

Making the Pedagogical Elements Used by Prospective Mathematics Teachers Visible in Teaching: Scenario Writing Activities

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Abstract:

Introduction: In the reflective writing process, teachers make identification, information, explanation and evaluation activities (Spanneberg, 2009). It is thought that the scenarios written by the teacher candidates in order to teach a certain subject can give them an opportunity to think deeply. However, these teaching scenarios can be a valuable tool for reflective thinking in terms of educational matters such as teaching methods, pedagogy, and beliefs.

Methods: In this study, it was investigated whether script writing is an effective tool to make pedagogical elements visible in the prospects of mathematics teachers. Case study pattern, which is one of the qualitative research patterns, was used in the research. For this purpose, thirty prospective mathematics teachers who participated in the study were asked to write two scenarios. The first one is called as "car travel" and the other one is called as "triangles and similarity" scenario. Before the study, some basic frameworks were defined for both scenarios. These are explained to prospective teachers. The "car travel" scenario in this research was given within the scope of the theme which includes only two people and a limited environmental interaction. The second scenario is the triangles and the similarity scenario. In the second scenario, the role of a teacher who conducts applied and real-life education outside of school is defined.

Results: In general, it is concluded that script writing activities are very useful in training teachers. The data obtained from both scenarios reveal that the pedagogical elements constructed during the scenario writing activities become concrete in the minds of the prospective teachers.

Discussion: It is observed that prospective teachers often include the structure of teaching related to real life in their scenarios. It is stated that teaching in the context of real life increases academic success and students' interest in the lesson, and thus, the content is learned perceptibly by the students (Acar & Yaman, 2011). Another cognitive element that prospective teachers include in their scenarios is the use of available

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materials. It is noteworthy that the prospective teachers used real-life tools and materials as materials in the place chosen for the scenarios of their scripts.

Limitations: This research is limited to script texts written by thirty prospective teachers.

Conclusions: Thanks to this visibility, feedback can be given on the pedagogical elements that the prospective teacher will use in the future.

Key words: mathematics teacher education, scenario writing activity, script writing, feedback to pedagogical elements.

Introduction

Activities based on making students' thoughts visible are very important for teachers to design activities for teaching mathematics meaningfully (Lieberman, 2009). However, it has been stated that the teaching approaches of teachers who see and analyze students' thoughts have improved over time. Similarly, the efforts of faculty members who train prospective teachers to make their opinions on teaching visible are valuable in terms of giving them the opportunity to direct them. Spanneberg (2009) emphasized that teachers' thinking about their own practices is very important for their professional development. Practices that guide teachers to reflect on their teaching methods are not new (Gilbert, 1994). For example, according to Dewey (1933), reflective thinking is one of the key concepts for meaningful learning and development. Loughran and Corrigan (1995) and Schon (1983) defined reflective thinking as the process of interpreting and understanding new things by examining one's practices and thoughts. If we revise this definition for mathematics teachers, we can see it as the process of making inferences by constantly examining a teacher's own practices in mathematics classes (Spanneberg, 2009). It has been stated that using teaching portfolios containing written views about their own teaching can be very useful to lead teachers to think about their own practices (Dana & Tippins, 1998; Wolf, 1994). Many different methods can be used to prompt teachers to reflect on their own practices such as micro education, portfolio, and lesson study. In this study, it is aimed to reveal the potential of script writing activities. In this respect, it has been seen that script writing activities can be considered as a tool for prospective teachers to improve themselves.

1 Teaching scenarios and reflective writing concepts

In the reflective writing process, teachers carry out identification, information, explanation and evaluation activities (Spanneberg, 2009). In their study, Goldsmith and Shifter (1997) stated that teachers who want to change their mathematics teaching strategy usually conclude that they need to learn new terminologies to be used in teaching. This requires teachers to use language in a

different aspect. Hatton and Smith (1995) categorized reflective writing as descriptive reflective writing, dialogic reflection on dialogues and critical reflective writing. Reflective writing about dialogues is defined as making comments about the possible situations of a conversation. This process involves thinking deeply about conversations. It is thought that the scenarios written by prospective teachers at this stage to teach a certain subject can give an opportunity to think deeply. However, these teaching scenarios can be a valuable tool for reflective thinking about educational matters such as teaching methods, pedagogy, and beliefs.

