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Different Types of Resources Used by Master Students Considering Their Thinking Styles

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Abstract

The aim of this research is to determine the different types of resources, regarding the thinking styles, used by mathematics teachers to create an a-didactical situation using a video-game from an essential resource. In this research embedded mixed method was used. Participants were ten teacher-student-researchers, studying at the master degree program at a university in Turkey. The data obtained is analyzed regarding thematic analysis and descriptive statistic. The assignments were analysed in three categories; teacher resources, student resources, and researcher resources. It was found that assignments were used two types of resources, namely "teacher resources" and "student resources". There were no assignments that used "researcher resources. Also, it was also found that the legislative forms, hierarchic and monarchic forms, local levels, external scopes and liberal leanings were dominant among the students. It is suggested to increase the work to put forward the researcher identities in teacher-students' education at the Universities.

Keywords: thinking styles, minecraft, documentation approach, mathematics teachers, master's degree students

1. Introduction

Recent years, studies have been conducted to analyse the resources that students use for their learning and the process of documentation genesis from these resources (Schacht 2015, Ruthven 2017, Gueudet & Pepin 2018). The documentation approach to the didactics of mathematics (Gueudet & Trouche, 2010) focuses on the analysis of the document development process for teaching and learning, using a set of resources. According to this theoretical framework, the genesis and the construction of documents are realised by the use of the resources and thus by the schemes of use of these resources. The concept of the document can be expressed as follows:

Document = Resource + Utilisation Schemes.

The process of construction of document is dynamic. A document contains as many resources like links to each other and can generate many other documents. The utilisation schemes can be a fixed organisation for certain conditions, or they can be recreated during documentation genesis. The utilisation schemes can also be transferred to other contexts, adapted to new situations, and combined with other schemes. (Gueudet & Trouche, 2009). The documentation genesis process is shown in the theoretical framework in Figure 1.

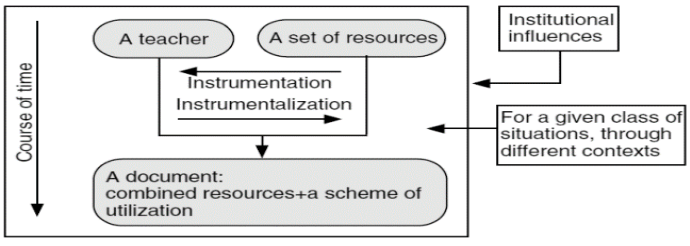


Figure 1. A representation of documentation genesis (Gueudet & Trouche, 2009)

The documentation approach, analysing the transformation process of resource into documents for teachers, supports the idea that the document construction process has a significant effect on teachers' professional development. The role

of the teacher is no longer to be the holder of the knowledge but to be a conductor who will organise activities during which the learner will carry out actions with a goal, actions in which he will build himself know it. In this perspective, in the didactics of mathematics in the late 90s, Brousseau sublimates constructivism in the didactics of mathematics with his theory of didactic situations. His theory was based on several key elements. He first considers the notion of an environment, which is in a way all that is interacting with the learner in the classroom. "The middle is all about who or what the learner is acting on. The "milieu" is everything that acts on the learner. The "milieu" is everything with whom or what the learner is acting on."(Brousseau, 1998). The second key notion is the notion of situation. It determines three types of situations: the didactic situation, a situation whose purpose is to teach, a non-didactic situation, i.e. a situation devoid of any teaching intention, and the a-didactic situation, i.e. a situation where the intention of teaching is not explicit at first sight for the learner. Thus in the a-didactic situation, the teacher will set up fun activities whose objective is defined by the nature of the game itself. The third key notion is the concept of the didactic contract which "describes the implicit or explicit rules governing the sharing of responsibilities, relative to mobilised or structured knowledge, between the teacher and the student. It is, therefore, a representation of expectations on both sides."(Marc, 2014, p.40). This didactic contract limits the actions of learners to ensure the smooth running of activities. Since the advent of video games in three dimensions, many studies have focused on studying the contributions of the integration of video games in pedagogical sequences using a constructivist approach (Pelay, 2011).

