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International Journal of Curriculum and Instruction 14(1) (2022) 655-678

IJCI
International Journal of Curriculum and Instruction

A research on the influences of the Covid-19 pandemic: The case of mathematics teachers' resource systems

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Abstract

This study was conducted to examine in depth the influences of the Covid-19 pandemic on the resource systems of mathematics teachers. This qualitative study is based on the documentational approach to didactics and is a case study conducted with two secondary school mathematics teachers teaching in the 7th grade. The research was limited to the subject of equations and equalities. Reflective analysis was used as a data collection method in this study. The data were obtained from the participating teachers in two stages, pre-pandemic and pandemic periods. Data in the first stage, which included the pre-pandemic period; consisted of the schematic representation of resources system for the face-to-face education period of the equations and equalities subject before the beginning of the online education and the semi-structured interview conducted before the online education of the subject started. The data of the second stage including the pandemic period, were obtained through the schematic representation of resources system prepared by the teacher at the beginning of the online education, and the video and audio recordings of the lessons in which the teacher taught the equations and equalities unit in a certain class with online education during the pandemic period. In the first part of the data analysis, the data obtained from the teachers in the pre-pandemic period were subjected to content analysis and the resources systems of teachers in face-to-face education was revealed. As a result of the examination of the schematic representation of resources systems prepared by the teachers in this section for the face-to-face education period and the analysis of the interview data, two themes, "General Habits" and "Special for Face-to-Face", were reached. In the second part, the data obtained from the teachers during the pandemic period were subjected to content analysis, and the teacher's resources systems in online education was revealed and two themes were reached: "General Habits" and "Special for Pandemic". When the resources systems of the teachers for the period in face-to-face education was compared with the resources systems for the pandemic period in the third section, the change in the documentation systems of the mathematics teachers during the pandemic was also revealed in detail. The results revealed that the duration of completing the unit has changed during the pandemic period, the variety of sources used did not change, but the type shifted from printed sources to z-book applications and benefited from much more technological tools than face-to-face education.

Keywords: Documentational approach to didactics, resource, mathematics teacher, Covid-19 pandemic, reflective analysis

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1. Introduction

The Covid-19 pandemic is an epidemic that has spread worldwide as of 2020 and has very severe consequences. Conditions that have a profound impact on the global scale, such as Covid-19, change people's lives on their own (Bozkurt, 2020). With the World Health Organization declaring a pandemic in 2020, life has been interrupted in many countries and various precautions have been taken against the pandemic. These precautions include closing schools and switching to online education. As Bozkurt (2020) mentioned, it is inevitable that education, which is a dynamic process, will also be affected by this great change. Teachers, who had to switch from face-to-face education to online education, had to change their teaching habits (Bozkurt, 2020).

Online education is an education method that has been used for a long time in many countries, including Turkey. Clark (2008) argued that online education is more effective than face-to-face education in various aspects. The report of United Nations Education Science Culture Organization (UNESCO, 2002) confirms this idea. The Ministry of National Education (MNE) and universities also benefit from online education for various purposes. While the Ministry of National Education provides education opportunities through open education schools to individuals who can not formally complete secondary or high school education, it also provides support to students in formal education through the Education Informatics Network (EIN). In Turkey, online education can be carried out effectively with mobile devices and computers (Bozkurt, 2017; Kirik, 2016; Somuncuoglu, 2005; Ruzgar, 2004).

Besides the benefits of online education, it is seen that there are also weaknesses. Basaran, Dogan, Karaoglu, and Sahin (2020) state in their research that online education is weak in terms of interaction, active participation in the course, suitability for individual differences, and technical problems and these need to be improved. Duzgun and Sulak (2020) similarly refer to inadequacies in terms of infrastructure, content, instructor and learner.

The applications of online education, which has benefits and limitations, in the period of Covid-19 pandemic in Turkey constitute the subject of this research. Considering that this period will last longer and may be repeated in different conditions in the future, it is important to examine the effect of the pandemic on the documentational processes of teachers.

1.1. Theoretical Framework

In this study, a documentational approach to didactics, which is based on the role of resources in teachers' work, was used (Gueudet, Pepin, & Trouche, 2012; Gueudet &

Trouche, 2009). Developed on the digitalization of information and communication (Basturk-Sahin, Tapan-Broutin, Trouche, Gueudet, and Pepin; 2020), this approach especially emphasizes the nature of the relationship between teachers and resources and the concept of the teacher's resources system. At this point, teachers' resources constitute the curriculum, text, material and personal resources that teachers use in their daily work, teaching or planning/preparing their teaching. A teacher is exposed to a wide variety of resources and interacts with these resources to prepare teaching.