2 Mathematics teacher education system in Turkey

The duration of compulsory primary education in Turkey is determined to be a total of 8 years. This primary education period is given in two stages as 4 + 4. In the first 4 years, classroom teachers are responsible for giving all courses except English. In the country, students start the first grade at the age of 6 or 7. The second stage of primary education covers the second four-year education. In this period, each course is taught by branch teachers who completed undergraduate education in that field. Mathematics lessons in middle schools are carried out by elementary mathematics teachers and mathematics lessons given in high school period are carried out by high school mathematics teachers. It is necessary to complete a 4-year undergraduate program to get primary and high school mathematics teaching undergraduate degrees. Before 2008, a 5-year education was required to get a high school teaching undergraduate degree. The curriculum of education faculties is designed by the The Council of Higher Education from a sole centre to be the same throughout the country. These curriculums were last updated in 2017 (YÖK, 2017a; YÖK, 2017b). Accordingly, primary education mathematics teaching undergraduate program consists of 240 ECTS in total. 88 ECTS of these courses are occupational knowledge, 42 ECTS are general culture and 110 ECTS are field education courses. Theoretical courses on the teaching profession consists of general educational science courses such as Educational Sociology, Educational Philosophy, Educational Psychology, Teaching Principles and Methods and Ethics in Education, Assessment and Evaluation in Education. General culture courses consist of courses such as history, foreign language, information technologies as well as some elective courses. Field education courses consist of field knowledge courses such as geometry, statistics, analytical geometry, linear algebra, and pedagogical content knowledge courses such as geometry teaching, geometry and measurement teaching, algebra teaching, probability and statistics teaching (YÖK, 2017a). High school and elementary mathematics teacher education programs are largely similar to each other except for a few subject courses (YÖK, 2017b). Prospective teachers take two courses, Teaching Practice 1 and Teaching Practice 2, in the final year in order to apply the knowledge they have learned and to give feedback to their preferences in practice. The aim of the Teaching

Practice 1 course is determined as “making observations about teaching methods and techniques specific to the field, making micro-teaching applications with individuals and groups by using special teaching methods and techniques specific to the field, field-specific activity and material development, preparing teaching environments, managing the classroom, assessing, evaluating and reflecting”. The aim of Teaching Practice 2 course is determined as “making observations about special teaching methods and techniques specific to the field, making micro-teaching applications using special teaching methods and techniques specific to the field, preparing a lesson plan independently, developing activities and materials about the course, preparing teaching environments, managing the classroom, assessing, evaluating and reflecting”. Teaching Practice 2 is a course planned to be taken in the last semester of the final year.

3 Are scenario writing activities an alternative to teaching practice courses?

In almost all teaching undergraduate programs in Turkey, there is not any course in which student can plan a lesson independently and apply the activities within the scope of special teaching methods specific to the field and they can demonstrate all their preferences regarding teaching. For this reason, in this study, the teaching preferences of prospective mathematics teachers were revealed and the usefulness of “scenario writing for mathematics teaching” studies was examined in order to give feedback to them and to make class discussions on these issues. However, it is possible to make more realistic evaluations based on the data obtained from the teaching practice lessons. Nonetheless, weekly analysis of the data obtained by systematic observation in teaching practice and school experience lessons is time consuming. For this reason, instructors cannot give timely feedback to prospective teachers. Although the scenario writing activities consisted of the teaching activities that take place in the minds of prospective teachers, it is considered to be more economical in terms of time and cost. Scenario writing activities should not be seen as an alternative to teaching practice lessons. However, before teaching practice, it was seen as an important contribution to the deficiencies that need to be improved in the teaching approaches of prospective teachers. Because it enables prospective teachers to get feedback on the details of the teaching profession before teaching students in a real classroom environment. Also, in recent years in Turkey, at all levels and stages, curriculum updates are made (Sarica, 2018). Mathematics education program is among the revised programs. Thanks to these scenario-writing studies, prospective teachers will have the opportunity to examine the updated mathematics program.

The following question has been examined in this study: "Are the teaching scenarios written by prospective elementary mathematics teachers an effective tool to make the pedagogical elements used by prospective teachers visible?"

4 Method

4.1 Research design

Case study design, which is one of the qualitative research designs, was used in the research. Case studies can be conducted in various ways. The most important feature of this research design is that it examines one or a few situations in depth. In case studies, it is essential to consider all the factors related to the research problem with a holistic approach (Yıldırım & Şimşek, 2008). In this research, the effectiveness of scenario writing activities was examined to make the pedagogical elements of prospective teachers visible. For this reason, all the pedagogical elements in the scenarios created by the prospective teachers were tried to be revealed. The obtained data were evaluated with a holistic approach. It can be said that the holistic single case design, one of the case study designs, was used in the study. It is seen that there is no previous study conducted on writing teaching scenarios discussed in the research. For this reason, the analysis of the situation has been conducted with the themes and categories derived from the data.