According to the constructivist approach, all knowledge is constructed through a state of instability in real problems' situations. The subject of constructivism in higher education is even more complex when it comes to a postgraduate degree in the formation of teacher-researchers. This complexity stems from the fact that teacher-students have a triple institutional status: the status of the teacher in an educational institution, the status of student and learner in the third cycle in which they pursue their studies and the status of a researcher. The work of the student-teachers is on the one hand to meet the expectations of the institution of 3rd degree at the university and on the other hand to enrich their teaching practices in their profession of "teacher"; it is also to be able to develop schemes related to educational research in order to write a master thesis. In this problematique, we pay special attention to the interrelationships between thinking styles and the types of resources preferred by teacher-students in the institution "master's course". The resources used by both teachers and students are crucial to improve themselves in their profession and to achieve the goals they have set for themselves. There exist various studies in the literature, on resources that teachers use spontaneously during their lessons or on resources used during the preparation process of their lessons before their classes (Drijvers & Trouche 2008; Bueno-Ravel & Gueudet, 2009; Aldon, 2010; Shaaban, 2014; Pepin 2015; Gonzalez-Martin, Nardi & Biza 2018; Wang 2018,). In the digital age, the technology that has become a part of our everyday life is in education as digital-based learning (DBL). According to Erhel and Jamet (2013), digital game-based learning (DGBL) is a competitive activity that determines the educational objectives that will encourage learners to acquire knowledge. However, learning with play can be designed to encourage the development of cognitive skills, or it can be in the form of simulations that allow students to practice in the virtual environment. The potential of learning from games as instructional tools continue to be acknowledged by a diverse range of educators, educational researchers. Because it is known that computer games have a positive effect on students' performance in such as social sciences and mathematics (Annetta, Mangrum, Holmes, Collazo & Chang 2009; Huizenga, Admiraal, Akkerman, & ten Dam, 2009; Chang, Evans, Kim, Norton & Yavuz Samur, 2015). Sqire (2005) notes that teachers need to know how to use digital games to support education, as well as know how to make effective use of changing favourite games as an educational tool. Freitas (2018) emphasise that considering games do enhance student motivation, are engaging and can be associated with behavioural change, more active design studies are needed to ensure that the best interests of the learner are met in different contexts. This media is all the more suitable for setting up a didactic situation since it has rules predefined by programmers. The player will have the feeling of freedom, but it will be freedom limited by the characteristics of the game and also by the constraints defined by the learning activity prepared by the teacher. Thus, in any video game used for didactic purposes, there is, on the one hand, a tacit contract, on the rules, which one feels obliged to respect by the game; and on the other hand, a didactic contract related to the expectations of the teacher proposing the didactical situation in the ludic environment.

Teaching methods used by teachers in thinking, perception, information processing and meaningful learning of students are essential, and one of the most important factors affecting this choice is the perceptual dimension of thought (Duman & Celik 2011). A style of thinking is a preference for using abilities in certain ways and the way one likes to utilise abilities (Sternberg & Zhang, 2005). Sternberg (1990) emphases that teachers' thinking style often affect their teaching and they tend to teach, develop test and create assignments that reflect their preferred thinking styles. He refers to his theory as the theory of mental self-government which is the notion that people need somehow to govern or manage their everyday activities. Sternberg's defined 5 dimensions and 13 thinking styles grouped under these dimensions in the theory of mental self-government: functions (legislative, executive, and judicial styles), forms (hierarchic, oligarchic, monarchic, and anarchic styles), levels (global and local styles), scopes (internal and external styles), and leanings

(liberal and conservative styles) (Zhang 2002). Sternberg and Zhang (2005) stated that the theory of styles applies to education but also to other domains of personal and professional life.

If one of the objectives of the "university" institution is to train university students, another objective is to train researchers engaged in scientific research in the field. Even though there is research on university teachers' resources and documentation work (Biza, Giraldo Hochmuth, Khakbaz & Rasmussen, 2016; Geudet, 2017), these studies are limited to analysis of resources that they use for their teachings. In this context, a study on the use of resources concerning the "scientific research work" of researchers' subject to the "university" institution and the analysis of these resources in the context of the documentation approach, was not found in the literature. Given the universities' mission to train researchers, the analysis of resources used by master and doctoral students constitutes a field with gaps in educational research. It is also thought that the literature will contribute to the study of the effect of thinking styles in the context of the process of constructing the documents. In this context, the aim of this research is to determine the relations between thinking styles and different types of resources used by mathematics teachers studying in the third cycle of the university to create a ludo-educative a-didactic situation using a video game from an essential resource.

