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# Investigation of the usage of digital and non-digital resources in the transition from being teacher candidate to teacher

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*This study aims to investigate the resource usage of teachers from the beginning of their careers. For this reason, first, we examined the digital and non-digital resources of the teacher candidates. After two years, we studied with the same group to examine their resources while they were teachers. In this phase, we utilized Documentational Approach to Didactics (Gueudet & Trouche, 2009) as the framework and we designed the study as a case study with two mathematics teachers that were mathematics teacher candidates. We used the reflective investigation method. As a result, teacher candidates used digital resources in a more personalized way. When they became teachers, it was observed that they tended to use interactive e-books. Also, teacher candidates tended to use university textbooks and the resources that their advisors suggested. When they became teachers, they tended to use the resources that the ones accurate for the national exam system.*

*Keywords: Documentational approach to didactics, resource usage, teacher candidates, teachers.*

## Introduction

Teachers utilize both digital and non-digital resources in their teaching. Also, their usage of those resources can switch according to certain variables, such as classroom conditions, student attention, etc. While using those resources and selecting and organizing them, teachers are actually designing both their lessons and their resources at the same time (Brown, 2009). However, not only teacher affects the lesson and the resources, but also, the lesson and the resources can affect the teacher. This is an interrelationship between the teacher and the tools (Trouche et al., 2020).

Some of the resources diffuse the teacher's teaching day by day, but others can fade away. This happens with or without the consciousness of the teacher, but there are certain factors affecting teachers' choices. In this study, we aim to investigate the teachers' non-digital resources as well as digital resources and we try to examine the factors affecting usage of them in transition from being teacher candidate to teacher. The problems that guide this research are in the transition from being teacher candidate to teacher:

- What are the resources the use of which has ended and continues?
- What are the resources whose usage schemes remain the same and change?

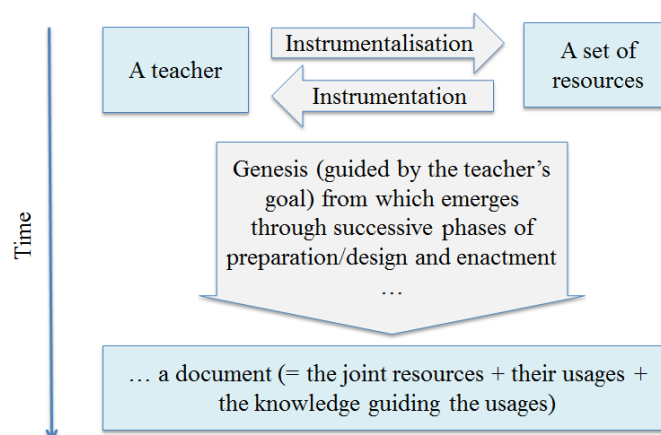
## Theoretical Framework

Considering that the resources used by teachers can be both digital and non-digital, it is important to use a theoretical framework that allows examining all kinds of resources in such a study that examines the resources used by teachers in the transition from being teacher candidate to teacher. For this reason, Documentational Approach of Didactics (DAD) (Gueudet & Trouche, 2009) framework was used to guide this study.

For a better understanding of the framework, one would need to clear all the concepts special to the framework. The first of those concepts is a resource. A resource can be thought such as a tool (Adler, 2000), but it is more than a tool according to DAD. For example, teachers' drawings on the blackboard can be a resource (a tool) and also students' responses can be a resource, too. Teachers use several resources in their daily work for teaching. This work can include selecting, modifying and creating new resources. According to DAD, this work is called documentation work and the outcome of it are teacher documentation. In their documentation work, teachers utilize both the text resources (e.g. textbooks, teacher guiding books, workbooks) and digital curriculum resources (e.g. digital interactive books, technological tools).