4.2 Participants

Thirty prospective teachers, who were elementary mathematics teaching undergraduate students, participated in this study. These participants took the communication lesson in the mathematics classes provided electively in the second year of the elementary mathematics teaching undergraduate program. Nineteen of the participants are female and the remaining are male. The aim of the course is, "to realize that mathematics is a language with its own symbols and terminology, to use the symbols and terms of mathematics effectively and correctly, to use mathematical language appropriately and effectively in mathematics and different disciplines and life, expressing mathematical thoughts using different forms of representation such as concrete model, shape, picture, graphics, tables, symbols, etc., expressing mathematical thoughts verbally and in writing, associating mathematical language with everyday language and symbols, interpreting the correctness and meaning of mathematical thoughts" (YÖK, 2017a). After giving the necessary preliminary information to the prospective teachers, the research process started.

4.3 Data collection process

Within the scope of the research, before the teacher candidates were asked to write teaching scenarios, basic information about communication and writing scenarios was given in mathematics classes. In this context, information was provided on the following topics.

- Elements used to organize and explain mathematical thoughts; using mathematical definitions, concepts and symbols to explain real life.
- The use of verbal, visual and written mathematical communication forms (pictures, graphics, dynamic structures, numbers, algebraic expressions, concrete materials) in mathematics teaching.
- Methods of developing mathematical thinking in communication between student and teacher, asking the student to represent the data, explaining a solution, defending a mathematical idea using written, visual and verbal communication, expressing their ideas, having a class discussion.
- Activities to be used at the beginning related to the process of managing a mathematical communication, concepts, strategies and representation forms that can be used in the teaching process, concept-based solutions, effective solutions and methods, generalization activities, asking question by using why and how; re-voicing, repeating, reasoning, adding on and waiting strategies (Chapin, O'Connor, & Anderson, 2009). However, the importance of asking effective questions is also mentioned in this section.

4.4 Training on writing a scenario

The scope of the training given to prospective teachers on writing scripts was in the following topics.

- Sound, visual, behaviour and dialogue elements of the scenario.
- Defining the environment in which the scenario takes place.
- Outline of the scenario (editing, main part and solution stages).
- Paying attention to the teacher and student roles in writing the dialogues, creating realistic dialogues.
- Making explanations about emotional items.
- Making descriptions of the environment and characters before each scene.

After giving information about these stages to prospective teachers, a scenario was prepared together in the classroom. The prepared scenario included the beginning of teaching a math subject in the classroom, managing the activities and closing sections. Shaping the story was easy with the help of everyone, since the subject of the scenario preparation phase was mathematics teaching.

4.5 Data collection tools

Within the scope of the research, the scenario requested from prospective teachers was defined by the researcher. In these definitions, the subject, characters and places in the desired scenarios were explained. Both scenarios focused on out-of-class mathematics experiences related to real life.

Scenario 1: Car Travel Scenario

In this scenario, teacher candidates were asked to address a math teacher who was driving a car with his son. In these conversations, they were asked to use mathematical contents such as speed, time, path, arrival time. Prospective

teachers were asked to write the dialogues between the father and his child during the journey in order to teach these concepts. The prospective teachers easily integrated into this content. In the scenarios written by the prospective teachers, it was expected that different pedagogical elements such as the language used, meaningful teaching, formula and rote learning would emerge.

Scenario 2: Triangles and Similarity Scenario

They were asked to imagine a mathematics teacher using "Right Triangles" and "Similarity" in the distance and height calculation. A situation in which the teacher takes his students out of the classroom to clarify the subject was defined. According to the scenario, the teacher was asked to think that he was calculating the height of the school with his students outside the classroom using right triangles and similarity. The place of the desired scenario is determined outside the traditional classroom environment and as an area where the subject is applied in real life. Therefore, in the scenarios, prospective teachers were allowed to use more innovative pedagogical elements.