Problem statements

How is the distribution of thinking styles of teacher-students given the assigned task?

How do teacher-students use resources related to the assigned task?

How do the teacher-students use resources related to the assigned task according to their thinking styles??

2. Method

2.1 Method of the Research

In this research, the mixed method was used, and the embedded mixed method design was adopted. The mixed method is defined as an approach that concludes by combining qualitative and quantitative data to understand the research problem (Creswell, 2017). The data in this type of study could be gathered, or it could be ordered sequentially. Its primary function is to embed the quantitative or the qualitative data in a larger frame, yet the data source plays a supporting role in the overall design (Creswell, 2014, p.16). In this study, the qualitative dimension was used to determine teacher-students' resources to set up a didactic situation, and qualitative data was used to determine the teacher-students preferred teaching skills.

2.2 Participants

Participants were 10 (2 male and 8 female) teacher-student with a 1-3 year experience in mathematics education, studying at the master degree program in a university in Turkey. The participants were chosen from the 20 students following a training module entitled "Approaches of teaching and learning in the didactics of mathematics" in master degree. Participants were selected on a voluntary basis. The research was carried out during the fall semester of the 2017-2018 academic year and corresponds to the first semesters of the participants in the master program.

2.3 Procedure

Firstly, the Thinking Styles Inventory applied to the participants. A 3-hour course was given on the TDS and on "The Race to 20"; Brousseau's article on "The Race to 20" was also given to them for reading and analysis. For this study, the essential resource imposed to construct a teaching document conforming to the TDS was the article entitled "The race to 20" (Brousseau, 1998). Then, the participants have been asked to construct a teaching scenario's document that is consistent with the TDS, in which it is a matter of an a-didactic environment using the video-game Minecraft. They worked in pairs and had two weeks to complete their assignments. They were free to choose the teaching subject for their teaching scenarios. The subjects of assignments that the teacher-students have chosen are the following: Formula of the perimeter of a rectangle (Binomial 1), the formulas of perimeter and area of quadrilaterals (Binomial 2), the notion of volume for uniform geometric solids (Binomial 3), logical connectors (Binomial 4) and the notion of area for polygons (Binomial 5). During the training module named "Approaches of teaching and learning in the didactics of mathematics", TDS was thought to the participants by discussing on the research article of Brousseau (1998) «Race to 20». Brousseau organized several phases in the teaching process based on this game, referring to different types of a-didactical situations (action, formulation, and validation) (Sensevy, Mercier & Schubauer-Leoni, 2002). Participants' levels of Minecraft game's usage is given in Table 1.

Table 1. Participants' levels of Minecraft game's usage

Participant Binomials	Beginners Level of Minecraft Usage	Medium Level of Minecraft Usage	Advanced Level of Minecraft Usage
Binomial 1		x x	
Binomial 2	x x		
Binomial 3	x	x	
Binomial 4			x x
Binomial 5	x	x	

2.4 Data Collection Tools

In this research Teacher-students' assignments and Thinking Styles Inventory was used to explore the relation between teacher-students thinking styles and the use of different resources.

Student-teachers' assignments. Homework was given to the participants of this master degree course where it was necessary to construct a teaching document that respects the didactical situations theory (TDS). They have been asked to construct a teaching document that is consistent with the TDS, in which it is a matter of an a-didactic environment and where the notion of play is present in Minecraft environment.

Thinking Style Inventory. Thinking Styles Inventory, developed by Stenberg and Wagner (1991) adapted to Turkish by Sünbül (2004) were utilized. The scale consists of thirteen dimensions that fall within the five dimensions. According to the dimensions, people can be understood in terms of functions (legislative, executive, and judicial styles), forms (hierarchic, oligarchic, monarchic, and anarchic styles), levels (global and local styles), scopes (internal and external styles), and leanings (liberal and conservative styles). Each item is scored through a 5 point scale with 5 denoting that the statement does describe the participant extremely well and 1 denoting that the statement does not describe the participant at all. The internal consistency coefficient of the sub-groups was between .70 and 86.

