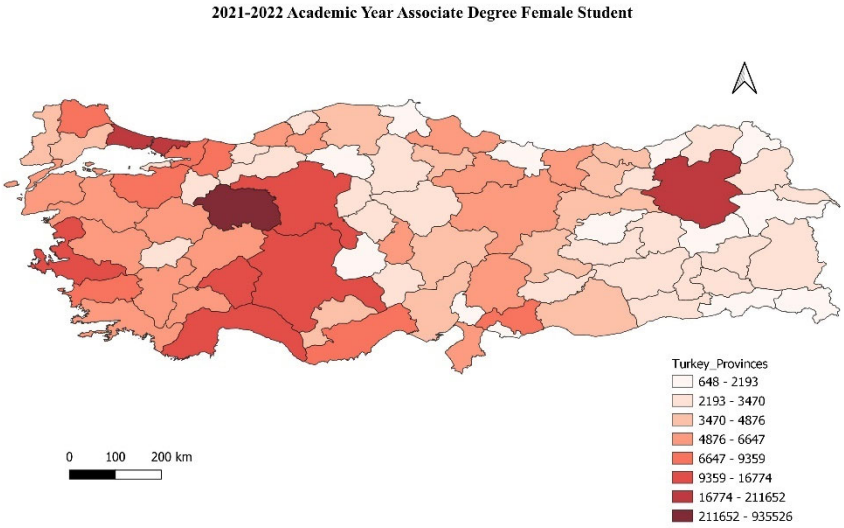

Figure 3.9 Map of 2021-2022 academic year associate degree female student

Figure 3.10 and Figure 3.11 show the thematic map of the number of male and female students enrolled in the undergraduate program. Contrary to the associate degree program, the number of men enrolled in the undergraduate program is higher. Unlike the map of the number of students enrolled in the associate degree program, the density in the number of students enrolled in the undergraduate program is seen in Ankara, in addition to Eskişehir, Erzurum and Istanbul.

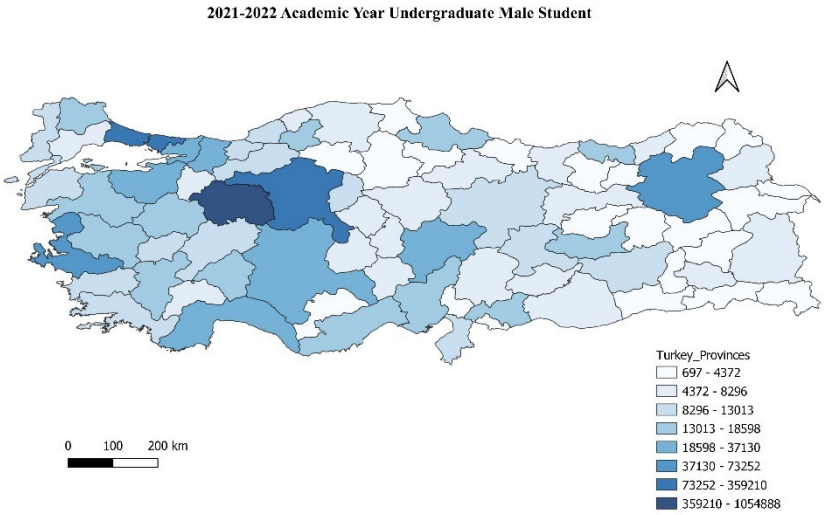

Figure 3.10 Map of 2021-2022 academic year undergraduate male student

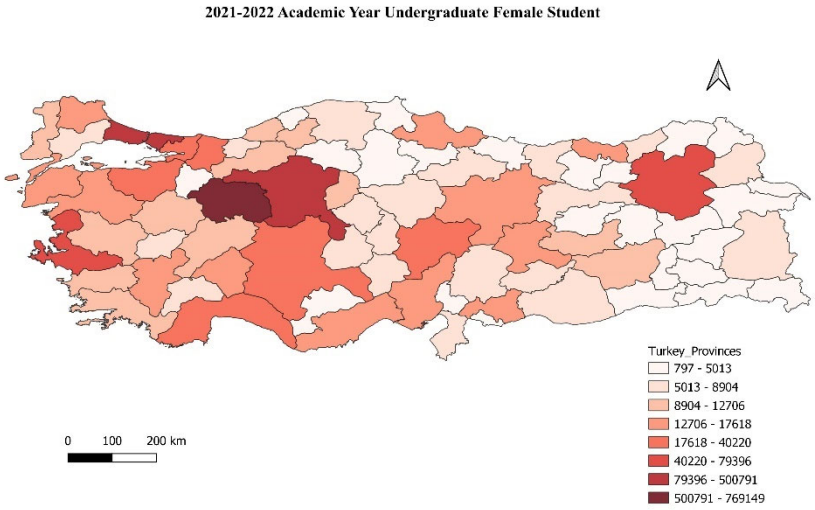

Figure 3.11 Map of 2021-2022 academic year undergraduate female student

Figure 3.12 and Figure 3.13 show the thematic map of the number of male and female students enrolled in the graduate program. Either way, the province with the highest number of students enrolled in graduate programs is Istanbul. We can say that female students enrol more in the master's program. In addition, it is seen that men who enrol in a master's program in Konya are visibly more intense than women in two ways.