4.6 Data analysis

Within the scope of the research, each prospective teacher wrote two scenarios. These scenarios were used in the coding method mentioned by Punch (2013) and Strauss and Corbin (1990). Themes, categories and codes created for this method are completely removed from the data. The scenarios were read independently by the author of this article and a doctoral researcher in the field of educational sciences. Researchers aimed primarily to reveal as many themes as they could find. Then, by discussing these themes mutually, they agreed to give similar theme names to the same phenomenon. The researchers re-read the data after agreeing on the themes. In the second reading, they aimed to reveal the categories of each theme. Researchers also agreed on the expression of sub-themes. At this stage, codes are given to each category. The author of the article and the assistant expert in data analysis coded the data by using these codes in the last reading. The formula of Miles and Huberman (1994) was used to calculate the reliability between encoders. The reliability coefficient between encoders was determined as 0.84. The information provided in the findings of the research were obtained through a consensus after the coding of the researcher and the assistant expert were brought together and discussed.

5 Findings

The findings of the research are given in two stages as "car travel" scenario and "similarity in triangles teaching scenario". When the emerging themes related to car travel themed teaching scenario are examined, it is seen that there are cognitive and affective elements for teaching. When the "similarity in triangles" teaching scenario is examined, five different themes are created. These are named as teaching dimension, assessment and evaluation, teacher, student and

school management dimensions. These themes are presented in separate tables below. Themes related to the car scenario are given in Table 1 as a single table. Findings related to the other scenario are presented below in a separate table (Table 2-3-4-5-6). Percentage and frequency values are given to identify the most frequently recurring categories in the scenarios.

Table 1

<i>Pedagogical elements used by prospective teachers in car travel scenarios</i>				
<u>Themes</u>	<u>Categories</u>	<u>Participants</u>	<u>N</u>	<u>Percent (%)</u>
Cognitive elements for teaching	Related to Daily Life / Realistic	K1, K2, K3, K4, K5, K6, K7, K8, K9, K10, K11, K12, K13, K14, K15, K16, K17, K18, K19, K20, K21, K22, K23, K24, K25, K26, K27, K28, K29, K30	30	19
	Using the question-answer method	K1, K2, K3, K4, K5, K6, K7, K8, K9, K10, K11, K12, K13, K14, K15, K17, K18, K19, K20, K21, K22, K23, K24, K25, K26, K27, K28, K29, K30	29	18
	Asking extra questions / using examples	K1, K2, K7, K8, K9, K10, K12, K13, K14, K15, K17, K19, K21, K22, K23, K25	16	9.9
	Using existing / surrounding materials	K1, K2, K3, K4, K6, K8, K11, K13, K17, K18, K22, K24, K25, K27, K28	15	9.3
	Associating with other disciplines or subjects (Science, Physics, Traffic, etc.)	K3, K4, K7, K10, K18, K22, K23, K24, K26, K28, K29	11	6.8
	Giving direct answer to the question	K3, K6, K7, K11, K13, K14, K15, K16, K17, K29	10	6.2
	Not saying the correct answer / having the student discover	K1, K2, K8, K9, K19, K23, K24, K25, K28, K30	10	6.2
	Using reasoning or guessing skills	K1, K9, K12, K18, K23, K24	6	3.7
	Increasing curiosity	K3, K8, K23, K25, K27, K29	6	3.7
	Reminding pre-learning	K8, K9, K19	3	1.9

Affective Elements for Teaching	Analogy	K9, K18, K26	3	1.9
	Using images	K2, K3, K29	3	1.9
	Including entertainment / game	K1, K22, K27	3	1.9
	Learning by invention	K2	1	0.6
	Questioning	K1	1	0.6
	Considering the student's level / cognitive development	K1	1	0.6
	Learning by doing and living	K25	1	0.6
	Considering factors such as interest, motivation, attitude, fear	K3, K6, K8, K15, K25, K26	6	3.7
	Encouragement for thinking and discovery	K1, K2, K4, K8, K23,	5	3.1
	Exam Anxiety	K15	1	0.6
	Teacher attitude	K15	1	0.6
Total			162	100

When “car travel” scenario written by the prospective teachers is examined, it is seen that cognitive and affective items are mostly included. The theme of the scenario takes place in an environment where there is little social interaction. Nearly all scenarios cover two people consisting of a father and a child. As expected, prospective teachers used concepts such as speed, time and distance in mathematics teaching during the travel. In the theme of cognitive items used by teacher candidates, it is seen that they all wrote realistic dialogues related to daily life. However, it has been observed that almost all of them used the question and answer method in writing dialogues. In this scenario writing, it was seen that prospective teachers used situations such as asking extra questions and using examples, using materials in the current environment, associating them with other disciplines, not saying the answer of the question directly and making the student find the correct answer. When Table 1 is examined, it is evaluated that the scenarios written by prospective teachers on the theme of car travel can be used to train teachers by giving feedback on the cognitive and affective items they use.

