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Analysis of Education Management Information Systems of the Ministry of National Education in Terms of Interoperability*

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Abstract: This research, which aims to reveal the current state of the Ministry of National Education (MoNE) information systems in terms of interoperability, was carried out with the basic qualitative research design under the scope of qualitative research. The data that constituted the source of the research were collected from teachers, vice-principals and school principals working in public schools at high school level. Semi-structured interview forms were used as data collection tool. The obtained data were analyzed by content analysis method. As a result of the analysis, the findings were gathered under two themes as intra organizational and inter-organizational interoperability. The results of the research showed that the Ministry of National Education has some features in terms of both intra-organizational and inter-organizational interoperability, but it cannot fully use the opportunities arising from the use of the central Education Management Information System (EMIS), and accordingly, there are areas that need to be developed in both dimensions in terms of interoperability. In terms of in-house interoperability, suggestions have been made such as transferring the data in the Education Information Network (EBA) to e-school, moving more student data between education levels, and transferring the data expected from the management levels through information systems by making it pre-defined. In terms of inter-organizational interoperability, it is recommended that the MoNE information systems be made interoperable with the Ministry of Health, Higher Education Institution and Social Security Institution.

Keywords: Interoperability, education management information system, e-school, mebbis

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Introduction

Using information technology infrastructure for operational, administrative, or strategic purposes has been a necessity rather than a choice for some time. Information systems are utilized in both public and private organisations to manage important operations.The use of information systems in the field of education started in the mid-1980s. Though these systems were used primarily for transferring some administrative and managerial activities to the computer, their area of usage increased in the following years (Cassidy, 2006). Today, in education, information systems are used for various purposes, such as improving the processes of planning, distribution of resources, monitoring, policy development, and decision making (Unesco, 2008).

Education systems are compound structures that concern almost every part of the society and have a wide range of stakeholders. According to the Ministry of National Education (MoNE) statistics for 2019-2020 there are 18 million students enrolled in formal education in Turkey. These students receive education from over one million teachers in 68 thousand of schools (MEB Strategy Development Presidency, 2020). After other stakeholders such as parents of the students in the system, citizens enrolled in non-formal education, and people working in the education-based service sector are included in these numbers, a small group that doesn't intersect with the field of education will remain. In this respect, it is possible to say that the Ministry of National Education is the largest public institution in the country. In order to manage such a large structure that is constantly operating, many information systems are used.

E-School, Educational Informatics Network (EIN), Ministry of National Education Information Systems (MEBBIS), Document Management System (DMS), e-Course, Information Management System of Education Financing and Education Expenses in Turkey (TEFBIS) are some of them. A vast amount of data is produced in these systems operating continuously.

In order to benefit from the data efficiently and automate data exchange between external and internal systems, interoperable systems must be made (Ligon, Swafford and Clements, 2018). The following statements in the Vision 2023 document published by MoNE in 2018 clearly reveal that data cannot be utilized sufficiently and that the data cannot be correlated (MoNE, 2018).

> *"… first of all, the data that is constantly accumulating but cannot be processed in different information systems used by the Ministry will be correlated, and then data will be processed."*

In the relevant document, it is stated that in the future, the aim is to make all the decisions based on data and to switch to data-based management on a school basis.

For this, it has been emphasized that various and large amounts of data should be processed and correlated with each other, structured according to to constantly altering conditions, and meaningful in terms of cause and effect relationship (MoNE, 2018). To

achieve these goals, it can be said that the current situation should be revealed by reviewing the MoNE information systems in terms of interoperability, and necessary improvements should be made. The broadest definition of interoperability, which can be explained as the ability to use and transfer information between institutions and information systems, is effective information sharing (Information Society Department, 2012, p. 4).

In 2005, a framework for public institutions was presented with the "Interoperability Guidelines" published by the Information Society Department of the State Planning Organization. The mentioned guide was later updated in 2009 and 2012 (Information Society Department, 2012).Tthe guide created by examining similar reports abroad, aims to ensure interoperability between all institutions that provide services to the public in an electronic environment, especially public institutions. As a result of studies in this direction, many institutions affiliated with different ministries can exchange data with each other on e-government. For example, many institutions can benefit from the data by accessing the identity and address database kept within the Central Population Management System (MERNIS). In this way, the administrators of a primary school can automatically see the information of the students who have reached school age in their region. If the systems were not improved to work together, many data such as students' TR ID numbers, parent information, and address information would have to be kept separately within the Ministry of National Education system. It is clear that this situation will have many negative effects such as waste of resources, decrease in service quality, increase in costs, data duplication, and data inconsistencies. In institutions consisting of many sub-systems, such as the MoNE, data sharing between sub-systems of the institution is as important as inter-organizational data sharing. In order to improve the systems in this direction, it is necessary to ensure intra-organizational interoperability.

Education Management Information System (EMIS)

There is no complete clarity about what the information system is, what it does, and what features it should have (Alter, 2008; Paul, 2007). In simple terms, information systems can be defined as systems that collect, process, store, analyze and disseminate information for a specific purpose, mostly using computers (Rainer, Turban, & Potter, 2007). It is possible to name information systems according to their functions and areas of use, such as accounting, geographic, health, etc. The information systems used in the field of education are called "Education Management Information Systems (EMIS)". EMIS is an institutional service unit that produces, manages, and distributes educational data and information, usually within a national ministry or Ministry of Education (Hua and Herstein, 2003).

EMIS are comprehensive systems that bring together people, processes, and technology to provide education management with appropriate, accurate, useful, timely, and cost-effective information at all levels of administration (Bayrakci, 2007). According to another definition, EMIS are network systems that are established to provide information at different levels, places, and times to facilitate decision-making by education

administrators and include communication channels, information resources, computerized storage tools, and operation routines (Evans, 1970). Although the concept of "management" is emphasized in the definitions, EBYS are not only used for management activities. At the same time, they are integrated systems in which many data such as teacher and student information, evaluation processes, physical facilities related to schools, and educational activities at all levels of the education hierarchy are processed, analyzed, and shared (Hua and Herstein, 2003, p. 5). From this point of view, EMISs can be defined as integrated systems that span all levels of the education hierarchy, are used in operational, educational, and managerial activities, and facilitate effective decisions by education managers.

Interoperability

Data is an asset that can be used over and over, increasing in value as it is used rather than decreasing. When the data used by a system for a certain purpose come together with the data in other systems, it creates new values. Interoperability is enabling data originating from a context to be used by other systems as highly automated as possible (Rust and Bide, 2000). According to another definition, interoperability is the ability of two systems to understand each other and to use the functionality of each other (Chen, Doumeingts, & Vernadat, 2008). As it can be understood from the definitions for the two systems to be defined as interoperable systems, they should be able to exchange data as automatically as possible. Interoperability is generally considered in four sub-dimensions: *legal, technical, semantic,* and *organizational*. The legal dimension covers the work needed to ensure that organizations operating under different legal frameworks, policies, and strategies can work together. Applications such as investigating whether there are sectoral or geographical restrictions on the use and storage of data in different units in laws and determining the legal regulations that need to be made are related to the legal dimension of interoperability.

The technical dimension includes the creation of the necessary information infrastructure for the systems to work together, determining file standards and providing data security. *The semantic dimension* includes the studies made to produce common meanings for all systems using the data. Creating data dictionaries and setting metadata standards are activities aimed at improving semantic interoperability. *The organizational dimension* determines how institutions will use each other's functions by enabling cooperation between information systems at the institutional dimension ("New European Interoperability Framework", 2017). Considering all the processes covered by the dimension, it is possible to say that interoperability is a versatile concept that different disciplines should study. In this regard, interoperability is a product that can be developed through the coordinated efforts of specialists from numerous fields, including engineering, management organizations, business, law, and information technology. Moreover, due to the unique characteristics of each field, it is a field that requires different expertise.

Although data sharing between different organizations is highly emphasized in the definitions of interoperability, based on another classification made by Gasco (2012, p.

4), interoperability can be applied in four different ways:

1- Intra-Organizational Interoperability refers to the interoperability practices between different departments or units of a public institution.

2- Horizontal Interoperability refers to the interoperability practices between different public institutions at the same management dimension.