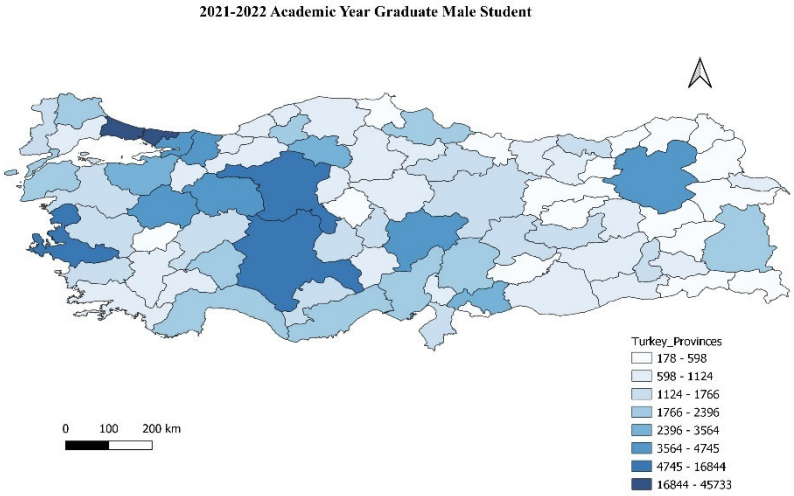

Figure 3.12 Map of 2021-2022 academic year graduate male student

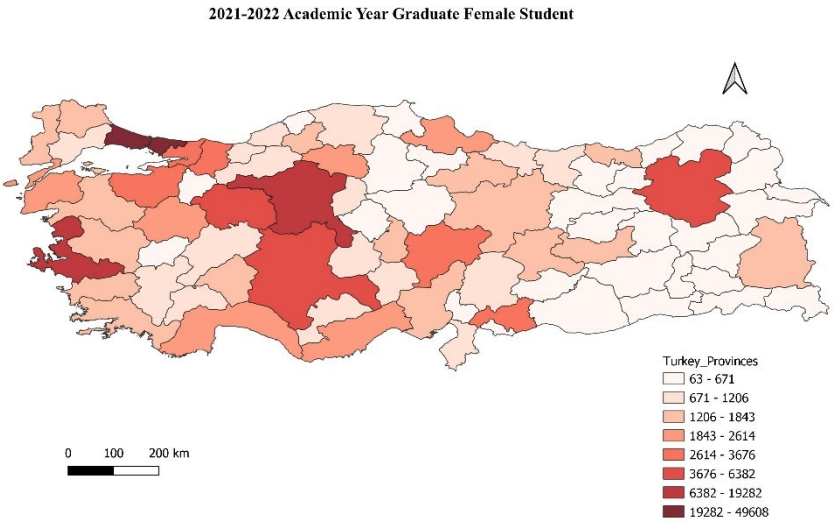

Figure 3.13 Map of 2021-2022 academic year graduate female student

Figure 3.14 and Figure 3.15 show the thematic map of the number of male and female students enrolled in the doctoral program. As in the master's program, the city with the highest density in the doctoral program is Istanbul.

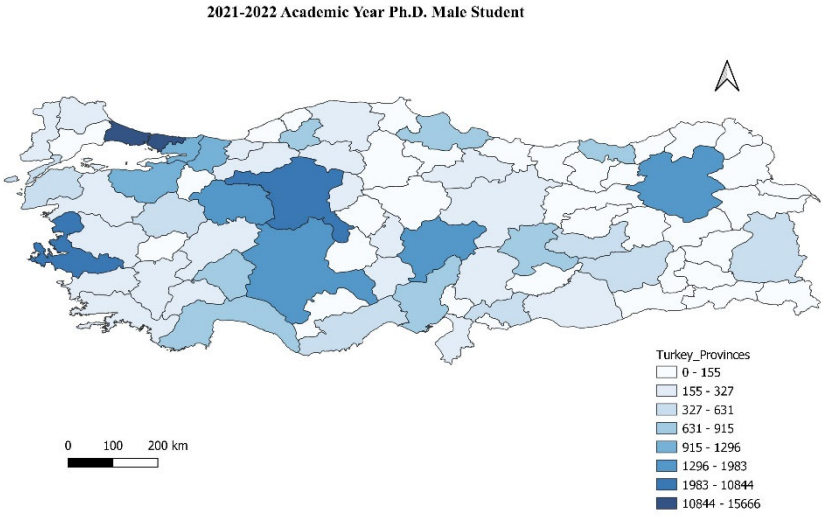

Figure 3.14 Map of 2021-2022 academic year Ph.D. male student

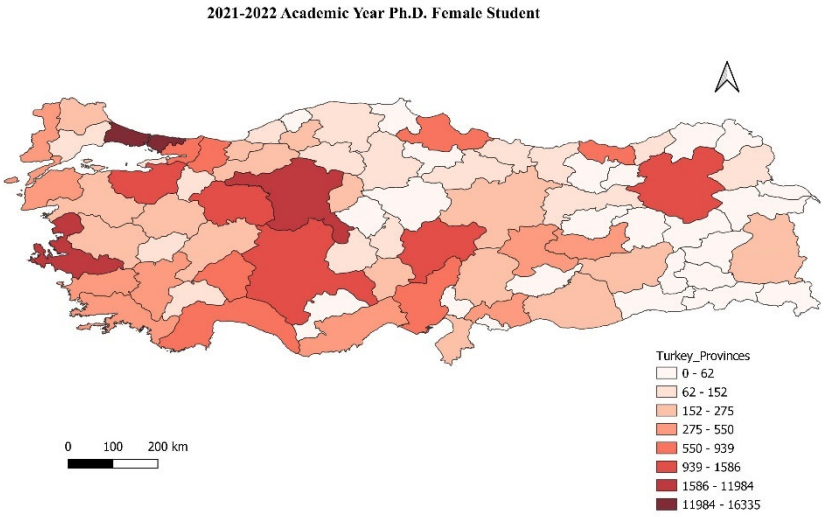

Figure 3.15 Map of 2021-2022 academic year Ph.D. female student

If a general evaluation is made, it can be said that there is a density of registered students from east to west. The number of students enrolled in all programs is seen intensely, especially in metropolitan cities. In addition, there is a decrease in the number of students continuing their education life after the undergraduate program.