One of the concepts of DAD is a document and it consists of resources and their usage schemes (Vergnaud, 1998). A scheme is a teacher's stable organization of their activities, for a given class of situations. A scheme has four components: (i) the aim of the activity, (ii) operational invariants, (iii) rules of action, (iv) possibilities of inferences. In DAD, schemes are considered as usage schemes of resources. All the resources of a teacher, form their resource system (Ruthven, 2007). When the resource system is associated with the usage schemes, they form the document system together.

In this study, DAD was chosen as the framework because it allows us to evaluate a larger collection, considering not only digital resources but all kinds of resources available to teachers. This holistic approach is thought to lead to a broader view of the relationship between the teacher and resources (see Figure 1).



**Figure 1: Documentational genesis process in DAD (Trouche et al., 2020, p.3)**

As seen in Figure 1, DAD focuses on the relationship between teachers and their resource system. As well as special concepts, there are special names of the processes for teacher's relationship with resources. When the requirements of the resources influence teachers' practice, the process is called instrumentation. When the teachers' aims and knowledge lead to their choices and changes on their resources, the process is called instrumentalization. And the DAD suggests that these processes work both ways. In time with the ongoing instrumentation and instrumentalization processes and the usage schemes of the resources, teachers create documents which is called documentational genesis.

## **Research Design**

In this study, we utilized qualitative research methods to be able to investigate the usage of the resources in detail. The study was designed as a case study. And reflective investigation approach was adopted as a data collection method.

### **Participants of the case study**

In this study, we studied with two teacher candidates and followed them when they started teaching. The teacher candidates, Mary and Keira (pseudonyms) were not the best technology users or with the most resources. Mary and Keira were willing to share their work with resources and were able to introduce their usages in detail. Also, they were volunteering for the lesson preparation sessions as an extra activity. That's why we chose them for this study to investigate their resources. So the sampling method is criterion sampling method and the criterion are: (i) Being in the last year of undergraduate education in the 2016-2017 academic year, (ii) those who have taken the courses "Field Papers in Mathematics Education" and "Teaching Practice", (iii) to be appointed as a teacher to public schools affiliated to the Ministry of National Education (MoNE) in 2018, (iv) being volunteer for the study.

### **Mary**

Mary is a teacher who has drawn the attention of researchers with her studies even before the research. She came to the fore during her student years in terms of both the scores she got from the exams of the courses related to mathematics teaching and the emphasis she made on the notes she took during the lessons. Another remarkable point about Mary is that she attends classes like a teacher. She has become a student who feels like she will tell her students what she has learned after leaving the class. Mary has been a student who has attracted the attention of the instructors, especially while teaching lessons that require exemplary lectures. During the example lecture, she had no problems while controlling the class and giving appropriate answers to the questions asked. She was also able to use applications such as the Cabri Geometry on the smartboard in the teaching practice as needed and gained the appreciation of her mentor teachers. It is noteworthy that there is great diversity in her teaching practice file in terms of resource use. Mary generally accepted teachers as resources, even contacted teachers who own resources shared on websites, tried to learn how they used these resources, and sought alternative teaching methods for different courses.

### **Keira**

Keira is a teacher who has come to the fore with her desire to use different materials in teaching lessons during her student years. Keira, like Mary, has shown outstanding success in teaching lessons, especially drawing attention to designing and using teaching materials that can be used in lessons. The teaching materials designed by Keira drew attention as they were suitable and durable for student use as they would be used in the classroom, and she stated that he wanted to use these materials when she became a teacher. She showed outstanding success both in teaching courses and in pure mathematics courses. She was able to successfully use smartboard applications in her teaching practice course. In addition, Keira's resource system is quite extensive, often containing resources for

different teaching materials. In addition, Karen also used the resources recommended by her mentor teacher in her teaching practice and added them to the resource system.

### **Method of data collection**

We utilized the reflective investigation method which is suggested by Gueudet and Trouche (2009) for those to use DAD. There are some principles of the method (Trouche et al., 2020, p. 6):

- Broad collection of the resources,
- Long-term follow-up,
- In- and- out-of-class follow up,
- Reflective follow up,
- Confronting teachers’ views on the documentation work and the materiality of it.