The documentational approach includes three main concepts introduced by Rabardel (1995): instrumentation; instrumentalization and genesis. When the teacher interacts with a set of resources to perform a teaching task, this interaction combines two interrelated processes: in the instrumentation process, the selected resources support and influence the teacher's activity, and in the instrumentalization process, the teacher adapts the resources to his/her needs. This fruitful interaction between the teacher and a range of resources, guided by a teaching goal; through successive stages of design and implementation in the classroom; a hybrid entity emerges, a document. A document is a combination of resources used, the way these resources are used, and the mathematical knowledge underlying these uses. To understand the relationships between teachers and resources, it is necessary to consider all the resources that the teacher works with. These resources, which are shaped by teachers' practices, are called the teacher's resource system. In studies on teachers' resource systems, it has been observed that resource systems are structured according to different dimensions (Gueudet, Pepin, & Trouche, 2013): education level/classes; mathematical subject areas (for example, resources for teaching fractions); types of mathematical activities (for example, resources for working with students); the level of documentation of the design (for example, a resource downloaded from the Internet; adapted or designed by the teacher him/herself); and sharing status with colleagues (for example, unshared resources; or shared resources with specific colleagues).

The documentational approach makes use of some specific methodological tools to reveal teachers' views on the use of their resources. Among these, drawing the "Schematic Representation of a Teacher's Resources System" has an important place in showing the resources used by the teacher according to different activities (Pepin, Xu, Trouche, & Wang, 2016).

1.2. Related studies in the literature

As Anderson (2020) and Zimmerman (2020) stated in their studies, together with the Covid-19 pandemic a compulsory and the most comprehensive social experiment, which is thought to have a long-lasting echo, has been carried out with 6 billion students around the world (Azevedo, Hasan, Goldemberg, Iqbal, and Geven, 2020). As a result of

this period, it is inevitable that these experiences will have reflections on education in the long run (Bozkurt, 2020). Within these reflections, it is natural to find both positive (Ferdig, Baumgartner, Hartshorne, Kaplan-Rakowski and Mouza, 2020; Keskin and Ozer Kaya, 2020; Telli and Altun, 2020; Reimers and Schleicher, 2020) and negative (Basaran, Dogan, Karaoglu and Sahin, 2020; Duzgun and Sulak, 2020) examples. The important thing is to learn a lesson from what happened and to develop new approaches by critically evaluating it (Costello, Brown, Donlon, & Girme, 2020; Eren, 2020).

After the schools switched to online education due to the pandemic, which started to show its effect in Turkey in the first months of 2020, it is seen that there are many studies examining and evaluating this change in education. When the literature is examined, it is realised that some of the studies (Kavuk and Demirtas, 2021; Arslan and Sumuer, 2020; Denge and Sulak, 2020) focused on the disruptions in online education during the pandemic period and among these disruptions, technological problems were the foremost emphasized as a big problem for teachers trying to cover the lack of face-to-face education with technology. In addition to technological problems, there are also studies based on the situation of teachers. Metin, Gurbey and Cevik (2020) emphasized in their study that online education during the pandemic period increases the workload of teachers and eliminates the concept of free time for teachers.

In another group of studies, it is stated that the needs and habits of teachers in online education change and teachers feel the need to plan their lessons in more detail against these changes, the weight given to technological materials has increased, and solutions according to current conditions are produced (Ozcakir Sumen, 2021; Basaran, Dogan, Karaoglu, Sahin, 2020; Yavuz, Toprakci, 2021).

1.3. Aim of the research

Although a lot of research has been done in a short time about the online education period that has developed due to the pandemic, there are still many points to be investigated about such an effective and radical change. In this study, it is aimed to reveal the effect of the Covid-19 pandemic on the resource systems of mathematics teachers. For this purpose, answers to the following sub-problems were sought:

1. What are the resource systems of mathematics teachers in the face-to-face education period (before the Covid-19 pandemic)?

2. What are the resource systems of mathematics teachers in the online education period (during the Covid-19 pandemic)?

3. What are the similarities and differences of the resource system of each teacher in face-to-face education and online education?

4. What are the similarities and differences between the two teachers' resource systems?

2. Method

2.1. Model of the Research

This study is a case study, which is one of the qualitative research methods. Case study is a research design in which the researcher deals with a situation, process, action, event or individual in depth (Creswell, 2014). Since the aim of this study was to examine the documentational processes of teachers, case study was considered as an appropriate method. As suggested in the theoretical framework of the documentational approach, reflective analysis was used in this study as well (Gueudet & Trouche, 2009). Reflective analysis is a data collection technique that provides information about the birth and development of the documentation system both inside and outside the classroom (Basturk-Sahin & Tapan-Broutin, 2018). The fact that it requires long-term in-class and out-of-class follow-ups and handles a wide range of data; makes reflective review a suitable data collection technique for the research problem.