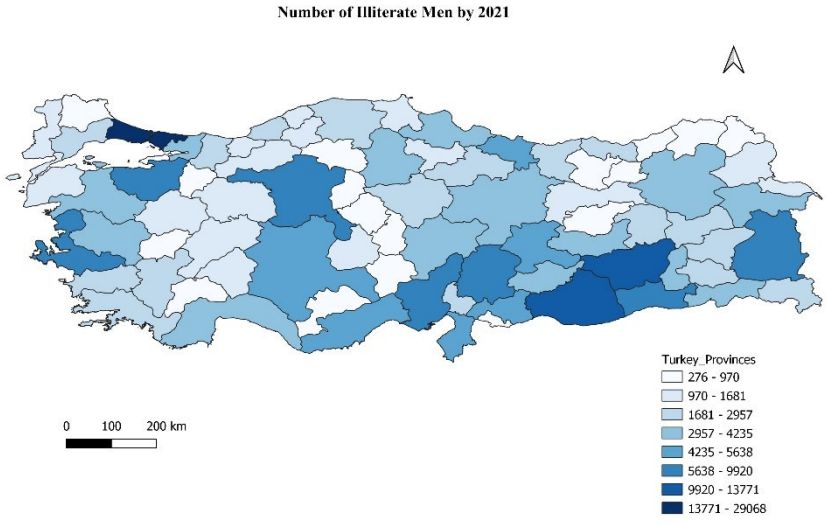

Figure 3.16 Map of number of illiterate men by 2021

Figure 3.16 and Figure 3.17 are thematic maps of the number of illiterate men and women. It is seen that the number of illiterate women is much higher than the number of men. The number of illiterate people is seen intensely in metropolitan cities and especially in Diyarbakır, Şanlıurfa and Van provinces.

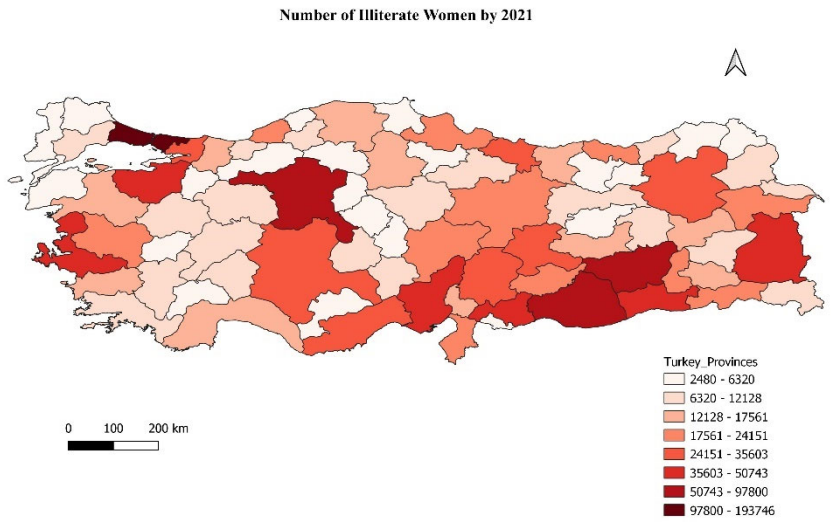

Figure 3.17 Map of number of illiterate women by 2021

Figure 3.18 and Figure 3.19 are the thematic maps of the number of male and female students graduating from primary school for individuals over the age of 6 as of 2021. It can be said that the graduation rate of women is higher than that of men.

Figure 3.20 and Figure 3.21 are the thematic maps of the number of male and female students graduating from primary education of individuals over the age of 6 as of 2021. While the number of primary school graduates is highest in Istanbul, it can be said that the number of graduates is higher than the number of women.

Figure 3.22 and Figure 3.23 are the thematic maps of the number of male and female students over the age of 6 who graduated from secondary or secondary vocational school as of 2021. When we look at these two images, it can be said that the number of male graduates is more than the number of females.