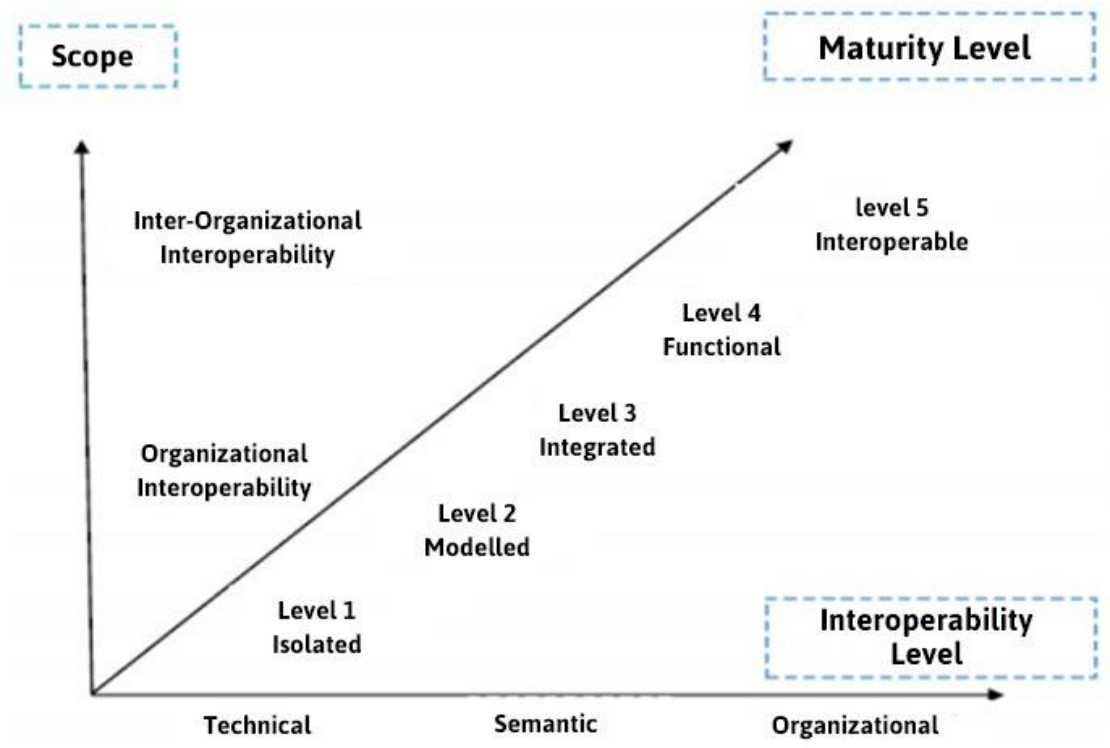
3- Vertical interoperability refers to the interoperability practices carried out between different dimensions of management in the public sector.

4- Regional or Crossborders Interoperability: It refers to the interoperability practices between public administrations of different countries.

In the study by Yazici and Ozdemirci (2019), an interoperability maturity model was created for electronic document management systems. In the study, which is one of the important researches in the field of interoperability in our country, electronic document management systems used in public are classified according to five maturity levels in technical, semantic, and organizational dimensions. In the model in Figure 1, the scope dimension of interoperability is considered as *institutional* and *inter-institutional* interoperability on the vertical axis. In this study, the interoperability of the MoNE information systems was evaluated in terms of the *scope dimension*.

Figure 1.

Structure of Electronic Recods Management Systems Interoperability Maturity Model (Yazici ve Ozdemirci, 2019, p. 91)



Data sharing between different units of an institution is mostly realized through *system/data* integration. However, the concept of interoperability should not be confused with integration. Although both are important for seamless data flow and collaboration, they are built on separate principles (Jakimoski, 2016). In a broad sense, interoperability means working with autonomy and independent working conditions; integration refers to coordination and integration of systems (Chen et al., 2008). While interoperability refers to the uninterrupted data exchange of systems while continuing to operate independently from each other, integrated systems work interdependently. The two integrated systems may inevitably work together; however, the two interoperable systems are not necessarily integrated (Chen and Doumeingts, 2003). It can be said that integration is a stronger connection than interoperability, but it is more possible to apply it in internal information systems. In the field of education, the integration of the information system where teacher data is kept and the information system where student data is kept can be achieved. However, these systems can be made interoperable instead of integrating the student information system and national health information systems. Although integration can achieve results that work in the short term, interoperability needs to be developed in order to create an education ecosystem that meets the needs in the long term (Campbell, 2019). According to Campbell (2019), one of the most important features that distinguish interoperability from integration is based on standards. Systems are built according to predefined standards, enabling them to speak a common language. In this way, new systems to be developed can easily exchange data with previous ones. In summary, although certain benefits are obtained with integrated systems, information systems need to be strengthened in terms of interoperability in order to create a sustainable system that is open to development.

Education and Interoperability

Studies in the fields of educational data mining and learning analytics, which form the basis of artificial intelligence applications in education (Baker & Inventado, 2014; Lemay, Baek & Doleck, 2021; Whitelock-Wainwright, Tsai, Drachsler, Scheffel & Gašević, 2021; Zhang & Aslan, 2021) and the value of educational data are increasing day by day. Educational data mining is the use of statistical methods, machine learning and data mining algorithms on different types of educational data to seek answers to educational research questions (Romero & Ventura, 2010). Learning analytics, on the other hand, is the measurement, collection, analysis and reporting of data about students and the educational environment in order to understand and optimize learning and their environments (Phil Long & Siemens, 2011).

While with educational data mining, macro decisions, mostly at the institutional level are analyzed, with learning analytics, micro-level analyzes are made to improve the learning environment. Educational data mining focuses on areas such as proper management of resources, providing decision support to managers, and making institutional and regional comparisons. On the other hand, learning analytics supports educators in improving education quality and contributes to the implementation of individualized teaching methods (Phil Long and Siemens, 2011). The success of both application fields

depends on the richness and diversity of data sources. One of the things that need to be done to achieve this is to make EMIS interoperable. The lack of data interoperability between different data systems poses a challenge for data mining and data analytics based on diverse and distributed data (Bienkowski, Feng, & Means, 2014).

With interoperability, the benefit obtained from data can be increased and the operation processes can be executed properly. In countries with no central education management information system, interoperability protocols are needed to transfer data in a healthy way when students are transferred from one institution to another or from one region to another. Within this context, various frameworks developed by states and private organizations are used for this purpose. CEDS (Common Education Data Standards) is a set of standards covering the entire educational process from pre-school, and formal education to graduation, aimed at ensuring the interoperability of schools. The aim of CEDS, developed by the US Department of Education is to carry out seamless student transfers between states and regions. In addition, it has been tried to ensure that new EMIS developed by the public and private sectors based on CEDS can seamlessly exchange data with existing systems (CEDS, 2020).

SIF (School Interoperability Framework) is another open-source interoperability framework developed by a volunteer organization. With SIF the aim is to ensure data sharing and interoperability of educational institutions at K12 level. It is used in England, Australia, New Zealand, and North America (Access 4 Learning Community, 2016). Ed-Fi data standard developed by a private organization for similar purposes is defined as a set of rules that allow multiple systems to share their information in a seamless and actionable way for the collection, management, and organization of training data (Ed-Fi, 2019). Ed-Fi is not only a system used for data integration but also provides solutions to ensure data security and privacy and data warehouses where data from different data sources are brought together (Miller and Cairy, 2015). When the definitions and purposes of use of these systems are examined, it is seen that they mostly aim to provide internal or external data exchange between EMIS. However, as mentioned earlier, interoperability also includes data sharing with other public institutions.

According to the report (Collins, Fruth, Sessa, & Laird, 2007) published by the Data Quality Campaign in the USA, the benefits of improving interoperability in education are:

- **Reducing the data entry burden of school personnel**: With interoperable systems, data is entered into the system only once and can be shared with schools, districts, and other units when necessary.
- **Reducing response time**: Delays in data sharing can reduce the benefit of data. In interoperable systems, when diagnostic data that requires intervention about a student is entered into the system, it can be instantly shared with the relevant people.
- **Improving data quality:** Whenever someone has to enter data manually, there is

a risk of error. Similar risks arise when manually moving data between systems. Interoperable systems automate data exchanges that significantly reduce the chance of errors.

- **Supporting data-driven decision-making:** Good decisions require timely and accurate data. All decision-makers benefit when interoperable systems provide higher quality data faster.

Although various studies have been conducted in the field of interoperability in our country (Eroglu, Cakmak and Kulcu, 2016; Gokkurt and Demirtel, 2017; Gurlenen, 2014; Yazici and Ozdemirci, 2019), no study in this direction has been found specific to Ministry of National Education. It is thought that examining the MoNE information systems in terms of interoperability, revealing the current situation, and investigating what improvements can be made in the system will contribute to achieving the goals mentioned above in the Vision 2023 document. In this direction, the problem sentence of the research is determined as "How are the information systems of MoNE in terms of interoperability?".

