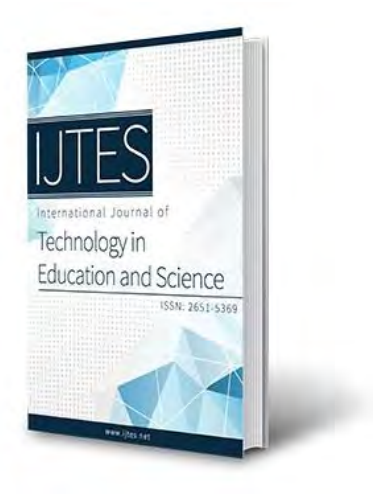

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Information, Media and Technology Skills in terms of Curricula, Process and Product in Middle and High Schools

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Abstract

The aim of this study is to examine how middle and high school curricula and practices support students to acquire information, media and technology skills. In the qualitative dimension of the study which was designed according to the mixed method, document analysis, observation and interview were used. The 23-itemed Information, Media and Technology Skills Competency Scale was used for the quantitative dimension of the study. Content analysis was performed for analysing the curricula, data obtained through observations and interviews. In the analysis of the data obtained from the scale, frequency, percentage, arithmetic mean and standard deviation values were used in the central and prevalence measurements. The results of the curricula analysis show that problem solving and information and data literacy skills were outnumbered in all analysed curricula. The activities carried out in the classroom during the observation and interview process were mostly related to information and media literacy and problem solving. According to the results of the scale; middle and high school students considered themselves to be relatively moderate in their information, media and technology skills. While the highest score of the students was of information and data literacy; programming skills were the weakest dimension.

Introduction

The penetration of technology in every aspect of modern society has affected social life as well as schools. Technology skills have become an important life skill over time. Lack of access to information and communication technologies poses a barrier to social integration and personal development (European Commission, 2008). It is stated that technology integration in schools has the potential to increase students' cognitive, affective and behavioral learning goals (Christmann & Badgett, 2003). It is expected that students who have access to technology in schools will be trained as creative and problem-solving individuals possessing information, media and technology skills in today's information society. The use of information and communication technologies (ICT) in schools offers teachers and students the resources to collect and analyze information, create multimedia presentations, and gain greater depth of knowledge. In order to enable this opportunity to be used meaningfully in the classroom, learning and teaching processes, the curricula are shaped accordingly.

21st century students can access information at any time, communicate and follow the media by using countless technology-based tools. Given the widespread use of the Internet, smartphones, computers, tablets, gaming systems and multimedia devices, it has become very important to teach students how to evaluate and interpret technology effectively and use it effectively. The task of the education community in the world of knowledge should be to support technology, to use technology in classrooms and to teach students how to use technology correctly (Hung, Lee, & Lim, 2012; Kaware & Sain, 2015; Spengler, 2015).

Providing students with information, media and technology skills can serve as a bridge between real life experiences and school experiences (Kolb, 2008). Information, media and technology provide students with unpredictable power to enhance their thinking, learning, communication, and collaboration and production skills. However, in order to use this power, students must first learn the skills needed to understand, manage and use this information, media and technology (Trilling & Fadel, 2009). Although most of the students know how to use technology, they do not have understanding and application skills about technology use and impact (Leung, 2010). It has become the duty of schools to integrate technology into learning-teaching processes and curricula, to teach students how to evaluate, interpret and effectively use information, to use technology in classrooms by supporting technology, and to teach the correct use of technology as a learning tool (Kaware & Sain, 2015).

Since the 1980s, projects have been implemented in Turkey to integrate digital technologies into education and to provide students with the necessary knowledge and skills in the knowledge economy. The FATİH [Movement to Increase Opportunities and Technology] Project, implemented by the Ministry of National Education [MONE] in 2010, aims to provide all students with the skills of the 21st century. Within the scope of the FATİH project, by 2018, 432 thousand 288 smart boards were distributed to schools and one million 438 thousand tablets were distributed to students. Thus, information technologies provided to classrooms are required to be used effectively in teaching activities for each learning goal in the curriculum. Main teaching activities should be conducted in a way that includes the effective use of information technologies [MONE, 2018]. In Turkey, the curricula and the textbooks of the subjects are determined at the national level. However, teachers can determine the methods and techniques they will use by themselves. Although ICT is taught as a separate course at primary and secondary education level, ICT is recommended to be used as a general tool for complementary activities in all subject areas and teachers are needed to corporate in digital content production and to integrate information communication technologies into their classes (European Schoolnet, 2017). For the implementation of information, media and technology skills in the classrooms students should be using ICT whenever appropriate to facilitate learning. To achieve this, ICT and other subjects should be combined and learning goals should not only comprise the core competences of the subject areas but also the ICT skills (Hoechsmann, & DeWaard, 2015). Teaching and learning process should engage students in learning considering the changing nature of subject knowledge with a need of digital skills of the age (Hague & Payton, 2011).

In this study, the extent to which the efforts to integrate digital technologies into learning and teaching processes support students' information, media and technology skills and the extent to which the current practices provide

students with these skills was investigated. The aim of this research is to examine the effectiveness of middle and high school curricula and applications in providing students with information, media and technology skills. These are the objectives of the study;

1. To find out the ratio of information, media and technology skills in the learning goals of middle and high school curricula.
2. To find out the teachers' opinions on the activities conducted in classrooms aiming at information, media and technology skills.
3. To find out the activities conducted during classes aiming at information, media and technology skills.
4. To find out to what extent do middle and high school students consider themselves sufficient in terms of information, media and technology skills.