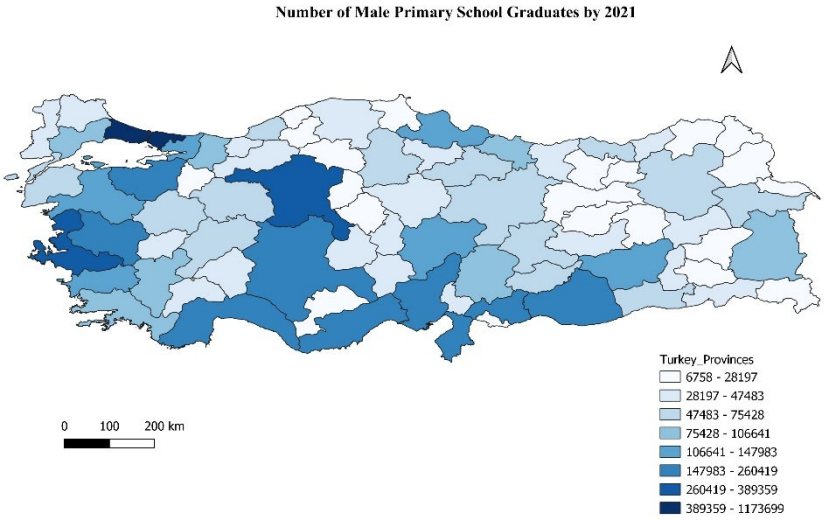

Figure 3.18 Map of number of male primary school graduates by 2021

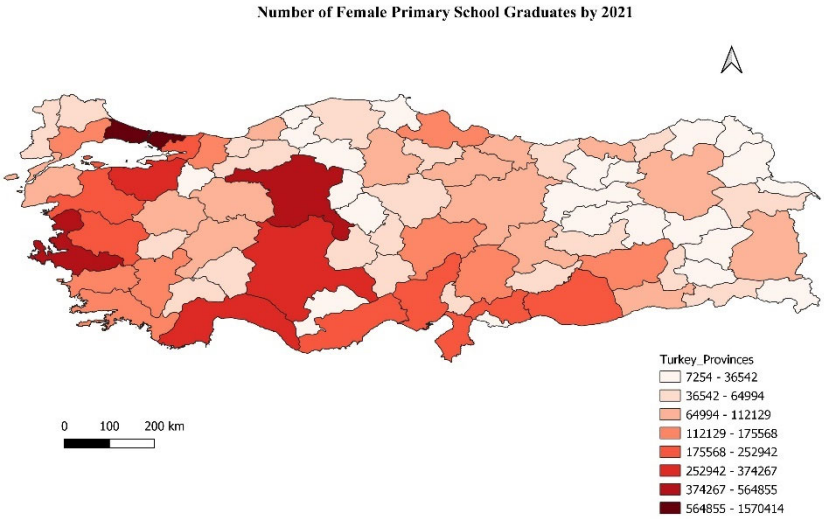

Figure 3.19 Map of number of female primary school graduates by 2021

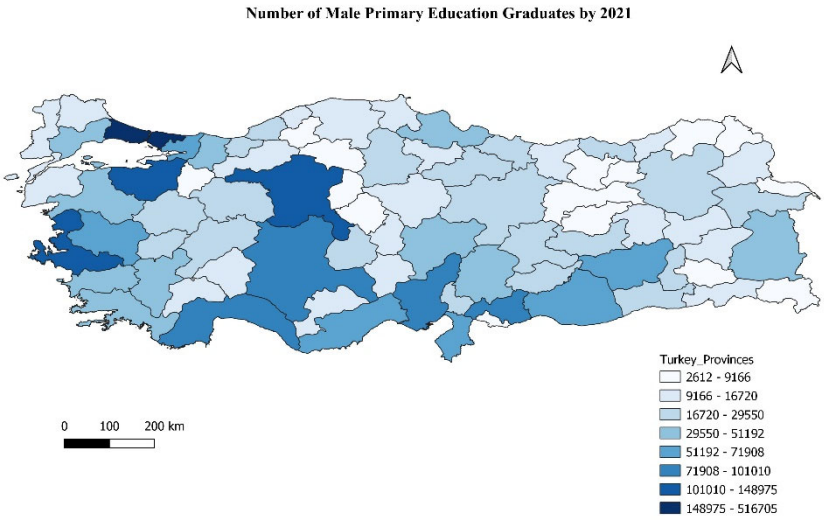

Figure 3.20 Map of number of male primary education graduates by 2021

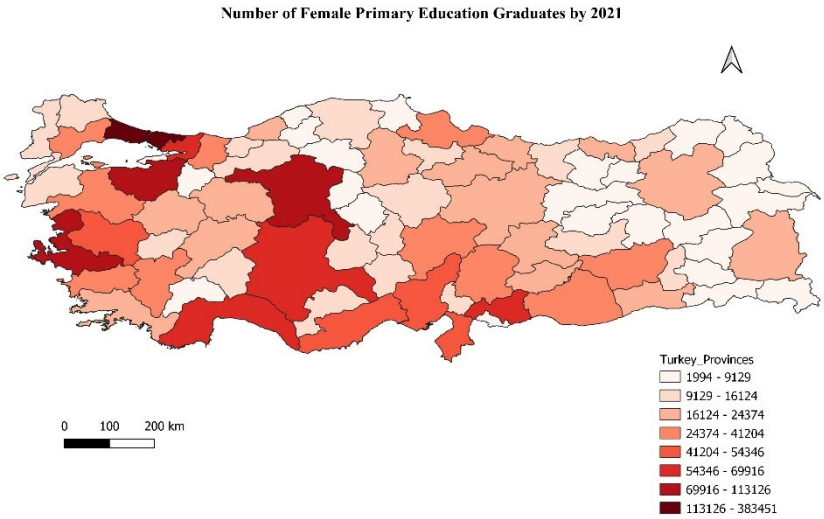

Figure 3.21 Map of number of female primary education graduates by 2021

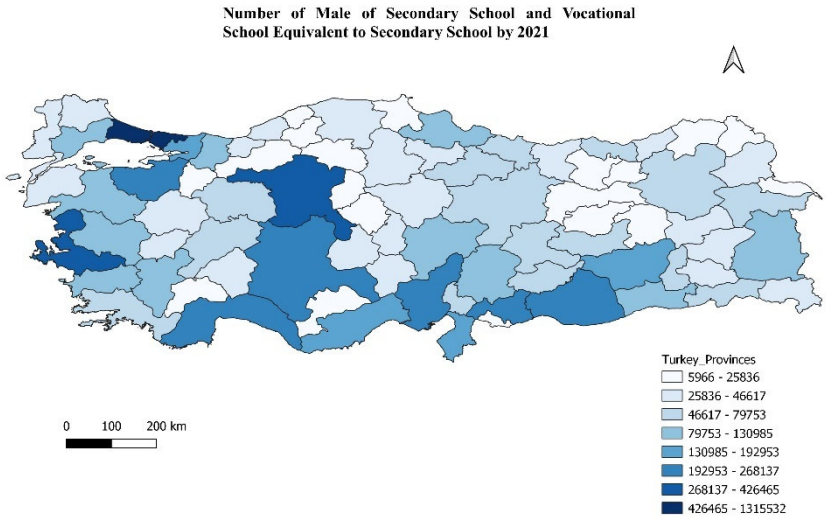

Figure 3.22 Map of number of male secondary school graduates by 2021

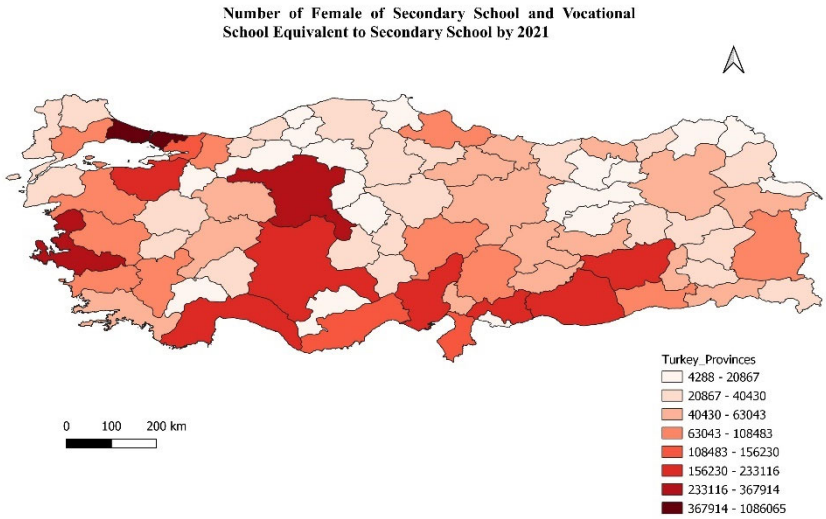

Figure 3.23 Map of number of female secondary school graduates by 2021