Table 2

Findings regarding the teaching dimension in "Triangles and Similarity" scenarios

<u>Themes</u>	<u>Categories</u>	<u>Participants</u>	<u>N</u>	<u>Percent (%)</u>
Elements used by the prospective teachers regarding the teaching dimension	The use of mathematics in daily life	ÖA1, ÖA2, ÖA3, ÖA4, ÖA5, ÖA7, ÖA8, ÖA9, ÖA11, ÖA12, ÖA16, ÖA17, ÖA21, ÖA24, ÖA27, ÖA28	16	12
	Meaningful learning	ÖA2, ÖA4, ÖA5, ÖA6, ÖA7, ÖA10, ÖA11, ÖA12, ÖA20, ÖA21, ÖA22, ÖA23, ÖA24, ÖA27, ÖA28	15	11.3
	Permanence	ÖA1, ÖA3, ÖA4, ÖA6, ÖA7, ÖA8, ÖA12, ÖA14, ÖA16, ÖA19, ÖA20, ÖA23, ÖA28	13	9.77
	Solving questions	ÖA5, ÖA6, ÖA7, ÖA11, ÖA12, ÖA13, ÖA17, ÖA18, ÖA19, ÖA23, ÖA25, ÖA26, ÖA30	13	9.77
	Teaching math outside the classroom	ÖA1, ÖA2, ÖA3, ÖA4, ÖA6, ÖA7, ÖA13, ÖA14, ÖA29	9	6.77
	Learning by doing and living	ÖA4, ÖA5, ÖA6, ÖA7, ÖA16, ÖA23, ÖA29	7	5.26
	Experiment and observation	ÖA1, ÖA2, ÖA4, ÖA6, ÖA10, ÖA14, ÖA18	7	5.26
	To love mathematics	ÖA3, ÖA13, ÖA14, ÖA18, ÖA19	5	376
	Using different teaching methods / materials / technology	ÖA1, ÖA2, ÖA14, ÖA22, ÖA25	5	3.76
	Fun lesson / Game	ÖA2, ÖA20, ÖA22, ÖA24, ÖA29	5	3.76
	Active student	ÖA2, ÖA13, ÖA14, ÖA26	4	3.01
	Associating what has been learned	ÖA10, ÖA20, ÖA24, ÖA26	4	3,01
	Interdisciplinarity	ÖA3, ÖA20, ÖA24	3	2.26
	Embodying the content	ÖA1, ÖA17, ÖA26	3	2.26
	Interest in the course	ÖA1, ÖA2, ÖA24	3	2.26
	Curiosity	ÖA5, ÖA8, ÖA12	3	2.26

Activity based lesson	ÖA11, ÖA13, ÖA28	3	2.26
Considering mathematics as a difficult lesson	ÖA5, ÖA23	2	1.5
Asking questions	ÖA1, ÖA26	2	1.5
Attending Class	ÖA18, ÖA26	2	1.5
Giving homework	ÖA26, ÖA2	2	1.5
Laboratory applications	ÖA2, Ö30	2	1.5
Paying attention to the basic and physical needs of students	ÖA1	1	0.75
Social activity	ÖA2	1	0.75
Classroom seating	ÖA25	1	0.75
Motivation	ÖA2	1	0.75
Value and character education	ÖA11	1	0.75
Total		133	100

When the findings related to the teaching dimension are examined in the "triangles and similarity" scenarios, it is seen that a wide variety of categories emerge. From these categories, it is seen that the themes of using mathematics in daily life, meaningful learning, permanence and problem solving are the most used themes. In this scenario, a prospective teacher was asked by the principal to teach students how to memorize information and shortcuts. In the scenario, the teacher candidate said, "This means memorizing, not learning. The information learned without establishing the link between mathematics and real life will not be permanent [ÖA8]. In one scenario, there is a school principal who thinks negatively about teaching mathematics outside the classroom. In the scenario, the teacher responded to the principal as "But dear principal, I will ensure that the students obtain the knowledge permanently by teaching mathematics outside the classroom. [ÖA3]." As examined in Table 2, prospective teachers used many elements related to teaching dimensions in the "triangles and similarity" scenario. It can be seen that these elements can be used during teacher training.