2.5 Analysis Techniques

The data obtained were analyzed concerning descriptive statistic and thematic analysis. In the qualitative dimension, the thematic analysis was selected to examine the data gathered from the document provided from teacher-students' assignments. The goal of the thematic analysis is to identify themes, i.e., patterns in the data that are important or interesting and use these themes to address the research or say something about an issue (Maguire & Delahunt, 2017). The participants of this study being ten teacher-students who worked in binary groups, five assignments constituted the qualitative data. The themes determined by researchers employing a-prior analyses, and they were the bases of the teacher-students' assignments' analyses. This theme was "Teacher" resources, "Student" resources and "Researcher" resources. In this study, «teacher resource» refers to all kinds of resources that teacher-students bring from their teaching professions (classroom decisions, students' classroom experiences, official and assistive books, etc.) and the reflection of these resources as a document to their homework. The «student resource» refers to resources originating from the master course given to the teacher-students on TDS and the «Race to 20», which is the essential resource for this research. The «researcher resource» indicates the resources as scientific research papers or thesis that the teacher-students reached through internet databases, libraries, etc. and that they used in the construction of their documents, in addition to the resources given in the master course. Teacher-students' assignments coded as Assignment 1, Assignment 2 and Assignment 3. The data was presented in its original form. In the quantitative dimension, the descriptive statistic was used and presented using tables.

2.6 Reliability and Validity

Information on the validity and reliability of the quantitative data collection tools we use in our study was derived from the literature used. Detailed information about the research process was also presented for qualitative data collection tools. In the qualitative dimension, the findings were interpreted by two researchers, and an agreement was reached on these interpretations. Çepni (2012) mentioned that in qualitative researches, it is necessary to share the reports obtained by the researcher with individuals involved in the study and to receive their opinions. In this study, the participants were informed in detail about the aim of the research, how the data would be used and analyzed.

3. Findings

The findings obtained from the analyses of data received by qualitative and quantitative methods were presented in this paragraph under two parts.

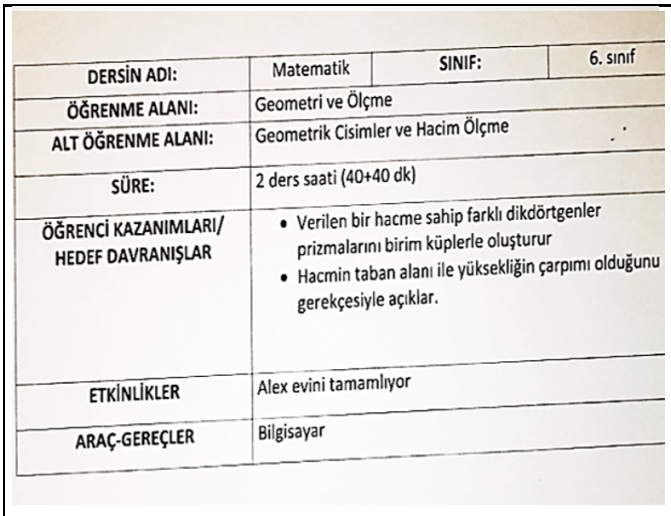
The analyses showed that two types of resources, namely "teacher resources" and "student resources," were used by the teacher-students. No "researcher resource" was encountered. In their assignments, binomials 2 and three used "teacher resources", binomials 4 and five used "student resources" and binomial 1 used "teacher and student resources" together.

The following paragraphs present the results of groups categorised according to the use of different resources. Concerning the teacher-students' assignments using "teacher resources", thematic analyzes were performed, and coding was realised as a result of these analyses. The codes were resulting from the analysis of the three assignments using "teacher resources" were given in Table 1.

Table 2. Teacher resources codes obtained from thematic analyses

Teacher Resources Codes	**Binomial 1**	**Binomial 2**	**Binomial 3**
Didactic time is taken into consideration			x
The course divided into two lesson hours			x
In addition to the activities carried out in the course, students are given reinforcement questions as homework		x	
Possible student mistakes and consideration of these mistakes are considered	x		
Different solutions of students are predicted	x		
Teaching programs are considered		x	x
The learning outcomes and acquisitions are expressed	x	x	x
Class level is specified		x	x
Quotations from textbooks are given		x	
Curriculum extensions are included		x	

When the assignments of teacher-students using "teacher resources" are analyzed, all binomials consider and express the learning outcomes in their scenarios. Also, there are two assignments indicating the classroom level and curriculum; these two assignments were using only teacher resources. It was seen that the assignments of Binomial 2 and 3 were constructed in line with the expectations of the institutions that they worked as teachers. A part of the assignment of the binomial 3 prepared by the institution's expectations was presented in Figure 1.