According to these principles we utilized semi-structured interviews, schematic representations of resource systems (SRRS), teaching practice files, interviews on the lesson preparation, lesson observations, and recall sessions. Semi-structured interviews and SRRS diagrams were handled together, because we used the semi-structured interview to understand the resource system better. All the interviews were audio-recorded. The SRRS diagram is a data collection tool that is “not structured for the researcher but it is structured for the participant” (Trouche et al. 2020). In other words, we did not structure the diagrams, they did draw their own SRRS diagrams to explain their resource system.

**Table 1: Data Collection Methods according to the Reflective Investigation Method**

<b>Reflective Investigation Steps</b>	<b>Data Collection Methods</b>
Broad collection of the resources	SRRS diagrams
Long-term follow-up	Teacher candidate and teacher observations
In- and- out-of-class follow up	Teaching practice files
Reflective follow-up	Interviews and Observations of the lessons and lesson preparations
Confronting teachers’ views on the documentation work and the materiality of it	Recall Session

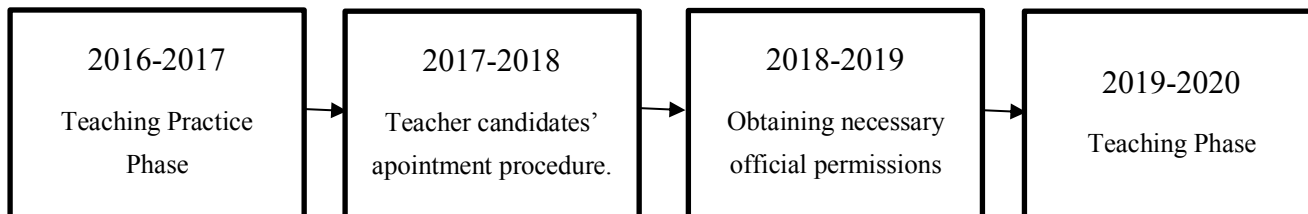
Teaching practice files were used as a written interview about what they realized in their teaching practice classes. This data collection tool did not use when the time they were appointed as teachers. Semi-structured interviews were used instead.

Both before their teaching practices and teaching sessions, we interviewed them about how they planned their lessons, then we observed them in the lessons. In the observation, one of the researchers took field notes and the lesson was video-recorded, too. After the lesson observations, we planned a recall session to get the interpretations of their own lessons.

### **Data collection procedure**

Data collection of this study started in the 2016-2017 education term. In 2016-2017, teacher candidates were in their teaching practice year and the first data was collected. Afterward, a two-year

break was given for the appointment of teacher candidates and for obtaining official permissions from their schools. And in the 2019-2020 term, data collection has completed while they were teaching in their own classes (see in Figure 2).



**Figure 2: Data collection procedure**

Teaching practice files of pre-service teachers who took the course were collected and analyzed. At this stage, the files of all teacher candidates who took the course were examined. However, after the participants were determined, the files of the selected participants were included in the study. Each participant's lesson was observed for 4 hours before the teaching period and 25 hours after being actual teachers, during the lesson observation, the researcher sat in the back rows like a student and took notes and did not interfere with the process. In addition, the lessons were recorded in order to prevent data loss and to be able to re-examine during the analysis. After all the lesson preparations, observations, and interviews, a recall session was organized in order to realize reflective remarks.

### **Data analysis**

The audio-recordings and video-recordings of the interviews and lessons were transcribed. Initial coding was based on the resources and their usages of the participants. We focused on DAD's key processes- instrumentation and instrumentalization. When we realize that there could be such a process, we coded it accordingly and checked it in the recall session. Because there were a lot of data collection tools, we followed the instrumentation and instrumentalization processes during the coding. This is in line with Yin's (2009) approach about using a framework to be able to do systematic coding.