2.2. Study group

The study was carried out with two middle school mathematics teachers, one female and one male, who were teaching in the 7th grade of secondary school. Teachers' use of resources, document creation processes and documentation systems are directly related to their professional development (Gueudet & Trouche, 2009). Since the aim of the study was to compare the resource systems of teachers in the pre-pandemic period with the resource systems in the pandemic period, purposeful sampling was used in order for teachers to have professional experience with which they would have created their own resource systems before the pandemic. Since the teacher's experience should be more than 5 years in the selection of purposeful sampling and his/her own resource systems should have been formed in face-to-face education, it was thought to be necessary for the purpose of the research that teachers have attended 7th grades before. In terms of the reliability of the comparisons to be made in the study, it was also ensured that the teachers were working in a similar school type and had similar experience. One of teachers participating in the study, Ali teacher, is a 29-year-old teacher who has 6 years of experience, works at a public secondary school outside the city center in Sakarya, is married and has one child, and is a doctoral student in mathematics education. Selin teacher, on the other hand, is a 32-year-old married teacher with no child who has 10 years of experience, works at a public secondary school in a central district in Bursa, and has completed her master's degree in mathematics education.

2.3. Scope of the Study

In order to examine the teachers' resource systems in depth, subject restrictions were made in terms of applicability and this study was limited to the equations and equalities in the secondary school 7th grade curriculum, since this subject is suitable for the use of various resources. Subject is planned to be covered in 15 lesson hours (3 weeks) in the united annual plan prepared by the teachers.

2.4. Data Collection Tools

Reflective analysis was used as a data collection method in the study and schematic representations of teachers' resources systems; semi-structured interview including schematic representations of resource use, interactions with colleagues, professional development programs and resource uses are considered as data collection tools. Data triangulation was provided by observing the organization of teachers' work environments at home, the way in which digital files and printed materials on their computers (student's worksheets, excerpts from textbooks, agenda, etc.) were arranged, and course records.

The data to be used within the scope of the study were planned and collected in two groups as “pre-pandemic” and “pandemic period”. In order to prevent the data from being affected by the conditions during the pandemic period, care was taken to obtain the data belonging to the pre-pandemic period before the teachers started the online education of the subject of equations and equalities.

Schematic Representation of Resources Systems: Documentational approach to didactics; requires some specific tools to take advantage of teachers' views on the use of their resources. Chief among these are the schematics that a teacher draws as a schematic representation of the documentation system, showing the resources depending on different activities (Pepin, Xu, Trouche, & Wang, 2016). In this study, the schematic representations of teachers’ resources system were taken from the teachers as for pre-pandemic and pandemic period. The schematic representation of the pre-pandemic was created by the teachers before the online lessons has started, and the schematic representation for the pandemic period has revealed in two stages: created at the beginning of the lessons and organized according to the experience at the end of the study.

Semi-Structured Interviews: Interviews were conducted in a semi-structured way based on schematic representations of resources systems received from teachers and continued on the basis of 4 main questions. In determining these 4 main questions and their sub-headings, the factors affecting teachers' resource systems, which were stated by Gueudet, Pepin, and Trouche (2013) and mentioned within the theoretical framework, were taken as the basic framework, and the sub-titles of this basic framework were

determined as a result of the personal experiences of the researchers and interviews with field experts. Due to the social isolation during the pandemic period, interviews were held as phone interviews which lasted between 20 and 35 minutes and were recorded with the permissions of the teachers.

Working Environment: Data reflecting the physical and digital working environment were obtained from the teachers. Due to the social isolation period that occurred during the pandemic period, the physical working environment was obtained through interviews and location photos, and the digital working environment was obtained through screenshots and files shared by teachers from their computers.

Recordings of the lessons: It is stated in the curriculum that the subject of "equations and equalities" should be taught as a total of 15 course hours for 3 weeks in 7th grades of secondary school. In this study, the teachers recorded the lessons that they taught about this subject during the pandemic period, both visually and audibly. Lessons were processed and digitally recorded by one teacher using "TEAMS" and another teacher using the "ZOOM" application. Ali teacher devoted a total of 11 lesson hours to this subject and finished the subject earlier than planned; it was observed that Selin teacher, on the other hand, devoted a total of 20 lesson hours to this subject and finished the subject later than planned.