Information, Media and Technology Skills

The way to equip students with the skills needed to educate them as productive individuals in the globalized 21st century digital world is through integrating digital technologies into educational sciences and curricula (Bardakcı & Keser, 2017). The learning paradigm of the 21st century is based on the students who are educated with the skills, knowledge and expertise needed to succeed in the digital economy (Kivunja, 2014). Founded in 2002 in the United States and funded by the Department of Education, the 21st Century Skills Partnership (P21) identified the skills to be acquired in the 21st century in order to guide schools in our age (Fox, 2011). These skills are classified under two main headings. In the first heading, basic courses and interdisciplinary themes are included (P21, 2009; Trilling & Fadel, 2009).

The second main heading is the support systems that will enable students to specialize in multidimensional skills expected in the 21st century. These support systems are addressed in three dimensions:

1. Learning and Innovation Skills: Creative Thinking, Critical Thinking, Problem Solving, Communication, Cooperation
2. Information, Media and Technology Skills: Information Literacy, Information and Communication Technologies (ICT) Literacy, Media Literacy
3. Life and Career Skills: Flexibility and Adaptation, Self-Direction, Social Skills, Productivity and Accountability, Leadership (P21, 2009).

Many terms are used to describe the information, media and technology skills that are among the 21stcentury skill sets and which are the focus of this study. Terms such as digital competence, ICT literacy, digital literacy and digital skills are utilized to cover skills and competences related to the use of digital technologies (Ilomäki, Kantosalo & Lakkala, 2011). The reason why these concepts, which are sometimes used interchangeably, do not have very specific definitions can be interpreted as not having reached the general provisions based on research. In theory, this deficiency reveals different definitions; each definition does not include all the skill areas covered by the concept, focusing on different aspects for specific reasons (Aviram & Eshet-Alkalai, 2006; Van Deursen & Van Dijk, 2009). Some sources (Aviram & Eshet-Alkalai, 2006; Erstad, 2010; Jones-Kavalier & Flannigan 2006; P21, 2009; Pool, 1997; Trilling & Fadel, 2009) have termed these three skills as digital literacy skills;

other sources named these skills as digital competence (Ala-Mutka, Punie & Redecker, 2008; Ilomäki, Kantosalo & Lakkala, 2011; Organization for Economic Cooperation and Development [OECD], 2005; Vuorikari, Punie, Gomez & Van Den Brande, 2016).

Digital Literacy

The concept of digital literacy was first introduced by Paul Glister in 1992. Glister has defined digital literacy as the ability to understand information and more importantly, to evaluate and integrate information in multiple formats presented through computers. According to Glister, literacy is a cognitive activity that requires not only reading but also understanding. Accordingly, digital literacy is the ability to use information accessed in life using the Internet and computers (Martin & Grudziecki, 2006; Pool, 1997). Skills that cover the digital world are defined as digital skills. Digital media is frequently used in communication, learning and production processes in today's learning, working and entertainment environments. According to some researchers who argue that the development of the concept of digital literacy is linked to traditional literacy and media studies (Erstad, 2010; Jones-Kavalier & Flannigan, 2006). Digital literacy represents the ability to perform certain tasks in digital environments. The concept of digital represents information in numerical form, which is generally used by computers; literacy includes the ability to read and interpret media, as well as the ability to reproduce data and images through digital applications, and to use new information obtained in digital environments.

Digital Competence

The concept of digital competence is a multifaceted, mobile concept that encompasses many fields and literature and evolves rapidly as new technologies emerge. Digital competence today means understanding the media, accessing information, taking a critical attitude towards the information being accessed and communicating with others using various digital tools and applications. All these qualifications belong to different disciplines and traditions (Ferrari, 2013). In the European Commission reports (2008), digital literacy is defined as the skills necessary to achieve digital competence.

In addition to the basic skills in the field of ınformation and communication technologies, access to information using the Internet, evaluating, storing, producing, presenting and sharing information are presented as skills that support digital literacy. Digital competence is strongly engaged with 21st century skills for citizens to actively participate in social life. The European Union adopted digital competence as one of the eight core competences necessary for lifelong learning (Ala Mutka, 2011).

A Digital Competence Framework (DigComp) was developed by the European Commission to create a European level consensus on the elements of Digital Competence and DigComp is presented as a tool to increase the digital competence of citizens. DigComp has been used for multiple purposes, particularly in the context of employment, education and training and lifelong learning. In DigComp, the features required for individuals with digital competence are grouped under five headings (see Figure 1).

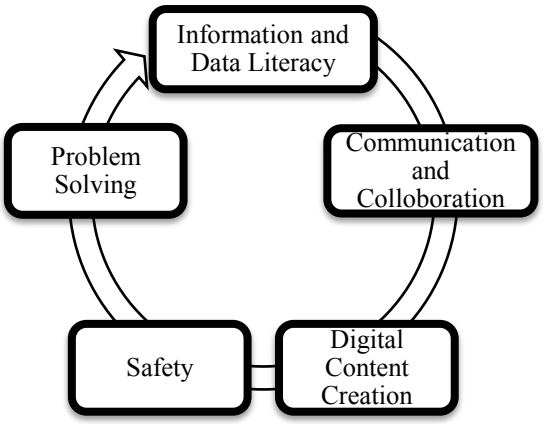


Figure 1. DigComp Digital Competence Areas

One of DigComp's key objectives is to plan training and education initiatives to increase the digital competence of specific target groups. DigComp also offers a common language and a common reference at European level in defining key areas of digital competence (Ferrari, 2013). The framework is expected to serve as a guide for the reliable and critical use of digital technology in all areas of life for information access, evaluation and use, communication through various channels, the production and sharing of digital content (Kluzer & Rissola, 2015). The framework provides detailed descriptions of all competences required to be proficient in digital environments and describes these competences in terms of knowledge, skills and attitudes.

The implementation of the framework in European countries for the purpose of education / student assessment and the professional development of teachers can be found. In Slovenia, for example, the DigComp framework is used to assess the digital knowledge and skills of students in different levels of education (Šerbec et al., 2016). In Belgium, Estonia, France, Poland and Northern Italy, training and courses in the field of information communication are also organized, especially in adult education and at the university level using the DigComp framework (Šerbec et al., 2016). In this study by using this framework created for European citizens, it was tried to determine the curricula learning goals and classroom activities related to the information, media and technology skills and information, media and technology competency levels of middle and high school students.