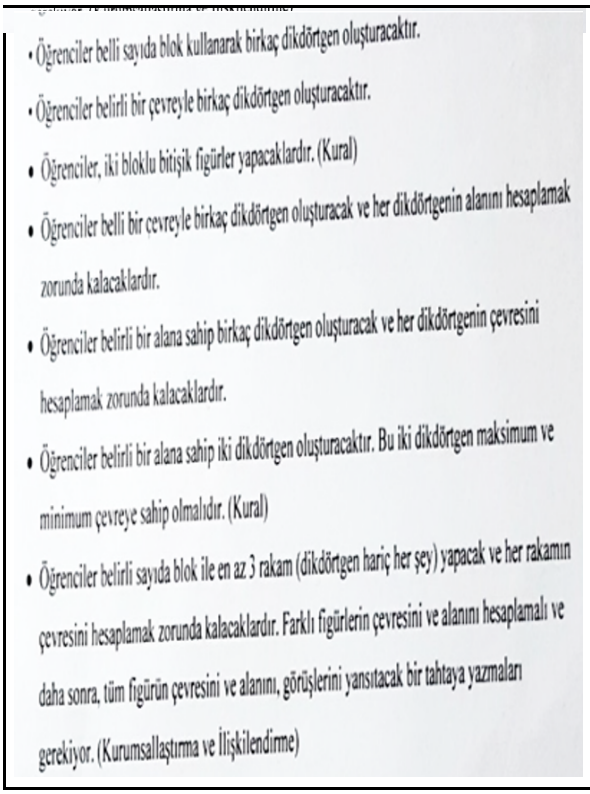
DERSİN ADI:	Matematik	SINIF:	6. sınıf
ÖĞRENME ALANI:	Geometri ve Ölçme		
ALT ÖĞRENME ALANI:	Geometrik Cisimler ve Hacim Ölçme		
SÜRE:	2 ders saati (40+40 dk)		
ÖĞRENCİ KAZANIMLARI/ HEDEF DAVRANIŞLAR	• Verilen bir hacme sahip farklı dikdörtgenler prizmalarını birim küplerle oluşturur • Hacmin taban alanı ile yüksekliğin çarpımı olduğunu gerekçesiyle açıklar.		
ETKİNLİKLER	Alex evini tamamlıyor		
ARAÇ-GEREÇLER	Bilgisayar		

Lesson:	*Mathematics*	**Grade**	6^{th} class
Learning context:	*Geometry and Measurements*		
Time:	*2 hours (40+40 minutes)*		
Students achievements/ Goals, behaviours:	** Different rectangles with a given volume form their unit prisms with their prisms.* ** They explain because the volume is multiplied by the floor area and height.*		
Activities:	*Alex completes his home*		
Tools:	*Computer*		

Figure 1. A part of the binomial 3's assignment and its translation

This result can be interpreted as the fact that teachers in Turkey have to make lesson plans, and that the education system forces teachers to do teaching based on learning outcomes. Thus, it can be said that the reflections of the requirements of the schools and institutions of the Ministry of Education were determined in the assignments of the teacher-students. It was noticed that the binomial 2, which used teacher resources, did not cite the game Minecraft, unlike other assignments. This may be because this binomial was at the beginning level in the use of the game. The binomial preferred to specify, point by point, the tasks that the students would perform; the possible answers of students, the

dialogues of the teacher and pupils etc. have not been considered in their scenarios. A section of the Group 2 scenario was given in Figure 2.