Figure 3.24 and Figure 3.25 are the thematic maps of the number of male and female students over the age of 6 who graduated from high school and high school equivalent vocational school as of 2021. When we look at these two figures, it can be said that the number of women who graduated from high school is decreasing towards the east.

In addition, we can say that the number of women who graduated from high school is less than the number of men.

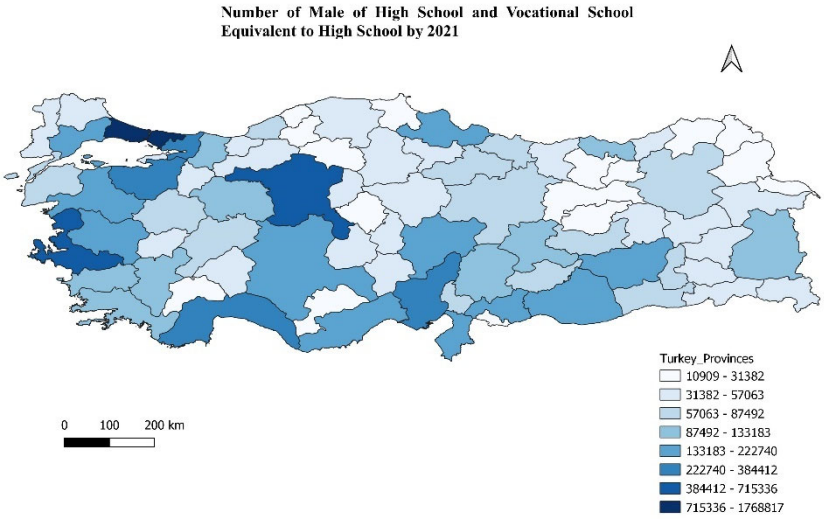

Figure 3.24 Map of number of male of high school and vocational high school graduates by 2021

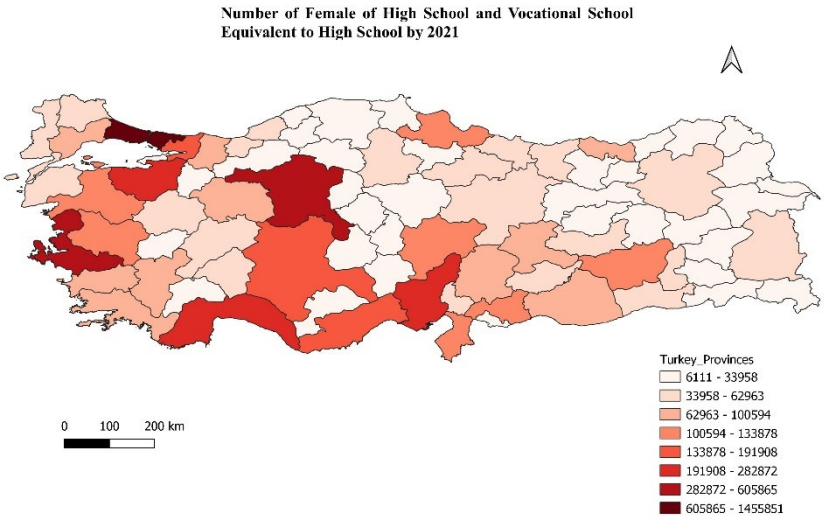

Figure 3.25 Map of number of female of high school and vocational high school graduates by 2021

Table 3.1 Number of students in the academic year 2021-2022 at the higher education level (YÖK, 2022c)