Method

Research Design

In this study, triangulation design, which is one of the mixed method research designs, was used in order to examine information, media and technology skills in secondary education. The design is a process that uses different methods to investigate a phenomenon and has four basic methods: 1) data diversity 2) researcher variation 3) theory variation 4) method variation (Denzin, 1978). In this study, a method variation was used to investigate the information, media and technology skills in secondary education.

In this study, Simultaneous Diversity Design, which includes the use of both quantitative and qualitative methods Creswell (2003), is adopted and the data is integrated in the analysis and interpretation stages. The

qualitative data obtained through the analysis of the curricula, teacher interviews and classroom observations, and quantitative data obtained from the responses of the students to the Information, Media and Technology Skills Competency Scale were compared. Document analysis, observation and interview were used in the qualitative dimension of the study. Using the descriptive model to determine the competences of students' information, media and technology skills constitutes the quantitative dimension of the study.

Participants

The quantitative data for this study come from the survey of students studying in middle and high schools affiliated to the Ministry of National Education in 2017-2018 academic year. In this study, random sampling method was used. In this method, because of the large population of the research, a sample with similar characteristics with the universe and a size representing the universe by statistical calculations is selected by random method. In the research, proportional cluster sampling method is used (Yıldırım & Şimşek, 2016, p. 117). For the proportional cluster sampling method, the universe is divided into subgroups (sub-universe) according to the variables that are thought to make significant differences in terms of research findings and groups are selected from each sub-universe (Karasar, 2017, p. 153).

The criteria of the Classification of Statistical Region Units defined by the European Union Statistical Office - Eurostat were used for sample selection. According to these criteria in Turkey, the sample of the study consisted of 26 provinces stated in Level 2. In order to determine a sample size capable of representing the universe, Anderson's theoretical sample size table was used (Balcı, 2011, p.106). According to this table, a sample of at least 1067 students with a 3% tolerance is sufficient to represent the universe.

In order to collect the necessary data in the qualitative dimension of the research, easy accessibility method was used as one of the purposeful sampling methods. Easily accessible sampling is used to select members of the target audience that meet certain practical criteria such as easy accessibility, geographical proximity, availability at a given time (Dörnyei, 2007, p. 99). In this research, observations and interviews conducted according to this sampling selection method were carried out in Niğde province, where the researcher could easily reach the participants. Criterion sampling method was used to determine the schools where interviews and observations about classroom practices were conducted in order to provide students with information, media and technology skills. Criteria sampling involves reviewing and examining all cases that meet some predetermined criteria of importance (Patton, 1991, p. 238). The criterion used here is the use of digital technologies within the FATİH Project.

A total of 24 middle and high school teachers from Niğde province participated in the qualitative part of the study. Teachers were interviewed and observed for the qualitative part of the study. These 24 teachers were from 3 middle and 3 high schools. Three teachers were chosen from Turkish, English, Mathematics and Science branches in middle schools; three were chosen from Turkish Language and Literature, English, Mathematics and Physics branches in high schools on a voluntary basis.

Data Collection Tools

The data of this research were collected from four different sources: Document Analysis Form, Teacher Interview Form, In-class Observation Form and Information, Media and Technology Skills Competency Scale.

Document Analysis Form

A document analysis form was developed to analyse the learning goals of middle and high school curricula in practice during the 2017-2018 academic year. The development of the form was based on DigComp and the dimensions of 1) information and data literacy, 2) communication and collaboration, 3) digital content creation, 4) problem solving and 5) safety. The curricula within the scope of the study were examined by taking into consideration the five skill dimensions and their sub-dimensions and criteria. For the analysis, first of all, the curricula of the compulsory courses in middle and high school levels were examined. As a result of the study, it was concluded that in the middle school, Turkish, English, Science and Mathematics and in the high school Turkish Language and Literature, English, Math and Physics curricula included information, media and technology skills and document analysis was carried out on the learning goals of these curricula.

Interviews

In the research, semi-structured interview technique was used for interviews with teachers. The semi-structured interview consisted of open-ended questions and probes, which were determined based on the literature and DigComp and arranged in accordance with expert opinions. The draft interview form prepared was tested by conducting interviews with teachers. As a result of the interviews; actual interview form to be used in practice was developed by considering the data obtained and expert opinions. In the interview form, teachers were asked about research tasks, communication and collaboration in digital environments, digital content production, internet security and problem-solving activities in teaching learning process.

In-Class Observation Form

In this research a structured observation form was used and the researcher was included in the natural environment where the research was conducted as a non-participant observer. The in-class observation form was finalized in accordance with the information, media and technology skills determined on the basis of DigComp, data obtained from pilot observations, experience gained by the researcher and expert opinions. Observations were conducted in spring semester of 2018 with the same teachers as in the interviews at the grade levels of 5-6-7-8 and 9-10-11. During the observation, the researcher sat at the back of the class and observed the lessons in the natural flow. Each teacher was observed twice. During the observation, activities aimed at information, media and technology skills were recorded. Following the observations, the types of activities recorded in the observation form were examined in the categories of information and data literacy, communication, content generation, safety and problem solving which are the indicators of digital competence determined in line with the DigComp. In the observation form; learning teaching activities, assessment activities and assignments were

identified whether those included information and data literacy, communication, content creation, safety and problem solving skills.

Information, Media and Technology Skills Competency Scale

In this study, "Information, Media and Technology Skills Competency Scale" developed by Hazar (2018) was used for middle and high school students. These skills are composed of six dimensions: information and data literacy, communication and collaboration, digital content creation, programming, safety and problem solving. A 5-point Likert-type scale was used to evaluate the expressions on the scale (1= Never, 2 = Rarely, 3 = Sometimes, 4 =Usually, 5 = Always). The lowest score that can be obtained from the scale is 23 and the highest score is 115. The higher scores indicate greater competence.