Methodology

The study was carried out using qualitative research methods. As stated by Maanen, qualitative research is an umbrella term. It is a set of processes that include techniques that try to define, solve, interpret and reach terms related to meaning (cited in: Merriam, 2018, p. 13). In the research basic qualitative research, which is the most common type used in the fields of education, management, health, social service, consultancy, and business was used. Basic qualitative research designs are those that use the qualitative research paradigm but do not include any of the additional dimensions (narrative, case study, ethnography, phenomenology, grounded theory) that other qualitative research approaches focus on.Similar to other research, these researches also focus on how people make sense of their own lives and experiences (Merriam, 2018). In this study, the basic qualitative research design was preferred since the aim is to reveal the current state of the MoNE information systems in terms of interoperability depending on the experiences and usage processes of the participants.

Participants

The data that constituted the source of the research was collected through semi-structured interviews from the participant group consisting of teachers, assistant principals, and school principals working in 9 high school schools in Sisli, Besiktas, and Kagithane districts of Istanbul. The interviews were held between May and October 2021. In the research, the theory-based sampling method, which is one of the purposive sampling methods used in qualitative research, was used. In theory-based sampling, data collection continues until the stage (saturation point) when the concepts, structures, and processes that may be the answer to the research question start to repeat (West,

2006). In theory-based sampling, the researcher does not initially know about the sample size (Yildirim & Simsek, 2013). This method can be used in cases where no strong theoretical framework can allow sampling with certain limits beforehand (Baltaci, 2018). Given the difficulty of collecting data from a large number of participants due to the qualitative nature of the study, the participants were selected from high school teachers, assistant principals, and principals employed by the Ministry of National Education.Because the diversity of schools is higher in high schools compared to primary education, the transfer processes are more complex and one of the researchers works as a high school teacher has effectively limited the research to high schools.

Of the participants whose opinions were consulted in the study, 11 are teachers (6 men, 5 women), 5 are assistant principals (all men), and 6 are school principals (5 men, 1 woman). 14 of the participants work in Vocational and Technical Anatolian High Schools, and 8 of them work in Anatolian High Schools. Since the principals and assistant principals working in vocational high schools are mostly male, the gender distribution of the participants could not be achieved. Demographic information of the participants is given in Table 1.

Table 1.

Demographic Information of the Participants

Code	Sex	Age	Seniority year	Job	Branch
MD01	Man	45	20	School Principal	Metal Technologies
MD02	Man	45	20	School Principal	Electrical & Electric Technologies
MD03	Man	48	25	School Principal	Moto Vehicle Technologies
MD04	Man	38	14	School Principal	Guidance
MD05	Woman	45	22	School Principal	Biology
MD06	Man	51	32	School Principal	Mathematics
MY01	Man	32	8	Vice-Principal	Biology
MY02	Man	33	10	Vice-Principal	Chemistry
MY03	Man	39	16	Vice-Principal	Electrical & Electric Technologies
MY04	Man	42	17	Vice-Principal	Information Technologies
MY05	Man	45	22	Vice-Principal	Electrical & Electric Technologies
OGR01	Man	38	11	Teacher	Information Technologies
OGR02	Man	31	6	Teacher	Information Technologies
OGR03	Man	35	9	Teacher	Information Technologies
OGR04	Man	40	17	Teacher	Information Technologies
OGR05	Man	35	13	Teacher	Information Technologies
OGR06	Woman	44	20	Teacher	Information Technologies
OGR07	Man	43	17	Teacher	Information Technologies
OGR08	Woman	32	9	Teacher	Turkish Language and Literature
OGR09	Woman	43	9	Teacher	Turkish Language and Literature
OGR10	Woman	37	13	Teacher	Mathematics
OGR11	Woman	33	9	Teacher	Mathematics

Data Resources

In the research, semi-structured interview forms consisting of open-ended questions were used, in which the participants could express their opinions freely. This was because the study aimed to identify transactions related to interoperability among the transactions that the participants routinely performed while using the MoNE information systems. Although semi-structured interviews are conducted using pre-prepared questions, they help open the subject with different questions during the interview, reveal different aspects of the subject, and reach new ideas about the subject (Merriam, 2018). This flexibility provided to the researcher allows for an in-depth investigation of the subject. In this respect, it has been decided that semi-structured interview forms are the most appropriate data collection tool for the research. The research used two data collection tools: the teacher interview form and administrator interview form. For the interview forms, opinions were received from an educational technologies expert, an assessment and evaluation expert, and a data science expert. Pilot interviews were conducted with a teacher, a vice principal, and a school principal using draft interview forms created in line with expert opinions. After the interviews were finalized, the interview forms were used as a data collection tool.

Data Collection Process and Role of the Researcher

Since the data that led to the research were collected under the COVID 19 pandemic, seven of the interviews were conducted online and 15 face-to-face. *Probe*questions w ere frequently used by the researcher during the interviews. Probe questions are not included in the interview forms; they appear randomly during the interview; they are used to enable the participant to open their answers and gather more information (Merriam, 2018, p. 98). Depending on the interview flow, changes were made in the order of the questions from time to time. During the interviews, with the participants' permission, audio recordings were taken in face-to-face interviews, and audio and video recordings were taken in online interviews. At the end of each interview, the researcher transcribed the audio recording of the interview and made ready for analysis.

Data Analysis

The data collected within the scope of the research were analyzed by the content analysis method. According to Shannon (2005), there are three different types of content analysis. These are conventional content analysis, directed content analysis, and summative content analysis. Directed analysis occurs when the analysis is started with initial codes based on the theoretical framework. In conventional analysis, codes are derived directly from data. The last type, called summative content analysis, is for counting and comparing certain keywords and codes produced. As mentioned earlier, interoperability is a complex process that is used in all sectors and has many sub-dimensions and classifications. Additionally, when the existing interoperability frameworks in the field of education are examined, it is seen that they have been developed for countries where

central EMIS is not used. In Turkey, all information systems used within MoNE are developed and used centrally. For these reasons, while coding the research data, initial codes based on the theoretical framework were not applied, and the codes were obtained directly from the data. In this respect, it is possible to say that the data analysis method used in the research is conventional data analysis according to Shannon's (2005) classification. Due to the iterative nature of the analysis process of qualitative research, the previous codes, categories, and themes were reviewed repeatedly at each stage and prepared for the presentation of the findings. The coding process was carried out using the NVIVO 11 program in a computer environment.

Credibility and Ethics

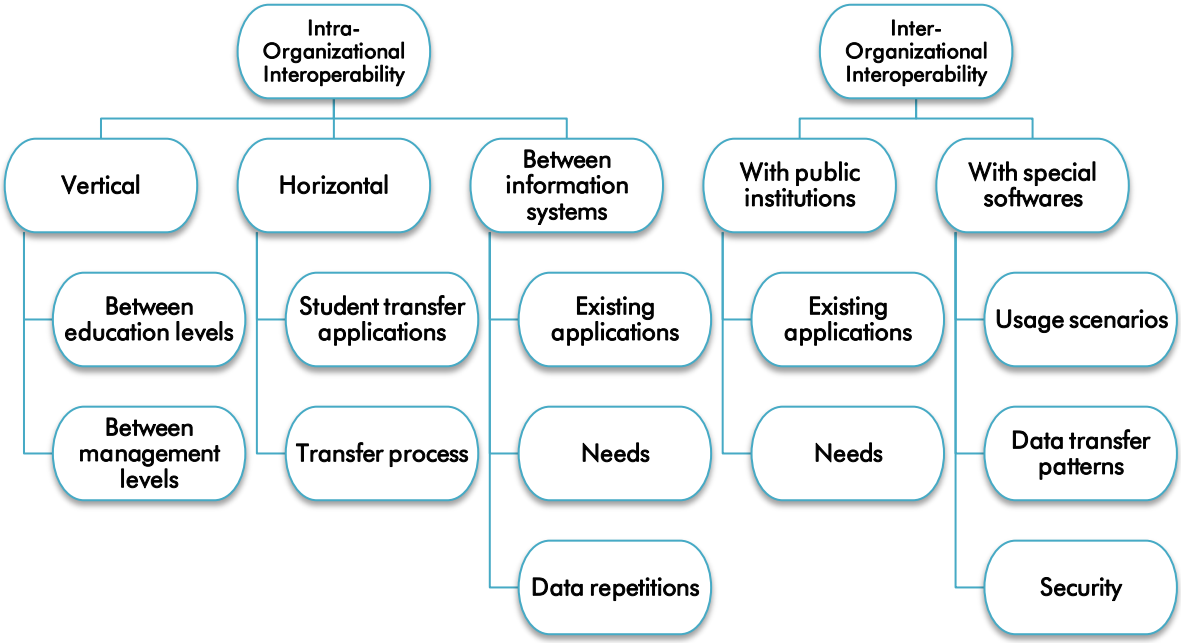
Various methods are used to ensure credibility in qualitative research. According to Creswell and Miller (2010), one of these methods is to explain in detail the number and characteristics of the participants, how they were selected, and the data collection tools and analysis techniques used in the research. In the methodology section of the research, this information was given in detail to increase its credibility. In qualitative research, the presentation of the findings and the determination of the examples to be transferred from the participants' views can be affected by the subjective choices of the researchers due to the nature of the research paradigm (Merriam, 2018). In order to minimize this effect and to allow readers to evaluate it, a simple transmission was preferred. In this direction, the findings were presented by giving examples from the participants' views rather than comments. To ensure the reliability of the research findings, the collected data were coded separately by both researchers, and then the similarity ratio between the coders was calculated. The agreement between encoders calculated according to the Miles and Huberman (1994) formula was 0.89. Before the study, the Istanbul University-Cerrahpasa institution obtained ethics committee approval. Before the interview, all participants signed a consent form. To protect the confidentiality of the identity information of the participants, anonymization was utilized. The participants who were school principals were coded with the prefix MD, teachers with OGR, and assistant principals with MY.