Table 3

Findings regarding assessment and evaluation dimension in triangles and similarity scenarios

<u>Themes</u>	<u>Categories</u>	<u>Participants</u>	<u>N</u>	<u>Percent (%)</u>
Views on Assessment and Evaluation Dimension	Frequent use of multiple choice questions	ÖA1, ÖA2, ÖA3, ÖA4, ÖA7, ÖA8, ÖA9, ÖA12, ÖA15, ÖA16, ÖA19, ÖA20, ÖA21, ÖA22, ÖA23, ÖA24, ÖA25, ÖA26, ÖA27, ÖA28, ÖA29	21	42
	Evaluation of success with the number of multiple choice questions with correct answers	ÖA1, ÖA2, ÖA3, ÖA4, ÖA6, ÖA7, ÖA8, ÖA9, ÖA11, ÖA12, ÖA15, ÖA16, ÖA17, ÖA18, ÖA19, ÖA26, ÖA27, ÖA28	18	36
	High school admission exam / examination system	ÖA1, ÖA2, ÖA4, ÖA8, ÖA12, ÖA17, ÖA20	7	14
	Perceiving "science high school students" as more successful	ÖA2, ÖA11, ÖA19, ÖA20	4	8
	Total		50	100

When the findings related to assessment and evaluation dimension are examined in "triangles and similarity" scenarios, it is seen that much emphasis is placed on test type exams with multiple choice questions. In the scenario of one of the prospective teachers, the principal said to the teacher, "I would like to ask you to do something. I want you to solve more multiple choice test questions than ever before to increase student success. If we can provide this, we will increase the student success [ÖA25]." This sentence expresses the school principal's expectation from the teacher regarding the assessment and evaluation dimension. It is thought that these themes created by prospective teachers can be used in the assessment and evaluation dimension in training mathematics teachers. Lecturers and prospective teachers taking the course can comment on these sentences and give feedback on how assessment and evaluation should be.

Table 4

Findings about teacher dimension in triangles and similarity scenarios

<u>Themes</u>	<u>Categories</u>	<u>Participants</u>	<u>N</u>	<u>Percent (%)</u>
Pedagogical Elements for Teacher Dimension	Pressure on teachers from principal, parent, colleague, etc.	ÖA1, ÖA2, ÖA3, ÖA4, ÖA6, ÖA7, ÖA8, ÖA9, ÖA10, ÖA11, ÖA13, ÖA14, ÖA17, ÖA19, ÖA21, ÖA22, ÖA25, ÖA26	18	29
	Rote learning	ÖA2, ÖA4, ÖA6, ÖA8, ÖA10, ÖA12, ÖA15, ÖA19, ÖA20, ÖA21, ÖA22, ÖA24, ÖA27, ÖA30	14	22
	Idealism in teaching	ÖA1, ÖA2, ÖA3, ÖA4, ÖA5, ÖA6, ÖA7, ÖA10, ÖA14, ÖA23	10	16
	Faculty of Education	ÖA5, ÖA7, ÖA9, ÖA12, ÖA15, ÖA16, ÖA21, ÖA22, ÖA23	9	14
	Undergraduate Courses			
	Being effective in students' lives	ÖA3, ÖA4, ÖA5, ÖA10	5	8
	Innovation	ÖA2, ÖA3, ÖA4, ÖA23	4	6
	Vocational orientation	ÖA1, ÖA2, ÖA5	3	5
	Total		63	100

When the findings related to teacher dimension are examined in triangles and similarity scenarios, it is seen that there are dialogues in many different areas such as pressure on teachers, education system based on rote learning, idealism, undergraduate teaching program, being effective in students' lives, innovation and professional orientation. Regarding the pressure on teachers, the principal said, "Let's try and see, as you say. But if you are not successful, you will be very upset; I am warning you about this right now. [ÖA 10]." In this case, we can interpret that prospective teachers have a perception that the principal will show negative attitudes and behaviours towards them, when they do not meet the expectations of the school management. In the scenario where a prospective teacher wrote about the preference of rote learning, the prospective teacher added a speech by the principal as "We should choose test solutions and rote learning method for the success of our school [ÖA 21]." Another prospective teacher added the following dialogue to the teacher role; "I am against education based on rote learning. Now go to the class and ask the right triangle and similarity questions. Is it a direct formula to their mind or will we do what we do outside of school? Because the children comprehend what they do by doing and finding on their own [ÖA6]". Regarding the idealistic teacher category, "The teacher returns to the class again and continues to teach the lesson without

wondering what the principal says. Because there is still hope [ÖA 10]” and “Yunus Teacher is a very young secondary school mathematics teacher. He has been appointed to a new school. He is very excited to be appointed. He has many goals and new thoughts that he wants to accomplish. Because, he has gone through these phases and he knows the students very well. When he starts his new school, he tries to activate his thoughts [ÖA14].” It is seen that these sentences provide a variety of data that can be discussed in terms of teacher training. A prospective teacher wrote the following statement in the scenario regarding undergraduate teaching program: “In line with the education received from the university, the young teacher believes that a real-life mathematics education will be more beneficial to students. The young teacher is determined to convince the school principal of his views [ÖA7]. In the scenarios written by the prospective teachers, it was seen that there are rich data that can be used for evaluations and feedbacks on the teacher dimension.