Data Collection and Data Analysis

The learning goals of the curricula were analyzed using the categories identified in the document analysis form. Sentence was chosen as the unit of analysis to be used in document analysis and the sentences were used to digitize the data using the presence or absence technique according to the presence of the category in the document. Above mentioned curricula were analyzed independently by three teachers from each branch and coded by using 1 or 0 values. The teachers were informed by the researcher about the information, media and technology skills and analysis before coding. Coding was made by giving 1 if the learning goal is related to the DigComp categories and 0 if not. Then the learning goals given "1" were counted and placed into the related category. In order to determine whether the agreement and reliability between the three encoders was acceptable, Fleiss Kappa statistic was used to determine the percent agreement and coefficient between the encoders. The kappa statistic is a frequently used statistic to test reliability among coders. Conventionally, Cohens Kappa (for two encoders) and Fleiss Kappa (adaptation of Cohen Kappa for 3 or more encoders) calculate the percent compliance of the encoders (McHugh, 2012, p. 276). Landis and Koch (1977) classifies values as poor between 0 and 20; reasonable fit between 21 and 40; moderately compatible from 41 to 60; good fit between 61 and 80, and excellent fit between 81 and 1.0. As a result of the analysis, it was found that Fleiss Kappa values correspond to values between 0.72 and 1. This finding shows that the experts make very consistent evaluations about the determination and classification of the learning goals.

Observation and interview techniques were used to determine activities in classrooms related to information, media and technology skills. For the analysis of the data obtained in the observation form, the status of the items in the form was scored as (1) for "observed and (0) for not observed. Frequency and percentages of the obtained data were calculated. In two observations for each teacher, activities aimed at information, media and technology skills, the frequency of these activities and the types of activities observed in different branches were tabulated.

Interviews were conducted at schools by the researcher and lasted about 10 minutes. Before starting the interviews, the teachers were informed about the purpose of the research and that the interviews would be

recorded with a voice recorder. In the analysis of interview data, firstly 250 minutes of audio recordings were transcribed and a 24-page data file was obtained. The questions related to the activities aimed at gaining students' information, media and technology skills were analyzed with the content analysis technique. In the content analysis, common points and important dimensions were tried to be determined in the answers given. The responses from the teachers were divided into meaningful sections and descriptive names were given to these sections. In order to find the themes to collect the codes under certain categories, the codes were first examined and found in common. Themes were determined by combining the related codes according to the similarities and differences of the codes.

In order to examine the information, media and technology skill levels of middle and high school students, Information, Media and Technology Skills Competency Scale was applied in the summer term of 2017-2018 academic year. The scale was responded by the students selected from each grade in each of the selected middle and high schools in the 26 provinces in Turkey. A total of 4217 students answered the data collection tool. 14 out of 52 schools to which the measurement tool was sent did not participate.

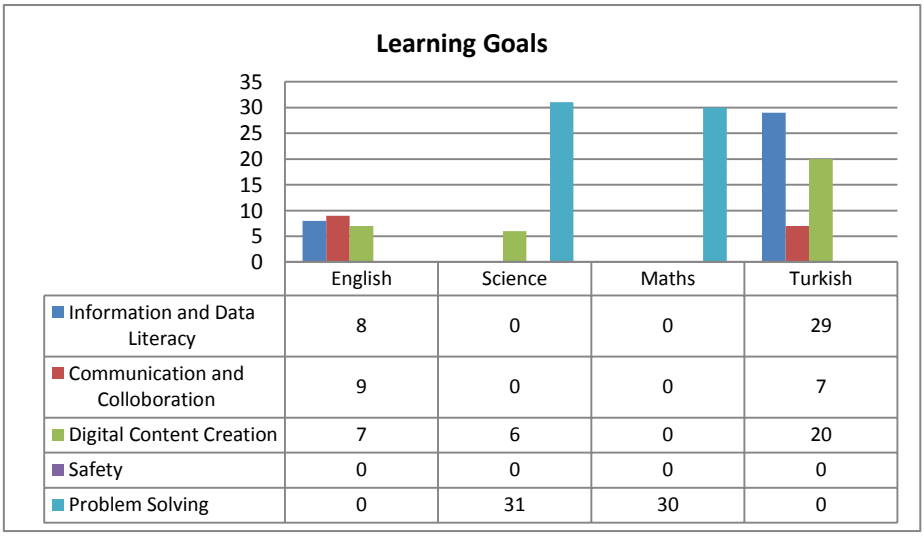
Prior to the analysis of the responses obtained from the scale, the data were checked, outliers and missing values were excluded from the analysis and the data were analyzed in SPSS 21 Package program. The intervals were assumed to be equal, and the score range for the arithmetic means was calculated as 0.80 (Score Range = (Highest Value - Lowest Value) / 5 = (5 - 4) / 5 = 4/5 = 0.80). Grading steps of the scale rated between 1 and 5 as (1) Never (2) Rarely (3) Partially (4) Mostly and (5) Always. Frequency (f), percentage (%), standard deviation and arithmetic mean were used to analyse the responses of the students to the scale. Mean, median, peak value, kurtosis and skewness measurements were examined to determine the normal distribution characteristics of the scores obtained from the scale. It was interpreted that the scores obtained from the scale were within ± 1 limits of skewness and mean, median and peak values were close to each other and it was interpreted that the scores did not show excessive deviation from the normal distribution.