The use of various data collection tools was in order to enhance the trustworthiness of the findings. Triangulation was employed to cross-check the conclusions. The triangulation was between the interviews, observations, and recall sessions.

### **Findings**

#### **Teacher candidate phase**

When Mary and Keira were teacher candidates, they were using smartboards in their teaching practice lessons. However, they both did not mention it in their SRRS diagrams (see Figure 3 and Figure 4).

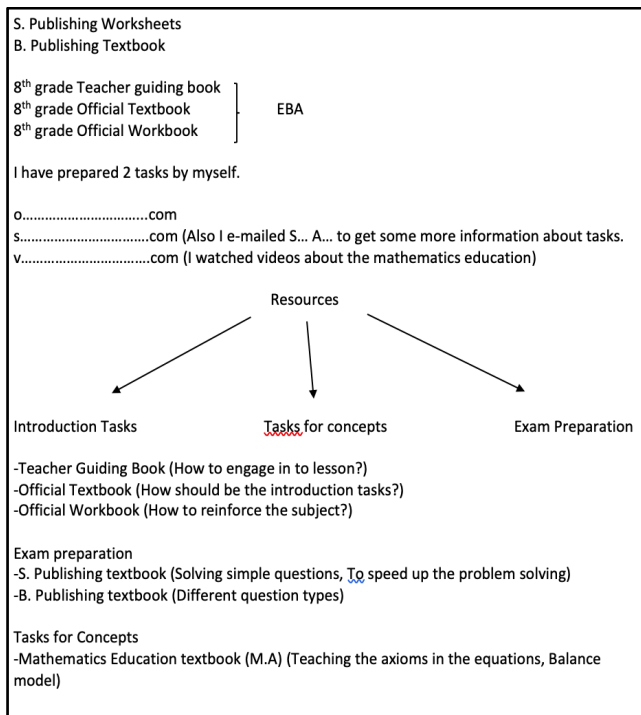


Figure 3: Mary's SRRS diagram

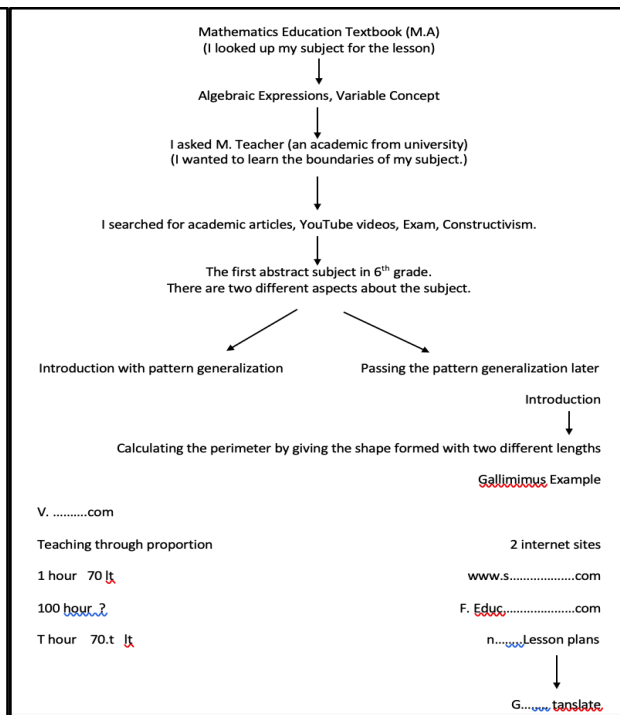


Figure 4: Keira's SRRS diagram

In Mary's lesson in her teaching practice, she used a balance system to emphasize the inequality concept. Even if she utilized a special program in the smartboard, she used only the pictures to demonstrate the systems she would like to exemplify.

In Keira's lesson in her teaching practice, she used a picture and brought concrete material in the class. She utilized a special program in the smartboard, but she generally used the smartboard just for demonstration. Additionally, she used a concrete material of the picture she shared on the smartboard.