Table 5

Findings regarding student dimensions in triangles and similarity scenarios

<u>Themes</u>	<u>Categories</u>	<u>Participants</u>	<u>N</u>	<u>Percent (%)</u>
Pedagogical Elements for Student Dimension	To give students the ability to interpret	ÖA20, ÖA24, ÖA28	3	21.43
	To provide students with inquiry skills	ÖA8, ÖA24, ÖA27	3	21.43
	Communication skills with students	ÖA23, ÖA24, ÖA25	3	21.43
	To give students mathematical thinking skills	ÖA10	1	7.14
	To give students the ability of abstract thinking	ÖA19	1	7.14
	Intensive, tiring and stressful programs of students	ÖA2	1	7.14
	Low academic success of students	ÖA2	1	7.14
	Responsibilities of Parents	ÖA1	1	7.14
	Total		14	100

When the findings related to the student dimension are examined in similarity scenarios in triangles, it is seen that issues such as commenting, questioning, communication, mathematical thinking, and giving abstract thinking skills are addressed. Moreover, it is seen that students' intensive, tiring and stressful schedules and low academic achievement are mentioned in the scenarios. In

addition, it was determined that the responsibilities of the parents of the students were also stated. Even if these issues are not at the centre of the second scenario asked from prospective teachers, their emergence can be considered as a remarkable finding. If prospective teachers were asked to write a scenario based on the skills that students should gain and focused on student problems, it is thought that more situations related to this theme would arise. In the scenarios written by prospective teachers, some expressions such as "But I am an idealist teacher with goals. My first aim is to establish a healthy communication with my students and to convey the world of mathematics to them in the best way [P23]", "If we always give them multiple choice tests, they will lose their abstract thinking skills [ÖA19]" and "When we first explain a topic, we should show the relationship of this topic with daily life and direct them to think [ÖA24]" draw attention. It is evaluated that these parts in the scenarios are so rich in content that they can be interpreted, illustrated and given feedback in training mathematics teachers.

Table 6

Findings on the school management dimension in triangles and similarity scenarios

<u>Themes</u>	<u>Categories</u>	<u>Participants</u>	<u>N</u>	<u>Percent (%)</u>
Elements for School Management Dimension	Education approach of the school principal	ÖA1, ÖA2, ÖA3, ÖA4, ÖA5, ÖA6, ÖA7, ÖA8, ÖA10, ÖA12, ÖA13, ÖA14, ÖA16, ÖA19, ÖA20, ÖA21, ÖA24, ÖA26, ÖA28, ÖA29	20	37
	Negative school principal image	ÖA1, ÖA2, ÖA4, ÖA5, ÖA6, ÖA7, ÖA8, ÖA9, ÖA14, ÖA16, ÖA17, ÖA18, ÖA19, ÖA21, ÖA23, ÖA24, ÖA25, ÖA26	18	33.3
	School prestige and advertisement	ÖA1, ÖA2, ÖA3, ÖA4, ÖA5, ÖA7, ÖA8, ÖA11, ÖA12, ÖA14, ÖA15, ÖA18, ÖA24, ÖA27, ÖA28	15	27.8
	School principal's attitude towards students	ÖA1	1	1.85
Total			54	100

When the findings related to the school management dimension are examined in the "triangles and similarity" scenarios, it is seen that the school principal's understanding of education, the image of the negative school principal, the prestige of the school and the advertisement are found in the teaching scenarios.

In addition, in the teaching scenario of a prospective teacher, the school principal's dialogues regarding the attitude towards the students were determined. It is seen that these parts about school management are very useful data to emphasize in teacher education. For example, from the scenario of a prospective teacher about the school principal's education understanding category, the following section is considered as a rich content that can be commented, exemplified and given as feedbacks in terms of teacher education.

Manager: Sir, last week you had an activity outside your classroom with your 8th grade students.

Teacher: Yes we did.