Findings

Findings on Information, Media and Technology Skills in Middle and High School Curricula

For the findings of document analysis on the ratio of information, media and technology skills used in middle and high school curricula, the number of learning goals that these skills are emphasized in English, Mathematics, Science (Physics in high school) and Turkish (Turkish Language and Literature in high school) curricula are presented in Figure 2. When Figure 2 is examined, it is observed that a total of 147 learning goals; 56 in Turkish, 30 in Mathematics, 24 in English and 37 in Science curriculum are related to information, media and technology skills. Accordingly, it is seen that the most emphasis on information, media and technology skills in curricula is Turkish while the least related learning goals are in Mathematics. In addition, it is observed that the weights of information, media and technology skills vary in the learning goals of the four curricula. In the Turkish curriculum, information and data literacy is emphasized more; in Mathematics and Science, problem solving dimension is emphasized. The safety dimension is not included in any of the learning goals analyzed. The first three dimensions of information, media and technology skills are mostly in verbal courses; it is seen

that problem solving dimension is concentrated in numerical courses. There are no learning goals emphasizing the safety dimension in the curricula of these courses. According to these findings, it can be said that the integration of information, media and technology skills into middle and high school curricula is provided partially. However, in the curricula examined, especially the insufficiency of the "safety" and "communication and cooperation" skills are noteworthy.



	English	Science	Maths	Turkish
Information and Data Literacy	8	0	0	29
Communication and Colloboration	9	0	0	7
Digital Content Creation	7	6	0	20
Safety	0	0	0	0
Problem Solving	0	31	30	0

Figure 2. The Ratio of Information, Media and Technology Skills in Middle and High School Curricula

Findings Related to Information, Media and Technology Skills in Teaching and Learning Process

Interviews with teachers and classroom observations were conducted to determine activities for information, media and technology skills. In the following, first of all, the findings reflecting the analysis results of the data obtained from the interviews are presented in the order of interview questions.

Teachers' Opinions on Research Tasks

24 teachers interviewed were asked what resources they recommend their students to use for research purposes. All 24 teachers interviewed stated that they were directing their students to digital resources in their research tasks. In addition to digital resources, the number of teachers directing students to printed resources is nine. Some of the teachers' answers to this question are as follows:

> "I want them to do preliminary research so they can come prepared. I say you can search the Internet or any printed source." (Physics Teacher)
>
> "I usually refer to Internet resources for research, for projects. At least I'm checking to see if they've got the right information." (Mathematics Teacher)

Teachers' Opinions on Communication and Collaboration in Digital Environments

23 of the teachers who were asked if they encouraged their students to use digital channels to communicate and

collaborate stated that they used WhatsApp application for communication and collaboration. Only one teacher stated that she communicated with students through social media. Ten teachers stated that they used these channels to help students with their homework, two for project tasks, 11 teachers used these channels to solve the problems that the senior students asked for the high stake tests and one teacher used these channels to follow what the students did in daily lives. Some of the teachers' answers to this question are as follows:

> "All students have my number. They ask on WhatsApp and I reply. They create groups in the class and add me and ask questions. In group work, they collaborate with each other via WhatsApp using a mobile phone." (Mathematics Teacher)
>
> "I don't use technology much. I communicate with some of the students while preparing a project. We follow students from WhatsApp." (Turkish Language and Literature Teacher)

The findings indicate that teachers do not prefer different channels to improve communication and collaboration skills of students using digital tools; they are carrying out activities for communication and collaboration with an emphasis on using WhatsApp almost exclusively. In the interviews, it is determined that especially Mathematics teachers communicate with their students in digital environments and help to solve the problems coming from them. In addition, it was found out that Mathematics teachers encourage collaboration among students through their assignments.

Teachers' Opinions about Producing Digital Content

In response to the question about the activities to produce digital products, 14 of the teachers stated that they required activities on the preparation of electronic documents, 12 teachers on pictures, 12 teachers on slide presentations, six teachers on videos and one teacher on audio files. Findings on producing digital content show that student mostly prepare electronic documents for assignments or projects. Here are some excerpts from the interviews:

> "It is not possible for students to draw or write about projections. They searched the internet and prepared and brought them in the form of images and videos." (Mathematics Teacher)
>
> "I want slide show for project assignments, performance tasks or practice exams. They can shoot videos sometimes." (English Teacher)

Teachers' Opinions on Risk Factors in Digital Environments

According to the answers about the risk factors the teachers warn their students about in digital environments; seven of the 24 teachers interviewed stated that they warned students about the dangers of sharing their personal information on the Internet, six of them on games, five of them on cyber bullying, four of them on unreliable websites, one on internet fraud, one on viruses and the other one on Internet shopping. Here are some excerpts from the interviews;

> "While playing games, I warn them about not to share personal information with people they do not know on social media." (English Teacher)
>
> "I provide information in classroom guidance. I'm against sharing any kind of data on the Internet. I'm telling that it might come up to different channels in the future." (Turkish Teacher)

Teachers' Opinions on Problem Solving Skills

10 of the 24 teachers interviewed were asked if they encouraged their students to develop problem solving skills while using / using digital tools. Here are some excerpts from teacher views on this question:

> "If I'm enough, I'll handle it myself. I get help from the students if I can't. There are good enough students for solving problems. They all take their video assignments in different programs and upload them to the board. Some don't play on the board. They added an extension and played the video. I learned this from the students." (English teacher)
>
> "We conduct problem solving activities on smart boards. In dynamic geometry software, I have students make drawings on the board. We solve the problems on the board." (Mathematics Teacher)

According to the findings, it is seen that teachers deal with problem solving skills in two ways. The first of these; while solving conceptual problems using software on the interactive board, the other is solving technical problems that arise when using digital devices and environments. Interviews show that especially Mathematics teachers encourage their students to solve conceptual problems by using educational software.

Findings on Observation Studies to Identify Information, Media and Technology Skills in Classroom Applications

In addition to the interviews, in-class observations were conducted to determine the activities of teachers related to the information, media and technology skills in classroom practices. Table 1 shows the percentage and frequency distribution values of the results for each item in the classroom observation form. As seen in the table, some of the items were not observed in any of the courses followed. The item related to the information and data literacy skill dimension "Enabling students to question the reliability and accuracy of information and resources" was not observed in any of the courses. In terms of collaboration dimension "Asking students to collaborate using digital tools "and "Communicating with students using digital tools" were followed only once. "Informing students about copyrights and licenses related to digital content and "Informing students about the risks that may arise while using digital technologies" which are the indicators of creating digital content and gaining safety-related skills were not observed in any of the classes followed.