2.5. Data Collection Process

While planning the data collection process, it was taken as a basis that the experience gained in online education does not affect the data related to face-to-face education. For this reason, 20 days before the subject of equations and equalities was introduced in the online education period, the teachers were asked to prepare a schematic representation of the resources systems for face-to-face education on this subject, and then a semi-structured interview was conducted about the face-to-face education period before the online education period of the subject has started.

Then the teachers were asked to prepare a schematic representation of resources system for the online education period on the first day of the online education period. The reason for this schematic representation to be requested on the day the education starts, is that the teachers would have completed the preliminary preparation by planning the online education period. At the end of the training, the teachers were asked to share the digital documents (tests, videos), photos of their libraries and working environments, and the folders on their computers related to the subject, as well as to arrange the schematic representation of resources system they prepared for online education in line with their experiences.

2.6. Analysis of Data

After the data collection, the sources in the data obtained were examined in terms of material, mathematical and educational components, and the documentation systems of the teachers were analyzed in two groups as pre-pandemic and pandemic period. The task of summarizing the data by making a meaning according to the categories formed by classifying the data from a certain angle is called content analysis (Tavsancil & Aslan, 2001; Cepni, 2018). In the light of this content analysis, firstly the two situations were compared with each other and then the changes in the teachers' documentation were compared with each other, and the effect of the pandemic on the teachers' documentation systems was tried to be revealed.

2.7. Validity, Reliability and Ethical Concerns

Validity is one of the strengths of qualitative research. The use of multiple approaches is often preferred to increase validity. Different data collection tools are used to provide different perspectives to the researcher in data triangulation (Mclintock & Greene, 1985). Four different data collection tools were used in this study. In addition, the opinions of an external auditor, who is an expert in the field, was also sought in order to examine the study objectively and in multiple ways, to ensure that the research was evaluated objectively and thus to increase its validity. Considering the above-mentioned factors together, the validity of this study was ensured.

Reliability is also very important in qualitative research. Considering the suggestions of method researchers such as Creswell (2014), Gibbs (2012) and Yin (2017) to increase reliability in qualitative research; care was taken to record the process in audio, written and visual formats, and to cross-check with the external controller in order to ensure that the analysis and coding achieved are free from errors. In this way, reliability was ensured in this study.

Due to ethical concerns in the study, the voluntary participation of teachers in the study was provided, and the images and personal data in the course records were not shared under any circumstances. Teachers and students were informed about this issue and necessary permissions were obtained. For this purpose, the names of teachers were changed in the report.

3. Results

In the evaluation phase of the data obtained in this study, first of all, schematic representations of resources systems, interview data and course records were analyzed and codes were extracted. When these codes were examined, it was noted that the codes

obtained for both teachers concentrated on similar headings. These common and frequently encountered titles were determined as categories, and after the codes were grouped according to these categories, themes that would cover and represent the categories were revealed.

When the codes belonging to the pre-pandemic period were evaluated, it was determined that the codes were grouped as the pre-lesson period, which basically includes the planning of the lessons, and the period during the lessons, which directs the teaching of the lessons, and the special for face to face education codes. For this reason, the pre-pandemic period was handled in three categories as "planning the lesson" and "lecturing the lesson" were combined under one theme as they represent "general habits"; and the rest under one “special for face-to-face” theme.

It is seen that the codes during the pandemic period are the codes related to the attitudes and behaviors of the teachers towards the students, the practices related to the conduct of the lesson during the lesson, the technical problems experienced, the problems experienced by the teachers due to the pandemic conditions, and the positive/negative situations arising from the teachers' mathematical knowledge. These codes were grouped in the categories of "Approach to students", "Lecturing the lesson", "Situations related to technology", "Teacher behaviors in pandemic" and "Teacher's approach based on the subject", respectively. The codes related to the attitudes and behaviors of the teachers based on their mathematical knowledge were collected in the category of "Teacher's approach on the basis of the subject". When these categories are evaluated, it is seen that the categories of approach to students and teaching are gathered under one theme because they reflect the "general habits" of the teacher; situations related to technology, teacher behaviors in the pandemic, and the teacher's approach to the subject categories were found to be appropriate under one theme, since they are "pandemic-specific".

The following analyzes and tables have been produced according to these criteria.