Findings

As a result of the content analysis, two themes were founded: Internal Interoperability and External Interoperability. Sub-themes and categories of these themes are visualized in Figure 2. Existing definitions and classifications of interoperability were examined while determining themes, sub-themes, and categories. Since interoperability is an interdisciplinary concept applied in all sectors, and studies conducted abroad specific to education focused on the transfer of student data and the interoperability of schools in countries where the central EMIS is not used, themes and categories that overlap with the existing literature could not be determined.

Figure 2.

Themes, Sub-themes, and Categories of the Study



Findings on the Themes of Intra-Organizational and Inter-Organizational Interoperability

Three sub-themes, namely Vertical, Horizontal, and Between Information Systems, were created under the Intra-Organizational Interoperability theme. The aim was to explain the data exchange between the vertical sub-theme and the units that are in a hierarchical relationship. The horizontal sub-theme was used to explain the data transfer processes that occur during the transfer of students to other schools. With the sub-theme Between Information Systems, the data exchange processes of the sub-information systems within MoNE were tried to be explained. The participants' opinions in each category of the sub-themes of the Intra-Organizational Interoperability theme are presented below.

Vertical. Under this sub-theme, two categories were created. These are Between Education Levels and Between Management Levels. With the "Between Education Levels" category, the data transfer processes that occur when students pass from any education level to the next level of education are coded. Since the participants worked at the high school level, opinions were gathered around the state of the student data transferred from secondary school to high school. Some of the participant opinions in this category are as follows:

> A teacher who gives the 9th-grade lesson at the beginning of the year can see the student's demographic information, where he lives, the income status of his family, if they are entered into the system in primary school. He or she cannot see the grades, but he or she can see information

> that cannot be altered, such as census data. Changeable data is reset. (MY01)No, we can't access any of them. Most of the time, we can't even access secondary school diploma grades after a certain period of time. This is a big shortcoming. The data is not transferred when the student moves to a higher education institution. The diploma grade is transferred at first, you can access it later if you have saved it as an experienced administrator. You cannot access it through the system if you have not saved it. For example, in secondary school, student's painting lesson is very good but we can't see it. From the e-school system, we cannot see what is bad and what is good in previous learning and acquisitions. (MD01)
>
> I can't access any information. We can't access the secondary school part. We can only see the school he came from. After the transfer process of the students, this information can't be seen either. (MD03)
>
> When the student is transferred, we only see the secondary school success grade. We can't see this whenever we want. When the student is recorded into the school's system, the grade point average can be seen, but when we want to look back later, we cannot see it. There is also a student file. It also includes demographic features, but it is timely filled and out of date(MD05).

It is understood that some data, such as identity information, demographic information, socioeconomic status are transferred while students pass from secondary school to high school. Some of this information is transferred automatically via MERNIS, and some are filled in manually. According to the participant's opinion with the code MD05, the data filled in manually is out of date. Other participants expressed their opinion in this direction (MD03, FY04). Participants generally find the data transferred from secondary school to high school insufficient. In particular, they see the lack of transfer of academic data and data on extra-curricular activities as a deficiency. The views of the participant with code MD04 on this subject are as follows:

> It goes like this. First we see the list around July. We can't find any information about that child in July. Only name, surname, t.r. identity number is given in the list. When parents come for registration, we are gradually activating their registration. When we activate it, we can still see only the notes from one, two, or three years ago. We can see the absences in the past years. We can see if there is a need for inclusion or special education. We cannot find any other information. We choose a year, for example, you say 2018-2019 second semester, and the grades appear. You can only see the grades for that period. For example, if you look at absenteeism, you see the complete absence of a year, and you can see the report card. Like this, we can only see their academic information. We do not have any retrospective information other than their academic information. (MD04)

In the "Between Administration Levels" category, which is another category in the vertical sub-theme, the opinions about the data transfer processes between the school and administrative units such as the District Directorate of National Education, the Provincial Directorate of National Education, and the Ministry were coded. Some of the participant opinions in this category are as follows:

> In general, they may request statistical information such as the total number of students, the number of class branches or the number of students in the class. (MY02)
>
> In general, the district national education directorate and provincial directorate of national education also request the data in e-schools from us. They don't take the data from there. They either can't see or don't know how to use the system, I don't know, but they always ask for some information. For example, how many orphan students are there? In e-school, this is obvious. For

> example, the number of children with 3 siblings is obvious there. For example, they ask for those with a sibling at school age. These questions increase our workload. (FY04)

> Statistics are often requested. The number of students left in the class. Statistics such as the number of successful students are requested, but they are all there. You can see it in the report section of e-school. This is what happens in general. Inclusion student numbers can be requested. But these are mostly available in e-school, as I said. This issue brings us an extra workload. (MD03)

Participants stated that senior management units usually request statistical data from schools. Although most of them are registered in the e-school management information system, they are asked still asked about the data. They see this as a chore for them and state that it causes disruptions in their workflow. The participant with the code MD06 expresses this situation as follows:

> This is a dynamic institution. Let's say we made a plan the night before, or let's say we made a one-week plan; our plans definitely don't fit. Let's say we're going to discuss norm squads with friends today. Suddenly we receive a letter with an urgent reply. They ask for statistical information. I get that information from e-school. If I can get it, you can too. Sometimes we click a menu and get it directly, sometimes, we need to collect the requested data from separate places one by one. The other day, for example, they asked for the number of students who graduated in the last 3 years. We looked it up from the e-school, it's a relatively easy thing. But if I can see it, why can't you? (MD06)

It has been stated that the same data is recorded into more than one information system, and accordingly, data repetitions occur. The views of the participant with the code MD04 on this subject are as follows:

> Let me tell you from our point of view. If I consider the incident as a school counselor, for example, the child has a report. This report is recorded into the Mebbis, but at the same time, it is recorded into the e-school. There is not much information about the grades of the child. Especially the information about absenteeism is both recorded in e-school and periodically sent to the district national education directorate in excel format. Sometimes data is sent too late and sometimes there are data repetitions. There are also times when we share the same data multiple times, creating a structure where healthy results cannot be drawn. Afterwards, a system emerges where corrections are made after seeing the mistakes and saying oh, so it is like this. (MD04)

It has been observed that the data flow in the MoNE is generally bottom-up, and only requests are transmitted from top to bottom. It has been stated that data requests are delivered to schools via DMS (Document Management System), and no feedback is provided to schools regarding the collected data. The view of the participant with the code MD06 is as follows:

> There's also this, we filled out a form recently. It was about the performances of the project schools in a year. We filled out information such as how many projects you participated in, Erasmus projects, TUBITAK's projects other than 4006 (they don't count it as a project), whether there is a school quality certificate, etc. This information goes directly to Ankara, but as a result of the data provided, there is no reply to us from there. (MD06)

Horizontal. The purpose of this subtheme was to explain how the transfer of students between schools occurred and what obstacles were encountered.. It consists of two categories. In the Transfer Applications category, the participants' opinions about how the transfer applications were received were coded. In the Transfer Process Category,

opinions on how the transactions were carried out after the application stage were coded.

> There are two types of transfer. Previously, it was only from school to school. The student's parents gave a petition for it. However, with the introduction of e-government, the parent can connect to the e-school via e-government and request a transfer without coming here. We only accept the transfer if the child deserves it. (MY04)

As stated by the participant with the code MY04, in the past, parents had to submit a printed petition to the school for transfer applications, but today they can apply for transfer for their children by logging in via e-government. Parents can apply for the transfer of their children by logging into the service titled "MoNE Student Transfer Procedure" under the title Ministry of National Education via e-government.