However, "Asking students to interpret the information accessed in digital environments "and "Asking students to transfer technological information to new situations creatively" can be said to be the highest observed items. According to these findings, it can be said that teachers carry out activities related to information and media literacy skills and problem solving skills in their classes. It was observed that communication skills, which were not emphasized at all, appeared as the weakest dimension and some skill dimensions were emphasized more in certain classes. In the observations, the activities related to problem solving skills are observed mostly in Mathematics, Physics and Science classes. On the other hand, in English classes, more digital content production skills are focused on. In none of the observations, an activity aimed at the safety skills was found. The example of communication related activity was observed only once in high school Mathematics.

Table 1. Information on Observations

Items	Observed		Not Observed		Total	
	f	%	f	%	f	%
In learning activities, evaluation activities and assignments:						
Information and Data Literacy						
Asking students to search for information and resources in digital environments	7	15	41	85	48	100
Asking students to interpret information accessed in digital environments	24	50	24	50	48	100
Enabling students to question the reliability and accuracy of information and resources	0	0	48	100	48	100
Communication and Collaboration						
Communicate with students using digital tools	1	2	47	98	48	100
Asking students to collaborate using digital tools	1	2	47	100	48	100
Having students participate in citizenship participation using digital tools	0	0	48	100	48	100
Digital Content Creation						
Enabling students to produce digital content in different formats	5	10	43	90	48	100
Informing students about copyrights and licenses for digital content	0	0	48	100	48	100
Safety						
Informing students about the risks that may arise while using digital technologies	0	0	48	100	48	100
Problem Solving						
Enabling students to identify and solve technical problems	1	2	47	98	48	100
Asking students to transfer technological knowledge to new situations creatively	24	50	24	50	48	100

Figure 3 shows the results the DigComp categories represented in the observations in different subject areas.

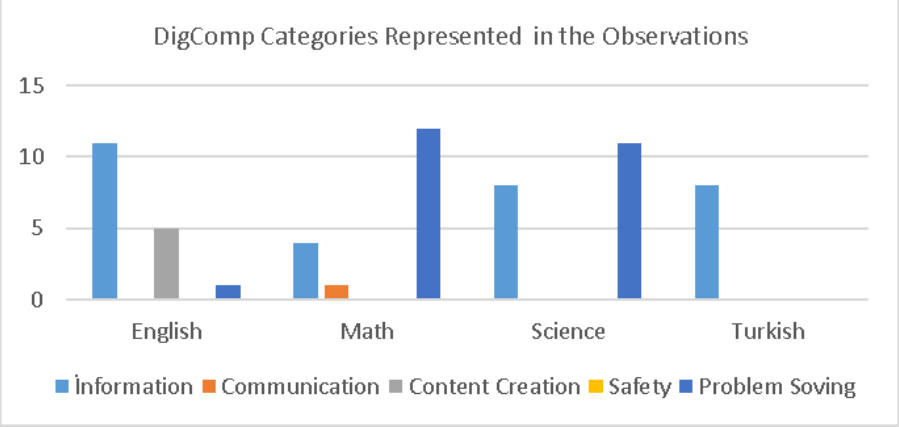


Figure 3. DigComp Categories Represented in the Observations

As a result of the document analysis conducted in line with the first objective of the research, it was observed that in class activities carried out were in harmony with the learning goals related to the information, media and technology skills. According to this finding, data obtained from document analysis were supported by observations. The outcome in Grade 7 Mathematics curriculum “Obtains and interprets the mean, median and peak value of a data group ”; the learning goals in Grade 9 mathematics curriculum “ Performs whole number of greatest common divisor and least common multiple applications ”and “Obtains the properties of the inner and outer bisector of the triangle”; the outcome in Grade 11 mathematics curriculum “Explains the exponential function”; the outcome in Grade 9 Physics curriculum “Analyses the variables that depend on the change in temperature of pure heat-giving or heat-giving materials ” are related to problem solving skill dimension and creative use of digital technologies sub-dimension in document analysis.

During the observations, the activities aimed at transferring technological knowledge to new situations were observed in these four learning goals and it was observed that the learning goals emphasizing the information, media and technology skills included in the Mathematics and Physics curricula were supported by activities directed towards these skills in the teaching-learning process. In grade 9 English curriculum the outcome “Makes a brief presentation about a civilization” is associated with the skill dimension of digital content production and digital content development sub-dimension in document analysis. During the observations, the activities related to enabling students to produce digital content in different formats were observed in the English classes for this outcome.

It was determined that two of the observations made in the Turkish classes were related to the information, media and technology skills. The learning goals in Grade 8 “Distinguishes subjective and objective judgments in listening / watching” and the learning goals in Grade 5 “Evaluates the content of listening / watching” were associated with the dimension of Information and Data Literacy and to evaluate information, data and digital content sub-dimension in the document analysis. In these classes, it was observed that there were activities for students to interpret the information accessed in digital environments. During the observations, it was found out that the activities related to information, media and technology skills were conducted in accordance with the results of document analysis.

As a result of the observations, it was concluded that the teachers used the interactive board intensively. During the observations, the frequency of activities aimed at accessing and interpreting information in digital media is remarkable. In addition, it was observed that the software installed on the interactive board was used frequently. The interactive whiteboard was used in English classes to monitor the digital content produced by the students and to listen to the audio files. In Science, Physics and Mathematics courses, problem solving and geometric drawings were made by using software installed on interactive board. In Turkish, Science and Turkish Language and Literature classes, videos and animations in Informatics Network and other educational software were frequently paused and the students were asked questions about the subject.