Provinces	**Associate degree male**	**Associate degree female**	**Undergraduate male**	**Undergraduate female**	**Graduate male**	**Graduate female**	**Ph.D. Male**	**Ph.D. Female**
ADANA	6943	4876	18598	15134	2181	1843	915	875
ADIYAMAN	5254	2812	4822	5375	197	194	36	25
AFYONKARAHİSAR	6625	5549	10218	11275	1367	1206	298	190
AĞRI	2322	2011	3867	4423	460	351	23	13
AKSARAY	2343	1812	6140	6547	1285	912	99	86
AMASYA	4562	3970	2553	3929	715	539	17	14
ANKARA	16382	16774	111186	122826	16844	19282	10844	11984
ANTALYA	17499	11003	27564	22906	2283	2614	775	840
ARDAHAN	1036	1173	1547	1371	211	168	18	22
ARTVİN	2890	3097	1901	2766	268	236	17	19
AYDIN	9019	8177	12711	12706	1320	1509	316	440
BALIKESİR	8422	5643	14615	13724	1471	1272	234	202
BARTIN	2898	2607	5577	5013	726	517	46	62
BATMAN	3677	2767	2908	2089	1391	572	59	20
BAYBURT	2373	2683	3330	3903	546	292	48	14
BİLECİK	3355	2917	4833	4119	752	432	84	75
BİNGÖL	3526	3322	3508	3555	676	344	153	29
BİTLİS	3075	2894	1756	1827	437	178	10	6

Table 3.1 Continues

BOLU	3585	3131	8807	11355	910	981	260	275
BURDUR	5952	5593	8296	8865	1052	976	177	152
BURSA	12184	8082	24248	22993	2911	3082	1296	1138
ÇANAKKALE	7468	5474	13013	14276	2258	2413	382	393
ÇANKIRI	2487	1735	4372	4883	3186	2007	194	120
ÇORUM	3512	2917	4253	4114	703	637	122	89
DENİZLİ	5752	5557	15878	14202	805	1011	327	406
DİYARBAKIR	4352	3290	11277	10073	902	671	474	245
DÜZCE	4456	3018	10442	8255	1111	954	254	169
EDİRNE	6241	4828	12148	12252	1386	1513	323	351
ELAZIĞ	4836	3322	13931	11137	1688	1455	582	408
ERZİNCAN	5638	3960	5770	6829	576	609	140	96
ERZURUM	178164	211652	73252	79396	4361	4178	1483	1239
ESKİŞEHİR	810241	935526	1054888	769149	4745	4434	1578	1586
GAZİANTEP	7966	6971	14837	15786	3564	3086	631	482
GİRESUN	5598	5336	5911	6304	781	779	85	102
GÜMÜŞHANE	3643	4101	4161	4636	954	549	88	52
HAKKARİ	830	648	697	814	178	63	0	0
HATAY	8093	5355	11722	8901	1661	1104	224	163
IĞDIR	2347	2373	2410	2242	946	506	72	25

Table 3.1 Continues

ISPARTA	12606	10965	18093	15535	2007	1628	844	705
İSTANBUL	131751	180296	359210	500791	45733	49608	15666	16335
İZMİR	19637	13518	62859	60295	6899	8556	2937	3642
KAHRAMANMARAŞ	7634	6018	8079	8904	1841	1174	290	207
KARABÜK	6660	5413	17490	10689	2396	1612	826	253
KARAMAN	3192	3919	4000	4764	1220	957	79	60
KARS	2580	2971	5749	5780	523	590	100	96
KASTAMONU	4561	3820	7437	7706	1113	983	221	135
KAYSERİ	7197	4782	23530	21246	4040	3676	1372	1182
KIRIKKALE	5092	3091	10441	10965	1065	1119	272	180
KIRKLARELİ	10393	7020	15894	16952	1845	1685	298	205
KIRŞEHİR	3485	2851	5217	5976	550	490	79	60
KİLİS	1482	1599	2444	3596	242	189	12	8
KOCAELİ	13273	9359	24183	18903	4294	3205	1096	939
KONYA	15604	10617	37130	40220	7598	6382	1983	1405
KÜTAHYA	8856	6647	15092	12120	3810	2141	360	163
MALATYA	4483	3716	12444	13782	1766	1519	772	550
MANİSA	8433	6349	14091	11737	1496	1288	274	242
MARDİN	2835	2559	3444	4063	779	538	63	25
MERSİN	10824	7701	13882	13245	2185	2340	366	447

Table 3.1 Continues

MUĞLA	8569	5677	12622	11044	1073	1324	322	350
MUŞ	2281	1901	2659	3004	395	252	38	5
NEVŞEHİR	5385	6038	5316	8102	1361	1252	180	148
NİĞDE	4306	2953	6436	7003	1124	1010	265	188
ORDU	3251	2193	4267	4960	541	719	108	109
OSMANİYE	2639	1505	3288	3526	726	479	63	35
RİZE	2480	2015	4824	5947	598	589	128	97
SAKARYA	11534	8256	23747	20689	4243	3077	1184	682
SAMSUN	7500	6523	17197	17618	2295	2481	747	628
SİİRT	2975	2564	4864	4423	876	476	73	25
SİNOP	2712	2028	3068	3688	539	377	11	3
SİVAS	6868	6105	12891	14165	1708	1673	293	239
ŞANLIURFA	5057	4341	6597	6700	906	647	279	165
ŞIRNAK	1027	963	963	797	542	182	28	4
TEKİRDAĞ	6787	3726	7317	6471	884	891	124	127
TOKAT	5224	4992	7715	8156	1425	1298	211	151
TRABZON	4800	4367	15634	15142	1568	1810	796	745
TUNCELİ	1309	1298	1374	1746	347	202	8	9
UŞAK	3876	3411	9085	8681	219	266	150	104
VAN	3886	3091	7564	7166	1949	1315	463	221