3.1. Findings of Ali Teacher

3.1.1. Pre-Pandemic Period

In the first stage of the study, in line with the schematic representation of resources system created by Ali teacher for the face-to-face education period and the interview, while the teacher was preparing the lesson plans, he first examines the textbook and then creates his own plan from beginning to end; he updates the resources he uses during the planning phase every year; benefits from various printed and digital documents and presentations; it has been reached the codes that he takes care not to go beyond the gains in the curriculum and to use the specified time for that subject, and that he definitely tries to use concrete materials, and that he definitely makes use of the scales as material in the context of equations and equalities. After these emerging codes were grouped

under pre-mentioned categories, it was deemed appropriate to combine them under the theme of "General Habits". The codes of the exchange of ideas and sharing of Ali teacher with the colleague teachers and the use of the materials in the EIN in the activities were combined under the theme of "Special for Face to Face". As a result of this analysis, Table 1 was obtained:

Table 1. Analysis of Ali Teacher in the Pre-Pandemic Period

Theme	Category	Code
General habits	Planning the lesson	• While preparing the lesson plans, firstly examining the textbook of the MNE, and then creating his own plan from beginning to end,
		• He changes the resources he uses while preparing the lesson plan every year,
		• Course durations vary according to the grade level, but always allocate the time specified in the plan to that subject,
		• Cares not to give more than the gains specified in the curriculum,
	Lecturing the lesson	• He definitely tries to use materials, he mostly uses scales,
		• He used the videos he found on the subject from digital platforms,
		• Using various digital documents and presentations,
Special for face-to-face	Colleague communication in face-to-face education	• Opinions are exchanged about resources through sharing within colleagues,
	Additional resources in face-to-face education	• It is seen that the EIN is used in the activities.

3.1.2. Pandemic Period

In the second stage of the study, as a result of the examination of the schematic representation of resources system prepared by Ali teacher for the online education period, the interview and the analysis of the course records, the teacher always and frequently continues the new topics by connecting with the old learned ones, frequently addressing the students who do not attend the course and asking questions, lectures and important lessons. İn order not to forget the points, he included concrete and catchy examples, did not spend much time on lecture and simple examples, focused on solving

many examples, promised the students but continued the solution when they had difficulties, benefited from the MNE textbook, z-book and PDF tests, and suggested different solutions. It was observed that the teacher did not support his paths, tried to go in parallel by checking the annual plan he prepared, the teacher used expressions and explanations that would mislead the student in the long term, and could not fully understand what was given in the question in some of the questions he solved in the lesson. After these emerging codes were grouped under various categories, it was deemed appropriate to combine them under the theme of "General Habits". However, Ali teacher's use of mobile phone for homework control, instant question-answer studies and asking questions that are not understood, sending homework from EIN, giving instant feedback to parents from the Education Support Programs Center (ESPC) system, making video suggestions from YOUTUBE channels for parts that are not understood, experiencing misunderstandings due to audio conflicts in the lessons, combining consecutive lesson hours, leaving the computer for a while students are solving the test, using the spaces in the MNE book as a whiteboard, using the cursor to point like a finger, interacting with people in the environment, the need to check the students' attendance several times After grouping the codes under various categories, it was deemed appropriate to combine them under the theme of “Special for the Pandemic”. As a result of this analysis, Table 2 was created.

Table 2. Analysis of Ali Teacher in the Pandemic Period

Theme	Category	Code
General habits	Approach to students	• Frequently addressing and asking questions to students who do not attend the lesson,
		• He promised the students, but continued to solve the problem when they had difficulties,
		• Does not support the different proposed solutions,
	Lecturing the lesson	• Continuing the new subjects by making connections with the old ones,
		• Including concrete and catchy examples in order not to forget the lectures and important points (Football match example, Libra example, Turkish-Matish dictionary, “The little one goes to the feet of the elder”)
	Teacher’s approach based on the subject	• He does not spend much time on lectures and simple examples and focuses on solving many examples,
		• Tries to go parallel by checking the annual plan it has prepared,
		• Benefited from MNE textbook, z-book and PDF tests, understanding of the subject,
		• Uses expressions and explanations that will mislead the student in the

		long run.
		• In some of the questions that he solved in the lesson, he could not fully understand what was given and requested in the question,
Special for the pandemic	Situations related to technology	• Using a mobile phone for homework control, instant question-answer studies and asking questions that are not understood,
		• He sent homework from EIN,
		• Provides instant feedback to the parents from ESPC system,
		• Making video suggestions from YOUTUBE channels for parts that are not understood,
		• Experiencing misunderstandings in lessons due to voice conflicts,
		• Using the spaces in the MNE book as a writing board, using the cursor to point like a finger,
	Teacher's behaviors in the pandemic	• Combining consecutive lesson hours,
		• Students are away from the computer for a while, while they are solving tests in the lesson,
		• He interacts with the people in his environment,
		• Students feel the need to check their attendance a few times,
		• It is seen that he has difficulty in following the end time of the course

3.2. Findings of Selin Teacher

3.2.1. Pre-Pandemic Period

In the first stage of the study, in line with the schematic representation of resources system created by Selin teacher for the face-to-face education period and the interview, although the teacher uses concrete materials in some subjects, she does not need to use materials for the subject of equations and equalities, and she considers the materials necessary in case of concretization of abstract subjects that challenge the students; although she does not use concrete materials, she tries to increase the interest in the lesson and the comprehension of the subject with entertaining lecture videos; she takes into account the achievements specified in the curriculum but changes the order of the gains where she deems necessary; she does not care about the specified course times, she plans the time she will devote to the subject according to the level of the class; it is seen that she reflects her own habits, learning style and experiences to teaching methods and techniques. After these emerging codes were grouped under various categories, it was deemed appropriate to combine them under the theme of "General Habits".