Participants expressed their satisfaction with the fact that transfer applications and transactions are made automatically through information systems. However, they stated that they had some problems. How the process works and the problems experienced in this process are coded under the Transfer Process category. The administrators can see the applications on the e-school EMIS, and the transfer takes place after the approval process. Transfer processes are finalized with the decision of a commission established within the school. The participant with the code MD05 mentioned the dysfunction of the transfer commissions.

> As the transfer committee, we have to accept the student, but there is an ambiguity about why the commission convenes about the student they don't know. We have to accept the student seen in the system. (MD05)

It has been observed that there are problems related to field and branch differences during student transfers in vocational and technical education institutions. In the current system, students choose their field of the profession at the end of the 9th grade, and in the 10th grade, they take courses on basic professional knowledge related to their field. According to the regulation, students can apply for transfer until the end of the 1st semester. Since the courses shown in the fields do not overlap, it was stated that the background of the students who changed their fields in the middle or at the end of the term was insufficient for the field they transferred. In addition, students who transfer in the middle of the semester must take the exams they missed to form their semester grades. In this case, students receive education with a new curriculum in a short time and take the exam. The views of the participant coded MD01 are as follows:

> There may be inconsistencies between the system the student comes from and the system in our school. This is how we solve them. In fact, the biggest problem here is that especially students who receive field education can change fields until the end of the 10th grade. For example, when the student transfers at the end of December, he can go to another field. We know that the coursework is mostly completed by the end of December. However, when the child is transferred, there may be cases where he did not take the courses he should have taken for a semester before, or even took other field courses. In this case, an attempt is made to ensure the equivalence of the courses he took and the courses he did not take by a commission. Or in a very limited time, from the beginning of January to the time of the report card, the student must be educated and assessed in these areas, and there should be an exam grade. This is not very healthy in terms of education. Therefore, I think that the field transfers towards December in the 10th class are not healthy. (MD01)

It was seen that the differences in elective courses caused another problem that arose during the transfers. The participants stated that the elective course that the student took in his previous school was not available in his new school, and that he had problems with assessment and evaluation. In addition, it was stated that the courses were not automatically matched, the transfer commission made a manual matching, and accordingly, the unity of practice could not be achieved. The opinions of the participants on these issues are as follows:

> In the elective courses section, it is as follows. Let's say in the first semester, the child takes a class about preparing a project. In my school, if there is no project preparation course at that time, the child takes another course in the second semester. Elective courses of schools are not compatible with each other. If the schools do not pay attention, the student take the same class again. There is something for that too. You look at the elective courses one by one while describing them. What courses have this student taken before? The system has such vulnerabilities if not taken care of. (MD05)

> Course pairings are not made automatically during transfers. The differences between the courses are usually due to the elective courses. If a school chooses a course, the school to which the student transfers can choose another course. We encounter this situation frequently. In this type of situation, you have to assign the new lesson to the student again. If he has received a grade about the course he has taken, it is not entered into the system. It can be entered if the commission decides. But if the teacher says that I will re-evaluate, I will make an exam; there is no strict rule there. It depends on the decision of the commission. Since it is done by the commission, there may be differences in practice from school to school at this point. (MD01)

Although all of the transfers are made via e-school EMIS, it has been observed that there are deficiencies in the transferred data, and some data are transferred via correspondence. Some participants expressed insufficient transferred data (MD02, MD03, MD05). Some of the views on this issue are as follows:

> For example, the inclusive student wants to transfer, but the inclusion information comes later. I think these should be transmitted through the system... On the screen about the transfer, we only see the school the child came from, the grade level, and the courses they are responsible for. (MD05)

> For example, when he goes from school A to school B, I can see the student's exams, but when he goes there, I can't see anything else. In other words, we cannot see the grades entered in the previous school of the transfer student. We request it by official letter. Because when we see that the notes are not entered into the system, we request them and enter them after they arrive. There is such a disconnection during the transfer. Each school can see its own grades. (MD03)

Between Information Systems. With this sub-theme, the interoperability processes between e-school and other information systems within the MoNE were explained in line with the participants' views. Opinions on the information systems sub-theme were coded in three categories: Applications, Needs, and Data Repetitions.

The existing interoperability applications between e-school and other information systems were coded in the Existing Applications category according to participant opinions. It has been seen that the information system with which e-school exchanges the most data is MEBBIS. It is thought that this situation arises because MEBBIS consists of many sub-modules as a roof information system.

Data such as personal information about teachers, assignment information, in-service training information are kept on MEBBIS. It has been stated that the information of the permanent teachers working in the schools transferred to the e-school via MEBBIS and assigned to the classes. After the paid teachers are added to the e-school manually by the school principal, the relevant transactions can be performed. After this stage, paid teachers can also connect to MEBBIS and EBA as teachers and carry out their work and transactions. The views of the participant with the code MD04 on this issue are as follows:

> In my opinion, the best thing about e-school is that it automates things. A new teacher is appointed to the school and his/her information comes from MEBBIS instantly. You don't bother to add it to the e-school separately... If a paid teacher is assigned, we add it from the e-school once, and then he/she can do everything like a permanent teacher. He/she logs into EBA and MEBBIS, applies for exams. (MD04)

E-guidance is a module within MEBBIS, used by RAMs (Guidance Research Center). It was stated that the status of the inclusive students was determined by the RAMs and transferred to the e-school automatically after they were processed into the e-guidance module. However, it was stated that teachers or school administrators had to make correspondence in order to notify the RAM of the changes in the student's current status (MY01).

In the category of needs, the participants' opinions stating that they see insufficient or incomplete data exchange with other internal information systems of the MoNE were coded. Participants stated that there is a one-way data flow with EBA, therefore EBA cannot be utilized sufficiently. The opinions of the participants on this subject are as follows:

> I think EBA is a very good system. There we can see what the student is doing daily, give time-limited homework, and see if they have done it or not. We understood its benefits better during the distance education period. But I can't see anything about EBA in e-school. When I grade the student, I only see the grades given by me and the grades given by other teachers. I think it would be more efficient if we could see the child's activities in EBA. (OGR04)

> Student lists are automatically sent to EBA. I see the students in my class if the administration makes an assignment. But the activities of the children there are not transferred to the e-school. I think this is a shortcoming. (OGR07)

In the Data Repetitions category, the participants' opinions about the situations where the same data was entered into more than one information system were coded. Participants stated that some data had to be entered both in the e-school and in different systems, resulting in data repetitions and inconsistencies. Some of the views on this issue are as follows:

> Let me tell you from our point of view if I consider the incident as a school counselor, for example, the child has a report. This report is recorded into Mebbis, but at the same time, it is recorded into the e-school. (MD04)

> It is not about the student, but about the general statistical data of the school. For example, we entered the promotional data of the school to e-school. We entered information such as how many classrooms there are in the school, how many libraries, laboratories or computers there are. We need to enter this into our MEBBIS as well. In this way, there can be repeated entries. (MD03)

> The Ministry of National Education uses many platforms. There is Mebbis, there is e-guidance, there is data we share through a portal we call the DMS (document management) system, and there are separate platforms where we log in for guidance work. There are also separate systems of Provincial directorates of national education systems; for example, we have ISTMEM, anket.meb.gov.tr (survey.meb.gov.tr). There is also something about BILSEM called e-itiraz.meb.gov.tr. So there are 50 platforms, and we have to enter data for each of them separately. We have to enter a report. We have to monitor each and every one of them individually related to the work we or others have done. All of these are used for different purposes, of course, but there are many cases where we enter the same data repeatedly. Sometimes the data we enter in one place and the data in the other place do not match, we have to think about which one is correct. (MD02)

Findings on the Theme of Inter-Organizational Interoperability

Two sub-themes, namely with Public Institutions and Private Software, were formed under the theme of Inter-Organizational Interoperability. With the sub-theme of Public Institutions, the data sharing processes of the MoNE with other public institutions were tried to be explained. In the sub-theme of Special Systems, the data sharing processes of MoNE information systems with third party software used in schools and prepared by private institutions were explained. The participants' opinions in each category belonging to the sub-themes of the Inter-Organizational Interoperability theme are presented below.

With Public Institutions. With this sub-theme of Inter-Organizational Interoperability, the interoperability practices between MoNE and public institutions affiliated with other ministries were tried to be explained. Opinions on this sub-theme were coded into two categories: Current Practices and Needs.