Findings on Students' Information, Media and Technology Skills

The Information, Media and Technology Skills Competency Scale was used to determine the degree to which the middle and high school students considered themselves sufficient in terms of information, media and technology skills. In this section, the data obtained from the Information, Media and Technology Skills Competency Scale are presented.

The mean and standard deviation values of the scores of middle and high school students from the general scale and sub-dimensions of the scale were calculated and given in Table 2.

Table 2. Distribution of Scores of General and Sub-Dimensions of Information, Media and Technology Skills Competency Scale

Sub-dimensions of Information, Media and Technology Skills	$\bar{X}$	ss
Communication and Collaboration	3.15	.01
Programming	1.90	.01
Problem solving	2.68	.01
Digital Content Creation	2.93	.02
Information and Data Literacy	3.74	.01
Safety	3.25	.01
Total	2.94	.01

When the general scale is examined, the mean score of middle and high school students is 2.94. When the sub-dimensions of the scale are taken into consideration, it is seen that Information and Data Literacy (3.74) is the highest- scored dimension and “Programming” (1.90) is the lowest-scored dimension. Mean scores for other sub-dimensions are “Communication and Collaboration” (3.15), “Problem Solving” (2.68), Digital Content creation” (2.93) and “Safety” (3.25). According to these findings, middle and high school students who participated in the study consider themselves to be relatively moderate in terms of their information, media and technology skills. Considering the sub-dimensions; while they deem themselves sufficient in “Information and Data Literacy” sub-dimension, they consider themselves sufficient in “Communication and Collaboration”, “Problem Solving”, “Digital Content Creation” and “Safety” sub-dimensions. In the “Programming” sub-dimension, students evaluated themselves as inadequate.

According to the arithmetic means, the item with the highest arithmetic mean (3.97) appear to be “Paying attention to the reliability of the information shared on the Internet” (Item 17), and the item with the lowest mean (1.72) is “Preparing a web site using one of the Web programming languages” (Item 6). When the percentage values of the items considered, “Paying attention to the reliability of the information shared on the Internet”. is the most preferred item with 47.9% of always option. Usually is the most preferred option with 24.7% for the items “Evaluating the reliability of the information available on the Internet” and “Using instant messaging tools”. Partially option is the most preferred option with the items of “Sharing various information and content (text, audio, video, pictures, etc.) on the Internet” with 24.4%. Rarely” is the most preferred option

with 26% for the items “Sharing various information and content on the Internet (text, audio, video, pictures, etc.)”. Never is the most preferred option with 66.9% for the item “Preparing a website using one of the web programming languages”.

Discussion

The aim of this study is to examine the effectiveness of middle and high school curricula and applications in providing students with information, media and technology skills. For this purpose, the curricula learning goals and classroom practices in middle and high schools were analyzed in detail and to what extent the curricula and practices emphasize information, media and technology skills were examined. In addition, the extent to which the curricula and practices provide students with information, media and technology skills were evaluated.

When all the sub-problems of the research are considered, it can be said that there are results that support each other partially. According to the results obtained from the analysis of the curricula, it is seen that the most emphasized skills in middle school curricula are problem solving and information and data literacy. It is seen that specific skills are more emphasized in the curricula of different countries. For example, in Finland, media and communication skills draw attention in curricula; In Scotland, emphasis is placed on problem-solving skills (Ottestad, 2013; Štibrić & Baranović, 2007). In Sweden, the curricula of many courses, particularly mathematics and technology, envisage the development of a critical and responsible approach to digital technology, identifying opportunities and risks, as well as adding digital competence skills to assess information. In addition, in the first three years of elementary school, the Mathematics curriculum includes learning goals in algorithmic thinking and programming (Berge, 2017). The integration of these skills into the curricula of all courses not only in the learning goals of ICT courses has begun to be implemented in many countries.

In many countries, digital literacy is not offered as a separate subject but integrated into curricula. For example, in Canada, digital skills are thought to be best acquired by integrating into curricula, and learning goals should include both digital skills and course-related skills (Bardakcı & Keser, 2017). Therefore, cross-curricular competences in compulsory education in Canada affect pedagogy in disciplinary areas (Hoechsmann, & DeWaard, 2015). In Denmark, digital competence is not a separate subject in primary and secondary school; instead digital competence skills, such as problem solving and logical thinking, are integrated into classes in primary and secondary schools (Berge, 2017). In Wales, the skills of Citizenship, Interaction and Collaboration, Generation, Data and Digital Thinking are integrated into curricula for each student aged 3-16 years (Welsh Government, 2015).

In the interviews with teachers, it was stated that the activities related to information and data literacy were conducted by all the teachers interviewed. Although the rate of activities towards problem solving skills was lower, it was stated that activities related to this skill were carried out in the interviews. In the classroom observation, it was seen that half of the classes had activities to support information and data literacy and problem solving skills. For the competency level of students' information, media and technology skills, the skill dimension with the highest average has emerged as information and data literacy. In a study by Lee, Kim & Lee

(2015), competency levels of high school students in South Korea were similar.

In the study, it was concluded that the students' most competent field was the ability to process information, followed by computers and networks, information society and ethics, respectively. In the Information Technologies and Software course, which was started to be implemented in Turkey in 2012, software and programming training subjects were added and basic programming training was started to be given to the students starting from the 5th grade. However, the findings of this study show that programming skills have emerged as the only area where students consider themselves inadequate. As stated by Akpınar and Altun (2014), this may be due to the general use of computer automation (office automation) applications and the lack of a curriculum based on programming and design. Fraillon, Ainley, Schulz and Friedman (2015) gave similar results in a study conducted in 19 countries with middle and high school students.

According to the study, the skill which students perceive them as most sufficient is information literacy and then content creation, communication, security, problem solving and programming respectively. These results can be interpreted as information literacy develops in information societies which are more easily accessible, but not enough progress has been made in programming skills. It can be said that skills related to information and data literacy give similar results for the scale applied to Grades 6 and 9 in Estonia using the same framework.