- Öğrenciler belli sayıda blok kullanarak birkaç dikdörtgen oluşturacaktır.
- Öğrenciler belirli bir çevreyle birkaç dikdörtgen oluşturacaktır.
- Öğrenciler, iki bloklu bitişik figürler yapacaklardır. (Kural)
- Öğrenciler belli bir çevreyle birkaç dikdörtgen oluşturacak ve her dikdörtgenin alanını hesaplamak zorunda kalacaklardır.
- Öğrenciler belirli bir alana sahip birkaç dikdörtgen oluşturacak ve her dikdörtgenin çevresini hesaplamak zorunda kalacaklardır.
- Öğrenciler belirli bir alana sahip iki dikdörtgen oluşturacaktır. Bu iki dikdörtgen maksimum ve minimum çevreye sahip olmalıdır. (Kural)
- Öğrenciler belirli sayıda blok ile en az 3 rakam (dikdörtgen hariç her şey) yapacak ve her rakamın çevresini hesaplamak zorunda kalacaklardır. Farklı figürlerin çevresini ve alanını hesaplamalı ve daha sonra, tüm figürün çevresini ve alanını, görüşlerini yansıtacak bir tahtaya yazmaları gerekiyor. (Kurumsallaştırma ve İlişkilendirme)

- *Students will create a few rectangles using a certain number of blocks.*
- *The students will form a few rectangles within a certain distance.*
- *The students will make two blocks of adjacent figures. (rule)*
- *The students will have several rectangles with a certain frame and they will have to calculate the area of each rectangle.*
- *Students will have to create several rectangles with a certain area and calculate the circumference of each rectangle.*
- *Students will have two rectangles with a specific area. These two rectangles must have a maximum, and minimum circumference. (rule)*

- *The students will make at least 3 numbers (everything except the rectangle) with a certain number of blocks and will calculate the circumference of each digit. They have to calculate the perimeter and area of the different figures and then write on a board that reflects the perimeter and field of all the figures. (Institutionalization and association).*

Figure 2. A part of the binomial 2's scenario and its translation

On the other hand, the binomial 2, unlike the other binomials, prepared a 5-question worksheet for students to do at home after class. It has been found that the effects of the "teacher resources" on the documentation are mainly at the level of the structural expectations of the institutions in which teachers work. The concept of didactic time, the anticipation of pupil errors and strategies for solving the problem also occurs during the construction phase of the document. Concerning the teacher-students' assignments using "student resources" in the institution "The teaching and learning approaches in mathematics didactics" course, thematic analyzes were made, and coding was realised as a result of these analyses. The codes resulting from the analysis of the three assignments using "student resources" were given in Table 2.

Table 2. Student resources codes obtained from thematic analyses

Student Resources Codes	Binomial 1	Binomial 4	Binomial 5
The content of the module of formation and the points that have been processed during the module are included		x	
The phases of TDS are considered	x	x	x
A similar structure to the structure of the article «Race to 20» is present	x	x	x

Group 4, using "student resources", designed a game with electrical circuits in Minecraft. It was found that they designed their assignment with elements similar to the game Race to 20. They also divided their gameplay according to the stages of the theory of didactical situations. The goal of the game expressed by the group 4 is: "The player who fills the boards of the logical connectors found in the electrical circuits wins". An example of screenshots that teacher-students have placed in their assignments was shown in Figure 3.

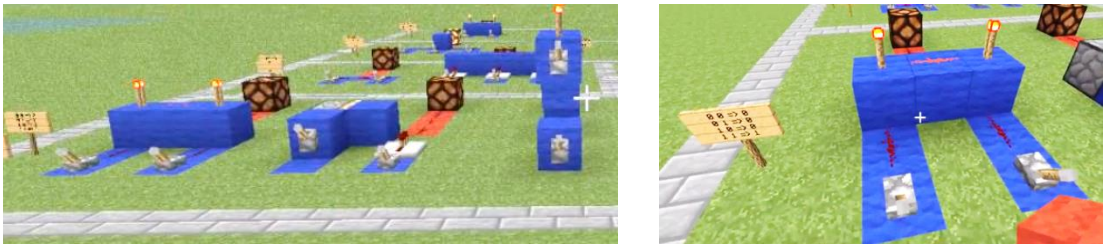


Figure 3. Screenshots of the binomial 4's game

For the «student resources» in the teacher-students' assignments, it can be said that they are strictly related to the essential resource. Indeed, the teacher-students take the essential resource as a model and produce a document resembling the essential resource imposed. They do a didactic analysis of the essential resource and apply the conclusions of these analyses to the teaching document. The analyses showed that one binomial (binomial 1) used teacher and student resources together in their assignment. A synthesis of the resources' use for this binomial's assignment was realised. Table 3 presented the codes obtained by the analyses of the binomial 1's assignment.