Table 3.1 Continues

YALOVA	3416	2804	4104	3655	590	411	150	113
YOZGAT	4683	3470	5750	6268	816	645	81	31
ZONGULDAK	5827	5380	9087	9258	1090	905	155	116

Table 3.2 School graduation status in Turkey according to the education status of the year 2021 (TÜİK, 2022)

Province	İlliterate men	İlliterate women	Primary school male	Primary school female	Primary education male	Primary education female	Secondary school male	Secondary school female	High school vocational school male	High school vocational school female
ADANA	8773	50743	192982	252942	82553	54346	208430	175774	253770	205358
ADIYAMAN	4235	24151	53094	64994	21530	19698	62995	52673	65949	48324
AFYONKARAHİSAR	1631	12128	75428	112129	29550	24374	69607	56000	78657	53028
AĞRI	3847	23420	54625	53915	17504	7887	59620	44244	40991	24381
AKSARAY	1418	10924	40796	53931	18047	14580	41316	34234	38934	28319
AMASYA	1213	6320	34522	48889	11388	11107	27199	23305	39361	28034
ANKARA	9920	68933	373006	564855	127545	113126	426465	367914	715336	605865
ANTALYA	3757	17561	222728	278112	84177	65389	213949	173005	303309	241417
ARDAHAN	604	3810	9886	12017	3830	2867	10099	7533	10909	6111
ARTVİN	598	3728	13678	22733	5593	4053	13645	10940	26224	15974
AYDIN	2612	13461	121281	153002	44798	33096	95760	77846	117087	100594
BALIKESİR	3691	15728	134421	189450	42256	34060	99115	81518	144785	110800
BARTIN	1210	5060	21138	26446	11798	8385	15728	14086	22275	16866
BATMAN	3519	20424	43104	52949	20360	16124	67707	60836	65453	45716
BAYBURT	276	2480	6758	9470	2788	2851	7142	5623	11899	8637
BİLECİK	578	2532	20487	31597	7459	7070	19456	14781	32993	20605
BİNGÖL	2111	10626	20267	22933	10186	7804	25836	23562	34719	29533
BİTLİS	1978	12107	28197	32403	11979	8995	39316	33213	35824	22289
BOLU	1061	6110	30447	42462	10445	10801	22272	18495	41421	30975
BURDUR	699	4224	30166	40693	9631	8190	22801	16755	30684	23986

Table 3.2 Continues

BURSA	7851	46168	260419	374267	116425	98812	268137	233116	384412	282872
ÇANAKKALE	1325	4358	61838	84311	16720	13939	40635	33329	65815	50867
ÇANKIRI	860	5178	20074	27813	6762	6811	16232	12357	24120	16108
ÇORUM	3313	15489	57879	74088	22755	18030	43583	35702	52575	38586
DENİZLİ	1970	9650	106641	136685	42528	36481	89103	71305	116585	95868
DİYARBAKIR	12596	71421	139836	148668	54739	33832	192953	165699	168312	115790
DÜZCE	1215	7428	35491	48836	18598	14145	32671	28391	48787	35346
EDİRNE	1572	6067	46849	60101	13924	11932	32298	24834	50882	39292
ELAZIĞ	3133	14638	41737	62199	18428	15073	54119	48252	72934	50384
ERZİNCAN	1198	7232	19465	25670	6746	5938	18773	15312	30972	23934
ERZURUM	4194	26565	62437	90652	20506	16873	70458	59219	87492	58249
ESKİŞEHİR	1668	10252	68048	111609	23667	23897	64646	56060	125673	90267
GAZİANTEP	5432	45966	180092	245958	101010	63350	225728	184077	181720	133878
GİRESUN	2456	14646	47483	51058	15840	12682	36321	28885	52763	39054
GÜMÜŞHANE	601	3897	12345	16336	4647	4723	10702	8336	19257	14082
HAKKARİ	1961	7081	17819	17349	5471	5326	30641	32128	39796	25743
HATAY	5166	20662	171407	197863	60227	47472	157159	135081	154669	121539
IĞDIR	1520	8700	18830	17188	7813	5575	22334	16175	18292	13472
ISPARTA	1162	7096	40783	58103	12575	11989	33267	27316	55607	45667
İSTANBUL	29068	193746	1173699	1570414	516705	383451	1315532	1086065	1768817	1455851
İZMİR	8370	40228	389359	522229	148975	107221	366535	303547	525915	441764
KAHRAMANMARAŞ	6834	35603	105373	135298	48553	36863	117765	97840	119500	80531
KARABÜK	1104	7147	21583	29671	8451	8165	18240	14860	31382	23659
KARAMAN	704	3438	25438	34552	12000	10484	22880	19521	25651	20906
KARS	1681	10942	27170	31587	10787	6982	31014	23255	28215	18530