In the interviews, they both mentioned that they used a specific smartboard program to be able to teach an effective lesson. And they emphasized that both of them designed their sessions all by themselves. They mentioned only the resources they used while designing.

### Teaching phase

Mary and Keira utilized the smartboard in their teaching, too. But this time, they both mentioned smartboard in their SRRS diagrams. In the teaching phase, according to lesson observations, they used interactive e-books in their lessons. But, while Mary's students have also textbook of the same e-book, Keira used the e-book only on the smartboard. Mary stated her situation as follows:

Researcher: Mary, you use an e-book on the smartboard. But, as I see, the students follow the lesson from their own books. Did you arrange it?

Mary: Yes, I asked them to buy this book. I also get the same book's teacher book version and e-book. Thankfully my students were able to get the book. Time is so important for us. And thanks to this e-book, I can complete all the aims in the curriculum. I also use another textbook with this e-book. When I want to give different examples about the national exams, I use that book. At that time, I close the smartboard and write the questions on the blackboard.

As it can be understood from the transcript, Mary combines the e-book with another book. But she used them for different aims. When she wants to solve harder questions for national exams, she closes the smartboard and the e-book for a while. In this situation, we can see the instrumentation process of DAD.

Also, Keira mentioned that her students could not get the students' book. That's why she explained that she could not use the students' book in the class. But she used the e-book for demonstration.

Researcher: Keira, you use an e-book on the smartboard. But the students have another book, not the same as the e-book?

Keira: Yes, I asked them to buy the students' book. But some of my students get and others were not able to buy the book. So, I cannot use the students' book in the class, but I use the e-book. At least I don't have to write the questions to solve on the board. I am already late in the curriculum.

It can be understood from the transcripts that they use the smartboard to gain time for the goals of the curriculum. When examining the transcripts, we can see that Keira limited her own usage of the e-book, because the students' book is not available for her students. This points out to instrumentation process of DAD. There were some notes on the teachers' book of Keira, which shows some definitions of mathematical concepts. In this case, we were able to see an example of the instrumentalization process, that Keira used her own definitions for the mathematical concepts in the teacher's book of her e-book.

## **Discussion and Conclusion**

In this study, we aimed to investigate the digital and non-digital resources in the transition from being teacher candidate to teacher. As a result, one of the resources, the smartboard, remained the same for both of the participants. However, the usage of it differentiated when started teaching. They used interactive e-books in their teaching, even if they did not use any e-books before. Also, the way both participants use these e-books is different from each other. Mary, for example, used the smartboard for speeding up the problem-solving. However, Keira used it both for the e-book and as a music and video player. They basically explained that their initial aim is to be able to catch the curriculum (Şahin, 2010). In their opinion, the curriculum is congested and they have to catch the curriculum as well as they have to catch their colleagues.

In this study, instrumentation and instrumentalization processes were also detected. According to their own aims and knowledge, they were able to revise their resources (instrumentalization process). For example, Keira was noted her own definitions for some mathematical concepts on the e-book she used. Also, she noted some rhymes about divisibility rules to remember them quickly. And Mary noted her own draft exam questions on her teachers' book. And she presented them using the smartboard.

Also, they were able to revise their own lesson practice to use that specific resource they aimed to use (instrumentation process). For example, Mary used another textbook for the national exams, and she needed to close the smartboard for this usage. Since she was not able to use the other book on the smartboard, she closed it and continued with the blackboard. Even if she stuck to the e-book most of the time, she changed her own practice.



Therefore, it can be said that they used the smartboard just for demonstration while they were in the teaching phase. They did not use its qualifications as a smartboard. So, we can say that they used the smartboard as a resource when they were teacher candidates, but they just used it as an educational technology when they were teachers (Adler, 2000).

Another result is that teacher candidates tended to use university textbooks and the resources that their advisors suggested. When they became teachers, they tended to use the resources that their colleagues used and the ones accurate for the national exam system (Gueudet et al., 2013).

## **Acknowledgment**

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