In the Existing Applications category, opinions about public institutions with which data is currently shared are coded. Participants stated that data is transferred to e-school only via MERNIS. Some of the opinions in this category are as follows:

> Some basic information about the students comes automatically through Mernis. This is a relief for us. For example, we see the student's parent information. Sometimes it is a student whose parent has passed away. When we press the update button on the system, we see it directly in the e-school. (MY03)

> I don't know if there is a transfer other than that; the credentials come from Mernis. (OGR04)

In the needs category, the participants' opinions about the public institutions that need to share data were coded. Participants stated that it would be beneficial to transfer some data from the E-Pulse system, Higher Education Institution, and Social Security Institution affiliated to the Ministry of Health to e-school. Some of the views on this issue are as follows:

> Health information is available if the administration enters it. It depends on the student's statement. E-school is not integrated into the health system. When students receive a report, they bring it by hand, and we do not have a chance to control it. It would be a very productive development if student reports were automatically displayed on the e-school screen in an integrated manner with the e-pulse system. (MD01)

We cannot see the health report he received in the past. Health reports should be integrated with the e-pulse system. We come across a lot of fake reports. (MY03)

But, for example, it can be diabetes or many other diseases. Since these are again dependent on the parent's statement, we cannot receive proper data. There is no link with the e-pulse system. It would be healthier if there were and if the data were directly extracted from there. In this way, the margin of error can be reduced. (OGR06)

We also look at the university placement status of our graduate students. We look at this information from the university system, not from the e-school. CoHE has a system called kikis; when we open it, we can see which student entered which university. We can't see it in e-school. But we cannot compare it with other schools. However, we can compare it with mutual negotiations. (MD03)

Information such as which university the graduate student attended and what happened after the university can be continued, and their records can be kept. (OGR10)

A system called e-graduate was created. But it was never fully realized. I generally do this. I try to follow the students I can find on LinkedIn. This makes the interaction limited to those who use that platform. If the child uses a social media account, we can follow them there. There is no other system. In fact, if it is an integrated structure with the SSIs (Social Security Institution) system. It would be healthier if the information about whether the graduate got a job or not and which company he was in would come from there. This problem can be solved by integrating with other institutions of the state. (OGR04)

With Special Software. The participants' opinions about the software developed by private companies that they use or need while carrying out their business and transactions were explained with this sub-theme. Participant opinions were coded under the categories of Usage Scenarios, Data Transfer Patterns, and Security.

It has been seen that there is a need to use special software for various purposes in schools. Participants stated that they use special software to send absentee messages to parents, carry out procedures related to SSI in vocational high schools, prepare lesson programs, and prepare programs for joint exams and responsibility exams. Some of the opinions of the participants in the Usage Scenarios category are as follows:

Some schools report absence on a daily basis, they do it through a separate system, or there are limits set in the regulation, such as when absence is 5 days, 10 days, 15 days, 25 days. A message is sent when the student reaches these limits. These systems do not have an automatic relationship with the e-school; they are manually entered into the message system after we receive the absentee letters. (MD01)

After the absences are received from the e-school in insurance transactions, these absences are entered into the e-declaration (e-bildirge) system of SSI. Accordingly, students' insurance fees are formed. There are intermediary programs for this job; you can export the data as xml and load it. (MD03)

We do the general curriculum with third-party programs. If such a system exists on the e-school, we can run it without the need for a different program. You know, there are procedures for additional lessons. For this, just as we enter the student's absenteeism in the e-school, we can also enter the teacher's, and the additional course can be calculated accordingly. It can be done without the need for a separate program. (MD05)

> We use a program like BILSA to make a course schedule. We also have to use 3rd party software for responsibility exam programs. (MY02)

Under the Data Transfer Types category, the opinions of the participants about the methods they use when transferring data between private software and e-school were coded. Participants stated that they mostly use the report screen to export e-school data. Data displayed as reports can be exported in XLSX, DOCX or PDF format. One participant (MD01) said he exported the data in XML format and uploaded it to the middleware. Except for this example, no application with automatic data transfer has been encountered, and opinions have been reported stating that the transactions are mostly done manually. Some of the participants' views on this issue are as follows:

> After the absences are received from the e-school in insurance transactions, these absences are entered into the e-declaration system of SSI. Accordingly, students' insurance fees are formed. There are intermediary programs for this job; you can export the data as xml and load it. (MD01)

> We run most of the processes manually. For example, we make the lesson plans in another program; then we manually enter them into the e-school. It bothers us a lot. (MY05)

> Ogrenci devamsizliklari belli bir siniri gectiginde mektup gondermek gerekiyor. Biz veliye mektup gondermek yerine mesaj sistemiyle bilgi veriyoruz. Devamsizliklari hem e-okula hem oraya girmemiz gerekiyor. Veliler e-okulun devamsizlik bilgilendirme servisine abone olup ogrencilerinin devamsizliklarini anlik olarak ogrenebiliyorlar ama tum veliler bu sisteme abone olmuyor. (MD04)

> When student absenteeism exceeds a certain limit, it is necessary to send a letter. Instead of sending a letter to the parent, we provide information via the message system. We need to enter absenteeism both in e-school and there. Parents can subscribe to the e-school's absenteeism information service and learn about their students' absenteeism instantly, but not all parents subscribe to this system. (MD04)

Under the security category, the opinions of the participants about the data security risks while using special software were coded. It has been observed that there is a greater need for third-party software in order to carry out internships in Vocational and Technical Anatolian High Schools. In some institutions, it has been observed that e-school user information is entered into the intermediary program so that the data in the e-school can be automatically transferred to special software during these processes. Due to this situation, it is thought that there is a vulnerability issue regarding data security. Some of the participants' views on this issue are as follows:

> There is no software blocking in the background regarding this, data is retrieved by entering passwords to intermediary programs. (MD03)

> We do not know if the intermediary programs receive other data in the background when they access e-school data for the process of students' insurance. These are not normally legal, but this should be protected via softwares. (MD01)

> We have to do some operations with special programs. You will either add the student lists to the program one by one manually or enter the passwords into the program if you want them to be transferred automatically. Is it risky? I think it's risky. But National Education should not compel us to do this. Either they need to make all our work from e-school or increase security in these processes. (MD03)

Conclusion and Discussion

The research findings are grouped under two themes: Intra-Organizational Interoperability and Inter-Organizational Interoperability. Although the themes created are similar to the dimensions of interoperability in Gasco's (2012) classification, it is not possible to say that they overlap exactly. Horizontal and vertical interoperability dimensions in the mentioned classification are considered sub-themes of the intra-organizational interoperability theme. Since central EBYS are used in our country, and there is no cross-border data sharing, no findings regarding regional and cross-border interoperability could be obtained. Since Gasco's classification is not an education-specific classification, the emergence of these differences is considered normal.

With the vertical sub-dimension of the Intra-Organizational Interoperability theme, it has been researched how and at what level the data is transferred vertically between management levels and education levels. With the Data Quality Campaign project carried out in the USA, studies are carried out to increase the quality of education data throughout the country and how to benefit from the collected data. In the report published by the organization in 2007 (Collins et al., 2007), it was stated that the right data in the field of education should be delivered to the right people at the right time. For this, it was stated that the data should be transferred horizontally and vertically, without the need for manual intervention, by strengthening interoperability. The findings of the category between education levels showed that the data transferred from primary education to secondary education is insufficient. It can be said that the use of central EMIS facilitates the vertical mobility of data. As a matter of fact, it has been observed that some of the data (identity information, demographic information, socioeconomic status, photo, etc.) of the students entered in primary education are transferred to secondary education. Still, some of these data are outdated and not used by teachers and administrators. Particularly, not transferring data about academic and extra-curricular activities is seen as an important problem by the participants. Previously, information such as which academic field the student excelled in, which sports and artistic activities he participated in, and which reward and punishment processes the student went through were not transferred to higher education levelThis means that the data memory is lost. This situation causes teachers and administrators not to have comprehensive information about the student's past education experience and not to benefit from the data sufficiently. It was observed that there were similar findings in the study conducted by Yoruk and Gunbayi (2022). Among the participant opinions expressed in the related research, there are statements similar to the ones in this research, such as that the past data of the students cannot be accessed and that the transferred data is insufficient in terms of both academic and extra-curricular data.