Table 3.2 Continues

KASTAMONU	2372	13002	45907	57411	14294	12141	29974	23150	40262	27566
KAYSERİ	3370	23484	120168	175568	51192	36722	130985	108483	165236	124972
KIRIKKALE	714	6103	19452	32998	7181	8241	23430	20867	42014	28482
KIRKLARELİ	911	3991	38135	51071	14381	12888	28776	23285	49343	36704
KIRŞEHİR	706	5209	20343	30490	7639	6362	18752	15861	28728	21986
KİLİS	617	2543	10947	12154	5955	5728	15382	14336	13791	12175
KOCAELİ	4057	25222	147983	215387	71199	61914	177742	156230	268497	191908
KONYA	5054	31459	224866	327483	86208	69916	207677	171333	222740	168898
KÜTAHYA	1549	7126	56650	90829	22369	22384	44144	37318	71076	45741
MALATYA	4895	29056	63751	89286	25448	20823	73362	58827	97448	72650
MANİSA	3786	20530	172844	220311	63962	48821	126333	104264	147238	111177
MARDİN	7302	41868	68943	77060	23433	19547	91205	78911	80695	53016
MERSİN	4948	25350	175174	227221	65356	47415	168634	140797	200567	162309
MUĞLA	1923	9475	104355	126946	35207	24367	79753	63043	120006	96480
MUŞ	2957	16909	36045	36542	13879	9129	45008	40430	35961	23567
NEVŞEHİR	693	5656	29581	41268	11523	10216	27119	22314	33410	26338
NİĞDE	970	8028	37016	48211	15868	12212	36293	29361	36860	28168
ORDU	5638	28821	82513	90285	27215	21901	66856	52953	85080	61179
OSMANİYE	2883	16143	44507	60077	19630	14430	52822	43997	62465	47870
RİZE	855	8253	31528	38261	12724	9659	28384	24378	46896	33958
SAKARYA	2696	16723	94087	132488	36673	30682	89340	75305	133183	100466
SAMSUN	4021	20831	138331	168069	50982	39227	111519	95527	141046	117363
SİİRT	2389	15043	24030	28339	9166	6739	37385	33769	32987	19201
SİNOP	1252	5651	26781	32864	9839	7904	17342	13675	21056	16842
SİVAS	3173	21413	57214	74880	19718	17828	54821	46202	78975	54121

Table 3.2 Continues

ŞANLIURFA	13771	97800	184679	201081	71908	35058	234313	198243	153131	92741
ŞIRNAK	3386	20865	40431	40650	11122	8670	66564	59084	57063	33827
TEKİRDAĞ	2195	10321	98009	132130	50030	41204	103601	85576	143200	99240
TOKAT	2243	10827	60485	84040	23372	20146	53059	43693	64433	46405
TRABZON	2777	21634	69552	89634	23908	18021	61719	51269	105157	82716
TUNCELİ	654	3563	6936	7254	2612	1994	5966	4288	13216	8237
UŞAK	887	4915	36630	49584	18501	15353	31523	25687	39929	31966
VAN	7179	42438	96708	109669	40964	22582	129748	101363	100970	62963
YALOVA	532	3203	20976	29942	7941	6540	21899	19073	33278	26746
YOZGAT	1949	11062	42590	59419	13557	12549	35978	29507	47402	30924
ZONGULDAK	2650	21308	60687	82694	26752	18281	46617	38609	74647	50930

CHAPTER FOUR
CONCLUSION

The aim of the study is to create thematic maps using GIS for distance education studies, which are accelerated with digital transformation, and to ensure that these maps support the decision-making process of the managers in the decision-making process. In this context, concepts were explained with literature studies and then thematic maps were produced and presented.

At the beginning of the study the word digital is defined as the combinations of 1s and 0s that come together to produce a meaningful result. In the most basic sense, the numerical processing and use of data in a system where data is transformed into information and information are transformed into knowledge has been called digital transformation.

In the age of information and communication, real-time information sharing can be made. It was emphasized that societies should improve themselves with this change. Especially in the 21st century, this rapid change and transformation have become noticeable and this process has been defined as the digital transformation process.

While this digital transformation manifests itself in all areas of life, it did not take place in the field of education, especially in the beginning. In a study done above, it was emphasized that it was a little late for digital transformation in the education system. With the changing world, business models are also changing, and it has been mentioned that the education of students should be organized with these systems, and this can be achieved with Education 4.0.

With Education 4.0, education can be realized independently of time and place. It has been emphasized that continuous learning can be realized creatively in all areas of life. It has been added that it will enable the development of skills such as digital literacy, communication, entrepreneurship, problem-solving, and global citizenship.

Education 4.0 is not only an education system but also issues such as critical analytical thinking, innovation, efficiency, knowledge sharing and career development.

The journey of industrial development from the 18th century to today's digital age is briefly mentioned as Industry 1.0, Industry 2.0, Industry 3.0 and finally Industry 4.0, that is, the digitalized world

A literature review has been conducted on digital transformation in education and several studies have been mentioned. In the field of education, some of the projects of MEB and YÖK institutions in the digital transformation process were mentioned.

The Covid 19 pandemic has affected every aspect of life, and in the field of education, a distance education system has been adopted. Along with this process, efforts to adapt the digital transformation process to the education system were initiated. In this study, distance education and its history are mentioned and with how a change has been experienced from the past to the present. In Turkey, during the Covid 19 period, the distance education process was tried to be adapted by MEB in basic education and by YÖK in higher education.

GIS is a system that connects geographic data with non-geographical data and enables these data to be displayed on maps. GIS supports data sharing, spatial thinking, visualization and learning. With GIS, data can be analyzed, updated, interpreted and managed. With this feature, GIS supports managers in the decision-making process.

With GIS, it can show school and student information with thematic maps, which provides various benefits. Unexpected situations can be noticed and intervened in thematic maps, better and more precise analyzes can be made when geographical factors are considered, it can increase the interest of the public, and it can be beneficial to creating planning and management scenarios.

Education Decision Support System provides relevant, accurate, reliable and real-time information to researchers, administrators, policy makers, education planners and

other data users. Educational decision support systems created with GIS are examined and explained.

Various institutions in Turkey have also created and used thematic maps using the GIS tool. In this study, the work of these institutions is mentioned and the maps they created are shown as examples.

In the last stage of the study, some educational information was mapped thematically in line with the statistical information obtained from TÜİK and YÖK. The purpose of creating these maps is to support the decision-making process of decision-makers with the analyses to be made from the maps created using GIS.

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