Table 3. Codes obtained by the analyses of the binomial 1's assignment

Binomial 1	Teacher Resources Codes	Student Resources Codes
	Possible student mistakes and consideration of these mistakes are taken into consideration	The phases of TDS are taken into account
	Different solutions of students are predicted	A similar structure to the structure of the article «Race to 20» is present
	The learning outcomes and acquisitions are expressed	

From the view of the theory of situations; the binomial 1 has chosen to teach the notion of the perimeter in the ludo-educative environment Minecraft. The instruction of the game written by the teacher-student is: "You are landscapers. At each turn of the game, you will be asked to guess in advance the number of cubes needed to build the barriers protecting the flowers. You will then check the answer by building the barrier on the software." (Cf. Figure 4).

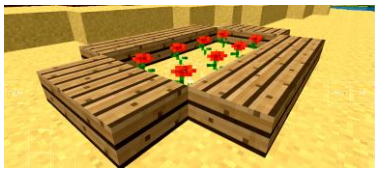


Figure 4. Teacher and student resources binomial example

The analyses showed that the binomial 1 created a problem-solving situation where an eight-step problem-solving strategy is used and where, in their opinion, the estimations of blocks for steps 6, 7, 8 would lead to the construction of the formula for calculating the perimeter of a rectangle; depending on the dimensions of its sides. The earlier easier steps (1, 2, 3) are supposed to allow learners to initiate for the construction of the formula when they cannot "count by the head" one by one the cubes in steps 6, 7, 8. The successive dimensions of the flowers' rectangles and the number of play turns constituted the didactical variables. The victory condition was clearly defined, and the rules of the game were established. To build the didactic activity and integrate all the components of the environment, the teacher-students were strongly inspired by Brousseau's "The Race to 20".

Concerning the "researcher resources", contrary to the expectation on a prior analysis, "researcher resources" were not found in the assignments. Because teacher-students may be thought that, to do their assignments, they should use the "teacher resources" they took out of the educational institution about the teaching profession, and that they should use the "student resources" to meet the requirements and expectations of the master course. Although this was one of the main courses at the master's level, it may be thought that teacher-students had not used the "researcher resources", such as scientific research and scientific knowledge reached through the Internet or in books, to do their assignments because they were still in the school year when they were only taking master courses, and they have not started writing their master thesis yet.

In the quantitative part of this research descriptive analysis of learning styles of teacher-students was done.

The assignments of the teacher-students were analyzed according to the categories of their thinking styles of teacher-students and these were presented in Table 4.

Table 4. The teacher-students assignments regarding to the categories of their thinking styles

	Constitute	Functions	Form	Levels	Scopes	Leanings
Assignment 1	Teacher-students resources	Legislative/ Judicial	Hierarchic/ Monarchic	Local	External	Liberal
Assignment 2	Teacher resources	Executive/ Judicial	Hierarchic/ Oligarchic	Local	Internal	Liberal
Assignment 3	Teacher sources	Legislative/ Executive	Hierarchic/ Monarchic	Global/ Local	Êxternal/ Internal	Liberal/ Conservative
Assignment 4	Student sources	Legislative	Hierarchic/ Monarchic/ Oligarchic	Global/ Local	External	Liberal/ Conservative
Assignment 5	Student sources	Legislative/ Judicial	Hierarchic/ Monarchic/ Anarchic	Local	Êxternal/ Internal	Liberal

According to the Table 4, it was deduced that the assignments' groups were seen to have every thinking style.

The thinking styles of teacher-students are analyzed and their distribution regarding the categories in resources were presented in Table 5.