Correspondence between all units within the MoNE is done through DMS. Using a common platform for internal communication is a very important interoperability practice. However, it has been observed that information systems are not sufficiently utilized in the data exchange process between management units. Participants stated that many data were requested from them unplanned and urgently. They complained

that this situation disrupts their workflow and reduces efficiency. In particular, they think that senior managers can obtain much desired statistical data through the information system. It was understood that the requested data were collected from various units and delivered to the upper units via DMS. In the research conducted by Altiok and Vicdan (2018), it was found that the documents transferred by DMS could be written documents, pictures, audio, and video files. When structured data obtained from information systems is converted into these formats and sent via DMS, it turns into unstructured or semi-structured data. It is clear that the processing, analysis and interpretation of such data will cause time and labor force losses. The related study showed that DMS was not integrated with e-school, so data transfer could not be made directly. It is considered that this situation supports the findings that DMS is insufficient in terms of interoperability.

Interoperability applications between different public institutions at the same management level are defined as "horizontal interoperability" by Gasco (2012). In this research, data-sharing processes between different schools are discussed within the scope of horizontal interoperability. Developing horizontal interoperability is a very difficult and important process in countries where central EMIS is not used. During the transfer of students between schools and regions using different information systems, the information systems used in schools should be made interoperable to ensure that their data is transferred decently. Many interoperability frameworks have been developed for this purpose (SIF, Ed-Fi, CEDS). However, in countries where central EMIS is used, schools can automatically be considered interoperable. While a parent petition was required for transfer applications in our country, nowadays, all applications can be made via e-government, and the process can be completed in digital environment. The research carried out by Kizilboga and Erdogan (2012) found that the transfer procedures carried out over the e-school make the transactions much easier than the old system. In this sense, although it is possible to say that MoNE information systems provide horizontal interoperability, it needs to be improved in some aspects according to participant views. Applications such as not being able to see the past grades of the students after the transfer and requesting the grades by correspondence depending on the transfer time can be considered problems can be solved with technical regulations, which are against interoperability. Interoperability issues arising from field conflicts and differences in elective courses during the transfer of vocational and technical education students between fields can be addressed through legislative changes.The interoperability features and needs between different information systems within the Ministry of National Education were elaborated on with the last sub-theme of the Intra-Organizational Interoperability theme, the sub-theme of information systems. Findings showed that some data are currently shared between e-school, MEBBIS, and EBA, but some points require improvement. Applications such as transferring teacher information from MEBBIS to e-school and EBA, easily integrating paid teachers into the system, transferring student lists to EBA via e-school were evaluated as positive aspects of the system in terms of interoperability. It has been determined that there is no data flow from EBA to e-school while the transfer process can be done from e-school to EBA. This shows that the data in the EBA is not sufficiently utilized. Some of the participants stated that they did not consider student activities in EBA during the assessment and evaluation

phase. A large amount of data emerges as a result of many activities of students on EBA, such as watching educational videos, solving questions, doing exercises, accessing course materials, watching lectures, participating in surveys, and sharing. Sharing the data obtained from these activities, which also reflect the educational life of the student outside the school, with the e-school will enable the students to be evaluated with a holistic approach. As a result, it is expected that the development of e-school and EBA interoperability will have significant educational benefits.

The external interoperability of MoNE information systems was investigated through two sub-themes: public institutions and private software.. As a result of the research, it has been seen that the MoNE information systems can only work with MERNIS in the public institution category. As it is known, all citizens' identity and address information can be found on MERNIS. Reducing the workload of school administrators, especially in the registration phase, by automatically transferring this information of students to the systems emerges as an important interoperability practice. Participants stated that it would be beneficial to share data with the Ministry of Health, Council of Higher Education (CoHE), and Social Security Institution (SSI), apart from MERNIS.

It has been observed that many educational and administrative processes in schools are carried out through corporate information systems. Still, special software is needed for some processes such as preparing the curriculum, preparing the joint exam and responsibility exam program, making insurance transactions in vocational high schools, and sending absentee messages. It has been observed that the MoNE information systems do not automatically share data with the mentioned software. Participants mostly stated that they had to transfer the data manually. It has been determined that e-school username and password information are entered in some of these programs to carry out the transactions quickly. To stop these applications that put data security and privacy at risk, it's important to add modules to corporate information systems or make technical and legal rules that make sure data is shared safely.

.In this research, which was carried out to determine the current status and needs of the information systems used in the MoNE in terms of interoperability, it was concluded that the MoNE information systems provided some interoperability features, but the opportunities arising from the use of central E EMIS were not sufficiently utilized. With the central EMIS, all the country's student, teacher, and institution information is kept on the same information systems. Accordingly, data transfers can be made easily during student and teacher transfers. Since the data defined in information systems are the same for all entities (student, teacher, institution), it is relatively easy to obtain statistical data. However, it is not enough to have only longitudinal data when it is necessary to answer more comprehensive policy questions such as which courses in primary education influence success in high school, what data can vocational guidance of students be made, what percentage of those who have received vocational education choose a career in the field they receive education, what data can explain the differences between institutions and regions. It is also necessary to connect and exchange data between different information systems, which are often designed and maintained separately from each other (Collins et al., 2007). As a more concrete example, since

student and teacher data are kept in different systems, their success can be measured separately. Still, when the effect of the teacher factor on student achievement is to be measured, the data in the two systems must be correlated. For this reason, instead of transferring data belonging to identical entities between systems by strengthening the interoperability of MoNE information systems, new results should be sought from the data by correlating data of different entities.

Recommendations

As a result of the research, it has been seen that the MoNE information systems have some interoperability features, but some aspects need to be developed. It is thought that the improvements to be made in line with the recommendations presented below will strengthen the MoNE information systems in terms of interoperability and enable more effective use of the data collected from the systems.

- To ensure vertical interoperability between education levels, the data transferred to the upper levels should be reviewed. By using central EMIS, teachers, and administrators should have access to more data on students' past educational experiences.
- To develop interoperability between management levels, the data expected from all units should be determined as predefined, and the data should be transferred between management levels through information systems.
- To benefit efficiently from the data collected from EBA, the importance of which is better understood with the transition to distance education during the pandemic period, its interoperability with e-school should be ensured.
- Research results showed that users had to enter some data into more than one system. With a broader research, these data should be determined and used from a single center.
- By making the e-school interoperable with the e-Pulse system of the Ministry of Health, information about the ongoing diseases of the students, which require monitoring by their teachers, can be transferred to the e-school. Currently, the processing of such diseases in e-school depends on the parents' declaration and cannot be processed in a decent way according to the participant's views.
- The quality of its outputs measures the efficiency of a system. To measure the quality of the education system, it is necessary to follow the students' experiences after graduation. It should be ensured that the data about the students placed in the university after graduation are automatically transferred to the e-school. The students participating in the workforce can be determined with the data coming from the SSI system and analysis can be made about which business lines they work in. In this way, the quality of education and the system's efficiency, especially

for students who graduated from vocational education, can be measured.

- The situations where special software is needed in schools should be determined, and the systems used should be improved to share data securely with the MoNE information systems.
- Data standards are essential components of ensuring interoperability (Quesneville et al., 2017). For this reason, education data standards should be established to establish a solid foundation for interoperability practices in education.
- In the field of interoperability, where researchers in our country have not worked before in education, more comprehensive qualitative and quantitative research should be conducted, and road maps that will guide education administrators should be created.

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References

Access 4 Learning Community. (2016). *Just the facts: "On the ground" SIF utilization*. Retrieved from: https://cdn.ymaws.com/www.a4l.org/resource/collection/00F1EAD6-732D-404B-83A4-FF7A4308DF14/Just_The_Facts__On_The_Ground_SIF_Utilization.pdf.

Alter, S. (2008). Defining information systems as work systems: Implications for the IS field. *European Journal of Information Systems*, *17*(5), 448–469. doi:10.1057/ejis.2008.37

Altiok, V. ve Duran, A. (2018). Okul yoneticilerinin dokuman yonetim sistemi (DYS) hakkindaki gorusleri. Anadolu University Faculty of Education Journal, *2*(1), 67–82. Retrieved from: https://dergipark.org.tr/tr/pub/aujef/issue/34595/385873 .

Baker, R. S. ve Inventado, P. S. (2014). Educational data mining and learning analytics. J. A. Larusson ve B. White (Ed.), In *Learning Analytics: From Research to Practice* (ss. 61–75). Springer New York. doi:10.1007/978-1-4614-3305-7_4

Baltaci, A. (2018). Nitel arastirmalarda ornekleme yontemleri ve ornek hacmi sorunsali uzerine kavramsal bir inceleme. *Bitlis Eren University Journal of Social Sciences Institute*, *7*(1), 231–274.

Bayrakci, M. (2007). *Turkiye'de egitim yonetimi bilgi sistemleri ve uygulamada karsilasilan sorunlar*. *Kuram ve Uygulamada Egitim Yonetimi* (C. 51). Retrieved from: https://dergipark.org.tr/tr/pub/kuey/126728.