In the study, it is seen that the information and data literacy levels of the students are higher than the other skill levels (Siiman et al., 2016). It can be said that this is due to the interactive board in the classrooms and the ease with which students have access to information with the help of digital tools. Almost all of the teachers stated that they use these boards in the classroom and the easy access to information on this board may have been effective in providing students with the skills to interpret the information.

Safety, which is the only dimension with no associated learning goals in analyzed middle and high school curricula, is a skill dimension that few of the interviewed teachers emphasized. Although the teachers stated that they drew attention to the risk factors in digital environments, there was no effect on this dimension in the classroom observations. According to these findings, it is seen that the number of teachers who give warnings about the dangers and security issues that the students may encounter on the Internet is quite low. A similar defect is noted in the report prepared by the United States National Cyber Security Alliance (NCSA, 2011). According to the results of the report, where students' views on information and computer safety are asked, it was found out that few teachers informed their students about the importance of creating strong passwords on the Internet, respect for private life and information security. In a study conducted by Elçi and Mediha (2016), it was stated that the lack of an in-school application environment and the prohibition of many sites could be effective in the low level of acquisition of skills related to the digital security dimension. According to the results obtained from the scale, although students do not have activities related to this skill in curricula, learning goals or classroom practices, students consider themselves to be relatively moderate in this field.

The learning goals of digital content production skills in the curricula are supported by the opinions of the teachers. More than half of the teachers stated that they were carrying out activities for their students to create

digital content. In-class observation studies show that the activities carried out in this area are not very high. In the dimension of digital content creation of the scale, students consider themselves to be relatively moderate. Findings on creating digital content show that students mostly prepare electronic documents for assignments or projects. Fraillon, Schulz, Gebhardt and Ainley (2015) reported that students mostly use word processing software to produce digital content at home or at school. The students mostly prepare presentations for school projects in Mathematics and foreign language courses; it is concluded that the number of students using graphical drawing tools or spread sheet tools is quite low.

In relation to the communication and collaboration skill dimension, there are few associated learning goals in middle school curricula, while this number is relatively increasing in high school curricula. Although more than half of the teachers interviewed stated that they carried out activities to support communication and collaboration in digital environments, only one activity was observed in the observations. According to the scores obtained from information, media and technology skills competency scale, the students find themselves moderate enough in this skill dimension. According to the findings of a study carried out by European Commission (2010) giving feedback to students in digital environment was reported to be at least applied by teachers in Turkey. Horzum (2010), in a study conducted with teachers, concluded that teachers' awareness of Web 2.0 tools in communicative context is not high and their educational use is not widespread.

According to the findings of the study, it is seen that teachers deal with problem solving skills in two ways. The first of these; solving conceptual problems using software on the interactive board, the other is solving technical problems that arise when using digital devices and environments. Interviews show that especially mathematics teachers encourage their students to solve conceptual problems by using educational software. Jacinto and Carreira (2015) argue that mathematical visualization and problem solving skills are highly interrelated; it emphasizes that visualization supports the transition to abstract thinking, especially in understanding how the mathematical concepts contained in figures or expressions are organized.

Conclusion

An increase in embedding digital competence in the school-wide curricula can be observed across the world since these skills are regarded as new ways for the students to engage with traditional subject areas (Sefton-Green, Nixon & Erstad, 2009; Hague & Payton, 2011; Murtafi'ah & Putro, 2019). For the Turkish context, the starting point of this study is that the Turkish education authorities declare the digital competence as one of the key competences to be acquired in schools. In the curricula documents it is also underlined that these skills should be reinforced by the teachers during instructions even though there is no explicit learning goal. From this point of view, this stress on digital competence by the educational authorities is meant to be investigated through official curricula documents as well the classroom activities.

As stated before, the curricula in Turkey are developed on the national basis so the first step was to investigate the curricula documents in terms of information, media and technology skills. Considering the possibility about the initiatives the teachers can take, observations and interviews were conducted. And the perceptions of the

students on their competence levels were also compared and interpreted. Among these skills, information and data literacy were a matter of content in terms of the curricula, observations, interviews and the results of the scale. However, communication and collaboration was not as emphasized as expected. In such a period when students engage in digital environments for long hours it is a handicap to turn a blind eye to those skills. It surely is not enough to expect these skills to be acquired only in ICT courses. Although students find their communicative skills moderate, it would be more sensible they attain the proper ways of digital communication during the course of their education.

Interwoven with communication, security is another competence dimension neglected in the curricula. Security issues should be integrated into the curricula as well as mainstream teaching activities so that students can follow safe ways while playing games, chatting or doing research in digital environments. In the study, the learning goals and activities related to digital content production were followed to a limit, but ethical issues such as copyrights and plagiarism took no notice in this regard. The curricula and various activities can highlight how students should approach content that is now very easy to access and respect work of others. In the report published by the European School Net in 2017, it was clearly expressed that the education system in Turkey adopted the skills within the DigComp framework for the students to raise as competent citizens of the age. In order to make the most of this framework, it is important that information, media and technology skills are included in the curricula in an interdisciplinary manner and teachers are supported for developing these skills in their teaching during classes.

Suggestions

It is seen that studies in the literature were carried out with either middle or high school students or teachers. This study is important as it clears the curricula, teacher opinions and virtual practices on information, media and technology skills as well as students' level of these skills both in middle and high schools. For further research, practical studies related to these skills may allow students to make a comparison between their actual skill levels and their perceptions of competency levels as information, media and technology competency scale is based on students' self-efficacy rather than hands-on skills. Future studies can be conducted to determine teachers' level of competency in information, media and technology skills and their ability to integrate information and communication technologies into teaching processes so that their competency and integration skills level may lead to fruitful in-service education.

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