Selin teacher does not directly benefit from any source while preparing lesson plans, she prepares a plan in line with her own knowledge without going into too much detail; the codes for determining the types of questions from the MNE book, EIN and other publications, making use of them during the preparation of the worksheet and giving the assignments from the MNE book were combined under the theme of "Special for Face to Face".

As a result of this analysis, Table 3 was obtained:

Table 3. Analysis of Selin Teacher in the Pre-Pandemic Period

Theme	Category	Code
General habits	Planning the lesson	• While preparing the lesson plans, first of all, the Ministry of National Education's textbook was examined, and then he created his own plan from beginning to end,
		• He didn't prepare the lesson plan in detail, only put it in order by examining the sources he used,
		• By changing the gain order, it starts with the conservation of equality first and gives a lot of weight to this part,
	Lecturing the lesson	• Does not use materials on concrete or simple subjects, but uses materials to concretize abstract subjects,
		• Following EIN and social media training groups,
		• Reflecting his own learning style to his teaching style,
		• His experiences and the institution he works for cause a change in his habits,
		• He did not use concrete materials on equations and equations, but made use of videos with entertaining narratives,
		• Adheres to the acquisitions that should be included in the lesson, but does not adhere to the durations, organizes the durations according to the characteristics of the class,
Special for face-to-face	Additional resources in face-to-face education	• Does not use a specific source in the lecture, but makes use of their own knowledge,
		• Benefited from EIN in worksheets,
		• It is seen that he used the MNE book for his homework.

3.2.2. Pandemic Period

As a result of the examination of the schematic representation of resources system prepared by Selin teacher for the online education during the pandemic period, the interview and the analysis of the course records; the teacher did not use concrete materials, benefited from the videos that would attract the attention of the students who supported the lecture, changed the order of the gains in the unit, took into account the gains given in the curriculum, but did not act appropriately to keep along with the time in the program, started by giving information about the unit and what to do in the lesson at the beginning of the unit and the lessons, often asked the students' opinion in the lessons and conducted the lessons with questions and answers, led the students to long discussions in the lecture videos, gave time for the students to take notes, made an explanation for not leaving students' questions unanswered, clarified the steps in the solutions by using different text colors, at the end of each lesson there was a report on what to do in the next lesson, gives interest to students, tries to make up for the lack of prior knowledge about a mathematics lesson or another lesson, helps students who have difficulty in solving questions, regulates the speed of expression according to students' understanding of the subject, encourages students to ask questions, and helps students solve questions at the end of the subject, after giving time she solves the question by discussing with students, encourage students to speak who are not willing to participate in the lesson, is open to different solutions, prioritizes students' understanding of the subject and often asks students' opinions about the solution. It was observed that she explained the subject from a different perspective and used expressions and explanations that would mislead the student in the long term. After these emerging codes were grouped under various categories, it was deemed appropriate to combine them under the theme of "General Habits".

The Selin teacher did not prepare a teacher's folder during the pandemic period, she made notes for the book instead of keeping a notebook for lectures, she used online resources to give homework, she chatted with the students while waiting for the class to attend the lesson and informed them about the course of the lesson, tried not to write too much, the voices spoke to each other., she had technical problems such as confusion, misunderstanding of what was said, she could not do some activities in the book because they were not suitable for online practice, she took a screen shot with her mobile phone to take attendance, asked the student the solution of the problem in solving sample questions, the teacher wrote the solution on the screen as the student said, she was too tired in the evening classes, progresses slowly until class participation increases, warns the student who forgets his microphone on, transmits homework solutions to students via mobile phone, starts the lessons ahead of time and is prepared until the students arrive. After the codes were grouped under various categories, the codes that the teacher emphasized in the lessons were grouped under various categories. It was deemed appropriate to combine them under the theme of "Special for Pandemic".

As a result of this analysis, Table 4 was created.