Bienkowski, M., Feng, M. ve Means, B. (2014). Enhancing teaching and learning through educational data mining and learning analytics: An issue brief.

Bilgi Toplumu Dairesi. (2012). *E-donusum Turkiye projesi birlikte calisabilirlik esaslari rehberi surum 2.1*. Retrieved from: http://www.bilgitoplumu.gov.tr/wp-content/uploads/2014/04/Birlikte_Calisabilirlik_Esaslari_Rehberi_2.1.pdf.

Campbell, J. (2019). Integration does not equal interoperability. Retrieved from https://www.aemcorp.com/educationdata/blog/integration-does-not-interoperability-make on 28 May 2021

Cassidy, T. (2006). *Education management information systems (EMIS) in Latin America and the Caribbean: Lessons and challenges*. Retrieved from: https://publications.iadb.org/publications/english/document/Education-Management-Information-Systems-(EMIS)-in-Latin-America-and-the-Caribbean-Lessons-and-Challenges.pdf.

CEDS. (2020). Common education data standards. National Center for Education Statistics. Retrieved from https://ceds.ed.gov/Default.aspx on 24 February 2019.

Chen, D. ve Doumeingts, G. (2003). European initiatives to develop interoperability of enterprise applications - Basic concepts, framework and roadmap. *Annual Reviews in Control*, *27 II*, 153–162. doi:10.1016/j.arcontrol.2003.09.001

Chen, D., Doumeingts, G. ve Vernadat, F. (2008). Architectures for enterprise integration and interoperability: Past, present and future. *Computers in Industry*, *59*(7), 647–659. doi:10.1016/j.compind.2007.12.016

Collins, L., Fruth, L., Sessa, M. ve Laird, E. (2007). *The right data to the right people at the right time: How interoperability helps America's students succeed*. Retrieved from: https://immagic.com/eLibrary/ARCHIVES/GENERAL/DATAQ_US/D070621C.pdf.

Creswell, J. W. ve Miller, D. L. (2010). Determining validity in qualitative inquiry. *https://doi.org/10.1207/s15430421tip3903_2*, *39*(3), 124–130. doi:10.1207/S15430421TIP3903_2

Ed-Fi. (2019). Ed-Fi data standard. Retrieved from: https://www.ed-fi.org/ on 26 February 2019

Eroglu, S., Cakmak, T. ve Kulcu, O. (2016). Kurumlararasi bilgi paylasimi ve birlikte calisabilirlik esaslari. F. Ozdemirci, N. Ozel, T. Cakmak, Z. Akdogan ve B. Yalcinkaya (Ed.), *e-Beyas 2015 Semposyumu* icinde . Ankara: Ankara University, BEYAS Koordinatorship. Retrieved from: http://www.openaccess.hacettepe.edu.tr:8080/xmlui/handle/11655/11794.

Evans, J. A. (1970). *Educational management information systems: Progress and prospectives*.

Gascó, M. (2012). Approaching e-government interoperability. *Social Science Computer Review*, *30*(1), 3–6. doi:10.1177/0894439310392181

Gokkurt, S. O. ve Demirtel, H. (2017). Ulusal stratejiler cercevesinde birlikte calisabilirlik eylemlerinin degerlendirilmesi. Journal of Ankara University Faculty of Language, History and Geography, *57*(1). doi:10.1501/Dtcfder_0000001512

Gurleyen, B. S. (2014). Birlikte calisabilir kurumsal icerik yonetimi hizmetleri. *Bilgi Dunyasi*, *15*(2), 421–438.

Hsieh, H. F. ve Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, *15*(9), 1277–1288. doi:10.1177/1049732305276687

Hua, H. ve Herstein, J. (2003). *Education management information system (EMIS): Integrated data and information systems and their implications in educational management 1*.

Jakimoski, K. (2016). Challenges of interoperability and integration in education information systems. *International Journal of Database and Theory and Application*, *9*(2), 33–46. doi:10.14257/ijdta.2016.9.2.05

Kizilboga, R. ve Erdogan, Y. (2012). Milli Egitim Bakanligi e-okul uygulamasinin yonetici, ogretmen, ogrenci ve veli gorusleri dogrultusunda degerlendirilmesi. *Journal of Ministry of National Education*, *42*(193), 5–16. Retrieved from: https://dergipark.org.tr/tr/pub/milliegitim/issue/36181/406756.

Lemay, D. J., Baek, C. ve Doleck, T. (2021). Comparison of learning analytics and educational data mining: A topic modeling approach. *Computers and Education: Artificial Intelligence*, *2*, 100016. doi:https://doi.org/10.1016/j.caeai.2021.100016

Ligon, G. D., Swafford, J. ve Clements, B. S. (2018). *The role of data standards in data driven decision support*.

MEB. (2018). *MoNE Vision 2023 document*. Ankara. Retrieved from: http://2023vizyonu.meb.gov.tr/doc/2023_EGITIM_VIZYONU.pdf .

MEB Strateji Gelistirme Daire Baskanligi. (2020). *Milli egitim istatistikleri orgun egitim 2019/2020*. Ankara. Retrieved from: http://sgb.meb.gov.tr/meb_iys_dosyalar/2020_09/04144812_meb_istatistikleri_orgun_egitim_2019_2020.pdf.

Merriam, S. B. (2018). *Nitel arastirma desen ve uygulama icin bir rehber*. (S. Turan, Ed.). Ankara: Nobel Publishing.

Miles, M. B. ve Huberman, A. M. (1994). *Qualitative data analysis: an expanded sourcebook*. Thousand Oaks: Sage Publications.

Miller, W. ve Cairy, D. (2015). *The Michigan data hub a strategic alignment and ROI study*. Maisa Leadership Innovation Results.

Paul, R. J. (2007). Challenges to information systems: Time to change. *European Journal of Information Systems*. Palgrave Macmillan Ltd. doi:10.1057/palgrave.ejis.3000681

Phil Long, B. ve Siemens, G. (2011). *Penetrating the fog: Analytics in learning and education*.

Quesneville, H., Dzale Yeumo, E., Alaux, M., Arnaud, E., Aubin, S., Baumann, U., … Whan, A. (2017). Developing data interoperability using standards: A wheat community use case. *F1000Research*, *6*. doi:10.12688/f1000research.12234.1

Rainer, K., Turban, E. ve Potter, R. E. (2007). *Introduction to information systems*. John Wiley & Sons, Inc.

Romero, C. ve Ventura, S. (2010, Kasim). Educational data mining: A review of the state of the art. *IEEE Transactions on Systems, Man and Cybernetics Part C: Applications and Reviews*. doi:10.1109/TSMCC.2010.2053532

Rust, G. ve Bide, M. (2000). The metadata framework: Principles, model and data dictionary. *WP1a-0006-2.0*.

Unesco. (2008). *Education for all by 2015 will we make it?* UNESCO Publishing. Retrieved from: https://unesdoc.unesco.org/ark:/48223/pf0000154743.

West, W. (2006). Beyond grounded theory: The use of a heuristic approach to qualitative research. *Wiley*, *1*(2), 126–131. doi:10.1080/14733140112331385168

Whitelock-Wainwright, A., Tsai, Y., Drachsler, H., Scheffel, M. ve Gašević, D. (2021). An exploratory latent class analysis of student expectations towards learning analytics services. *The Internet and Higher Education*, *51*, 100818. doi:https://doi.org/10.1016/j.iheduc.2021.100818

Yazici, S. ve Ozdemirci, F. (2019). Bilgi yonetim sistemlerinin birlikte calisabilirlik gereksinimleri ve elektronik belge yonetim sistemi birlikte calisabilirlik olgunluk modeli. *Bilgi Yonetimi*, *2*(2), 84–104.

Yeni avrupa birlikte calisabilirlik cercevesi. (2017). Retrieved from: https://ec.europa.eu/isa2/sites/default/files/eif_brochure_final.pdf on 28 May 2021.

Yildirim, A. ve Simsek, H. (2013). *Sosyal bilimlerde nitel arastirma yontemleri*. Ankara: Seckin Publishing.

Yoruk, T. ve Gunbayi, I. (2022). Milli Egitim Bakanliginca sunulan elektronik hizmetlerin karar destek sistemi olarak kullanilmasi: temellendirilmis kuram calismasi. Journal of Qualitative Research in Education, *22*(29). doi:10.14689/ENAD.29.6

Zhang, K. ve Aslan, A. B. (2021). AI technologies for education: Recent research & future directions. *Computers and Education: Artificial Intelligence*, *2*, 100025. doi:https://doi.org/10.1016/j.caeai.2021.100025

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