Table 5. The teacher-students thinking styles regarding to their assignment resources

	The thinking styles of teacher-students				
Assignments	Functions	Form	Levels	Scopes	Leanings
Teacher	Legislative (2) Executive (2) Judicial (1)	Hierarchic (2) Monarchic (3) Oligarchic (1) Anarchic (-)	Global (2) Local (2)	Internal (2) External (2)	Liberal (3) Conservative (1)
Student	Legislative (3) Executive (-) Judicial (1)	Hierarchic (2) Monarchic (1) Oligarchic (2) Anarchic (1)	Global (1) Local (3)	Internal (1) External (3)	Liberal (3) Conservative (1)
Teacher-Student	Legislative (2) Executive (-) Judicial (1)	Hierarchic (1) Monarchic (1) Oligarchic (-) Anarchic (-)	Global (-) Local (2)	Internal (-) External (2)	Liberal (2) Conservative (-)

Concerning the teacher-students' thinking styles regarding to their use of resources in their assignments, it can be said that the legislative forms (7), hierarchic (5) and monarchic forms (5, local levels (7), external scopes (7) and liberal leanings (8) were dominant among the teacher-students whereas executive functions (2), oligarchic (3) and anarchic (1) forms, global levels (3), internal scopes (3) and conservative leanings (2) were minimum.

3. Results, Conclusions and Recommendations

In this study, the assignments analysis revealed that one of the assignments uses two types of resources, namely "teacher resources", and "student resources", two assignments uses "teacher resources" and two assignments used "student resources". There were no assignments that used "researcher resources". As a result, it can be said that the effects of "the teacher resources" on the documentation process might mainly at the level of the expectations of the institutions that the teachers are subjects. Teacher-students were free on the choise of mathematical topics in their assignments. The use the Minecraft and the design of a-didactical environment in accordance with the constructivism were required from them. However, it was seen that the teacher-students did not reflected in "the researcher resources" into their assignements. This migt be interpreted as the fact that they do not yet have enough schemes to use the "researcher resources" for the construction of documents in a documentional process. Ruthven (2013) finds that teachers use their previous experience as one of the most important schemes in the process of constructing documents. In this study, participants did not have previous experiences as researchers, and the fact that they could not use researcher resources in the process of constructing documents parallel when evaluated in terms

When dominant thinking styles in assignment groups were analysed, legislative function, Hierarchic form, Local level, External scopes and Liberal learnings were highlighted. When the students' thinking style was analysed concerning their resources, it was found that the legislative forms, hierarchic and monarchic forms, local levels, external scopes and liberal leanings were dominant among the teacher-students whereas executive functions, oligarchic and anarchic forms, global levels, internal scopes and conservative leanings were minimum. Some researches were categorized the thinking styles in Sternberg's theory into three groups as Type I, Type II and Type III: Type I thinking styles including legislative, judicial, hierarchical, global, and liberal thinking style dominant people characteristics prefer to work on complex information processing and creative-generating activities, they are more effective in producing positive

behavior. People with dominant Type II thinking styles including executive, monarchic, local, and conservative thinking styles show a dominant tendency to engage themselves in more simple information processing and rule following activities. Type III thinking styles including oligarchic, anarchic, internal, and external thinking styles are inclined to act in a more situational-dependent manner (Zhang 2004; Zhu 2013). According to results of our research executive and monarchic thinking, the style was dominant at the teacher resources group whereas oligarchic and external were dominant at the student resources. Zhu (2013) found that Type II thinking styles seemed to have higher associations with dominant teacher interpersonal behaviours. Also, Zhang (2004) mentioned that Type II teaching styles about encourage rule following and simplistic information processing was almost exclusively favoured by students with Type II thinking styles. And he added that except for the oligarchic thinking style (a Type III style) was significantly predictive of the executive and monarchic teaching styles (Type II styles) as well. In this case, it might be considered that teacher resources are Type II, and student resources are type III. Zhu (2013) explained that Type III thinking styles including oligarchic, anarchic, internal and external were associated with freedom and strict interpersonal behaviours but this not significant for students. So, Sternberg (1990) stated that teachers need to flexible in their teaching in order to reach possible number of students. In addition, some tasks require one style, some require another and still others allow the doer some options such as when students need to complete worksheet that due to the next day, if their preference is legistrative/hiyerarchic, they will sometimes have to act in an executive/monarch manner.

As a result, in this study, researcher resources were not identified within the scope of documentation theory in the assignments of teacher-students. Also, it could be thought that students thinking style affect student documentation process. In this context, it is suggested to increase the work to put forward the researcher identities in teacher-students' education at the 3rd degree Universities.

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