Table 4. Analysis of Selin Teacher in the Pandemic Period

Theme	Category	Code
General habits	Approach to students	• Allowing time for students to take notes,
		• Students do not leave their questions unanswered,
		• clarifies the steps in the solutions by using different text colors,
		• In cases where the student has a lack of prior knowledge, he tries to make up for this deficiency,
		• Helping students who have difficulties in problem solving,
		• Encourages students to ask questions,
		• He also promised to the students who did not take their word to support the participation in the lesson,
		• Being open to different solutions,
		• Frequently asking students' opinions about the solution,
	Lecturing the lesson	• Does not use tangible materials,
		• Benefited from videos that support the lecture,
		• Changes the order of the gains in the unit,
		• Considering the gains given in the curriculum, but not acting in accordance with the time in the program,
		• At the beginning of the unit and lessons, it starts by informing about what will be done in that unit and lesson,
		• Asking the opinions of the students and conducting the lessons with question and answer,
	Teacher's approach based on the subject	• Watching lecture videos and leading to long discussions in between,
		• At the end of the lesson, he gives information about what to do in the next lesson,
		• Organized the speed of expression according to the students' understanding of the subject,
		• At the end of the topic, students are given time to solve the questions,
		• It prioritizes students' understanding of the subject,
		• In cases where the student has difficulty in understanding the subject, he explains the subject from a different angle to the student, even if he does not make gains,

		• Using expressions and explanations that will mislead the student in the long term,
Special for the pandemic	Situations related to technology	• Trying not to write too much, • There are technical problems such as mixing of sounds, misunderstanding of what is being said, • Some activities in the book cannot be done because they are not suitable for online application, • Taking a picture of the screen with a mobile phone for the purpose of polling, • Warns the student who forgets the microphone volume is on, • Delivering homework solutions to students via mobile phone,
	Teacher's behaviors in the pandemic	• The teacher did not prepare a personal file, • Using the MNE book for lecture, • He uses online resources for homework, • While waiting for the students to attend the lesson, chatting with them and informing them about the course of the lesson, • In the solution of sample questions, the student asks the solution of the problem, the teacher writes the solution on the screen as the student says, • Being too tired in evening classes, • It progresses slowly until class participation increases, • It is seen that he starts the lessons ahead of time and prepares and waits until the students arrive.

4. Discussion

In this section, the findings will be discussed separately as “pre-pandemic” and “pandemic period”. In the continuation, the results obtained for the pre-pandemic period will be compared with the results obtained for the pandemic period, and the change in the documentation systems of the teachers will be revealed and discussed. Discussions will be made primarily by emphasizing the common points in the findings obtained from the two teachers, and then within the framework of the points where the teachers differ from each other. At the end of the chapter, recommendations will be made based on the results of the study.

4.1. Pre-Pandemic Period

In the first stage of the study, which examines the pre-pandemic period, the findings of Ali teacher and Selin teacher regarding the face-to-face education period before the pandemic were compared. It is seen that they benefit from different printed sources, mainly EIN. The results obtained here are in line with the result of Kocaoglu Er, Yildiz, Tapan Broutin (2019) in their study that there are factors such as MNE resources, textbooks, source books, classroom conditions effecting the resources systems of teachers.

The fact that Ali teacher exchanges ideas and shares with the colleague teachers and uses the materials from EIN in the activities and that Selin teacher follows the education groups in EIN and social media shows that the teachers care about and follow the ideas of their colleagues. Parallel to many studies (İsik Sarioglu, 2020; Tapan Broutin, 2017; Assis, Gitirana, & Trouche, 2018, Kocaoglu Er, Yildiz, Tapan Broutin, 2019) revealing that the education they receive at the university is effective in teachers' resources systems, the ideas and shares of teachers from their colleagues is also seen effective in resource usage.

On the other hand; while Selin teacher goes beyond the recommendations in the curriculum in terms of the time management she will devote to the subject and the order of achievements, it is seen that Ali teacher avoids such changes. While this contradicts the conclusion of Aslan and Erden (2020) in their studies that the education level of the teacher affects the commitment to the curriculum, it coincides with the conclusion that the most criticized point in the curriculum is duration. While Ali teacher prefers to use tangible materials and digital resources, it is noteworthy that Selin teacher does not use both. Akmese (2020) also mentioned in her study the differences in teachers' approach to digital resources and stated that some teachers approached the use of technology with a distance.

4.2. Pandemic Period

In the second stage of the study, which deals with the pandemic period, when the findings of Ali teacher and Selin teacher regarding the online education period during the pandemic period are compared, it is seen that both teachers benefit from technological resources, produce solutions to the deficiencies they experience in online education within the framework of technology, in parallel with this, they encounter technological disruptions, and to increase students' participation in the lesson. It is seen that they also encourage students to speak who are not willing to participate in the lesson, often give feedback to students, support students who have difficulty in solving the question, and use expressions and explanations that will mislead students in the long run. Kavuk and Demirtas (2021), Arslan and Sumuer (2020), and Denge and Sulak (2020) also mention in their studies that teachers overcome the deficiencies they experience in online education with technology and experience technological disruptions in this period. The fact that teachers prepare their own programs and follow them in parallel is in line with the conclusion reached by Basturk Sahin (2015). In addition, it is seen that teachers' use of different printed and digital resources is in parallel with the studies on this subject (Ozmantar, Dapgin, Cirak Kurt, Ilgun, 2017). The homework and videos given by the teachers to their students from EIN and various sources are compatible with the schemes envisaged by Basturk Sahin (2015). On the other hand, the findings that the teachers closely follow the students and inform the parents about classroom management do not overlap with the conclusion that the student-related problems mostly occur in the mathematics lesson and that the negative and irrelevant reactions of the mathematics teachers are not effective in solving the problems, as stated in the study by Erol, Ozaydin, and Koc (2010), it is noteworthy that the teachers participating in the research, staying out of this generalization, are interested in the students as closely as possible. Konyalioglu, Ozkaya, and Gedik (2012) state in their study that teachers may find inadequacies in their field knowledge and these inadequacies may cause them not to notice the mistakes they and their students make. This result is in line with the findings obtained from the teachers in the current study.

However; it is noteworthy that while Ali teacher prefers to use technology much more, Selin teacher uses technology less, while Ali teacher concentrates on many example solutions, Selin teacher concentrates more on comprehension, while Ali teacher tries to comply with the times in the lesson plan, Selin teacher does not care about complying with the durations in the lesson plan. Dikbayir and Bumen (2016) also concluded in their study that teachers made changes in learning outcomes according to student level. In addition, it is observed that Selin teacher is tired in evening classes. Metin, Gurbey and Cevik (2020) also emphasized in their study that online education in the pandemic period increases the workload of teachers and eliminates the concept of free time for teachers.

4.3. Change in Teachers' Documentation Systems During the Pandemic Period

When the change in the documentation systems of Ali teacher and Selin teacher "during the pandemic period is compared; the commitment of both teachers to the curriculum did not change during the pandemic, and the specific examples or methods they used in teaching did not change; besides both of them turned to digital books and materials in their resource use and started to benefit from technology much more both in teaching and in communication with students. This result is in line with the result of İsik Sarioglu (2020)'s study that the use of resources is shaped by the increase in teachers' professional experience. The fact that teachers' commitment to the program does not change is compatible with the result of determining the commitment to the program, which is revealed in many studies on the factors affecting the program commitment, by factors that will not be affected by the pandemic, such as the development of the teacher and the level of education he/she works (Bumen, Cakar, Yildiz, 2014; Burul, 2018; Dikbayir, Bumen, 2016). In addition, although the variety of sources used for both teachers did not change, it was concluded that the type shifted from printed sources to z-book applications and benefited from technological tools much more than face-to-face education. Ozdemir Baki and Celik (2021), in their study, revealed the desire of teachers to increase their communication ways in online education during the pandemic period and concluded that technology can be a solution to this problem. In similar studies (Basturk Sahin, 2015, Basturk Sahin, Tapan Broutin, 2018, Kocaoglu Er, Yildiz, Tapan Broutin, 2019), it is seen that the result that teachers' resources system is affected by the conditions of the classroom and school also shows its effect under pandemic conditions.

However; Ali teacher shortened the time to complete the unit during the pandemic period, Selin teacher used the MNE book throughout the course in online education despite not using the book in face-to-face education, had an unprecedented time loss due to the expectation that student participation would increase at the beginning of the lesson, and there was very little writing in the explanation of the subject due to the difficulty of typing on the screen with the mouse. The changes in the needs and habits of teachers in online education, the fact that teachers plan their lessons in more detail, increase the weight given to technological materials, and produce solutions according to current conditions is a result encountered in different studies (Ozcakir Sumen, 2021; Basaran, Dogan, Karaoglu, & Sahin, 2020; Yavuz & Toprakci, 2021).

5. Recommendations

This study was limited in terms of the study group and the subject examined. Considering that the readiness of the students, the age and the level of abstraction of the subject will affect the documentation of the teacher; for similar researches to be carried

out in different study groups, different subjects and different teaching levels, it is thought to be useful in terms of deepening the subject and revealing it in more detail.

In addition, at the time of this study, the long-term effects of online education could not be observed yet. Similar studies to be carried out in the future may be a good resource to consolidate and review the results obtained from this study, considering that the experience of teachers in online education will increase over time and their documentation will improve.

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