Manager: Do you think this is the right decision, sir?

Teacher: I could not understand what was wrong with this.

Manager: They have the exams they need to take at the end of the year. It would be more useful if you solve many questions instead of wasting time with such things.

Teacher: Isn't it important to teach real life related lessons?

Principal: Students don't need real-life information right now. We should aim to prove our school's level of success to the city and the Ministry. Therefore, the number of correct answers to the multiple choice questions in the exam should be increased. We have to solve tests with multiple choice questions [ÖA9].

Regarding the image and advertising of the school in another scenario, the school principal told the teacher: "The success of the exam is important for our school. We need to show the others how successful and a good school we are." When data obtained from the scenarios created by prospective teachers are evaluated in general, it is seen that it contains a rich and diverse information for teaching dimension, cognitive and affective items, assessment and evaluation themes, and teacher, student and school management departments in education.

6 Discussion

The pedagogical elements used by prospective teachers in their first scenarios are examined under the sub-themes of cognitive and affective elements for teaching. It is understood that the pedagogical elements used by prospective teachers are mostly concentrated on cognitive elements. It is observed that prospective teachers often include the structure of teaching related to real life in their scenarios. It is stated that teaching in the context of real life increases academic success and students' interest in the lesson, and thus, the content is learned perceptibly by the students (Acar & Yaman, 2011). It is stated that prospective teachers have problems and are inadequate in associating the issues related to their fields with daily life (Yadigaroglu, Demircioglu, & Demircioglu, 2017). Considering that learning related to daily life provides meaningful and permanent learning, it is extremely positive that prospective teachers who are the

participants of this study frequently include this item in their scenarios. It is seen that teacher candidates frequently use the question-answer method in their scenarios. Similarly, Büyükalın-Filiz (2009) points out that the question-answer method is used in all lessons and that the ability to ask questions is an important competence for teachers. It is understood from the fact that prospective teachers attach importance to the use of examples in teaching in this scenario. At this point, it is stated that the examples used by the teacher should be interesting for students (Ersoy et al., 1991). Teachers should use meaningful, effective and interesting examples for students while providing examples related to the subject in the classroom by taking into account their students' levels, cognitive development and needs. In this context, domestic and foreign music, songs, movies, serials, books, stories, actors etc. that are loved or seen as popular by students should be followed. For example, it may be remarkable for students that, of course, regarding the content, when a science teacher gives examples of Ironman on pressure or wearable technologies, Marvel characters on space, or when a social science teacher gives examples from a historical TV series. In short, it was stated that it is advantageous to bring students' favorite heroes to the classroom environment in terms of content and to get help from them.

Another cognitive element that prospective teachers include in their scenarios is the use of available materials. It is noteworthy that the prospective teachers used real-life tools and materials as materials in the place chosen for the scenarios of their scripts. For example, in the driving scenario, they used the car's rear view mirror, speed / km indicators, traffic signs on the roads, gas stations, etc. It is seen in their scenarios that they use the tools as materials. This approach of prospective teachers can be evaluated in relation to their economics and close and distant principles in education. It can also be said that it is an extremely good qualification in terms of teacher characteristics, since it is also associated with daily life. It is stated that teachers are enthusiastic about it but not sufficient in terms of using materials in the lesson (Ulusoy & Gülüm, 2009). In another study, it was reported that teaching lessons with materials developed on probability was found to be positive by both teachers and students (Gürbüz, 2007). Again, it is seen that prospective teachers sometimes address issues in an interdisciplinary way in their scenarios. It is pointed out that many subjects that are desired to be taught to students have interdisciplinary features, and it is stated that interdisciplinary approach can be applied in both social sciences and science. In recent years, there are many studies that address science and social sciences in connection with each other (Ürey et al., 2013). STEM, which has become very popular in recent years, is an educational approach based on interdisciplinary teaching of science, mathematics, engineering and technology (Sarica, 2019). Interdisciplinarity is not related to certain subject areas. On the contrary, even fields that are perceived as distant and basic understanding paradigm, such as medicine, law, environmental sciences, energy, economics,

humanities, are likely to be presented under the same roof, in relation to several disciplines.

Another cognitive teaching item used by prospective teachers is to make students discover the correct answer or concept by not directly speaking. This situation can be seen as prospective teachers' attempts to apply the method of learning through the invention. In a study by Temizöz and Özgün-Koca (2008), mathematics teachers often said that they preferred traditional learning-teaching methods in their lessons. For this reason, they stated that they did not use it, although they thought that learning through the invention would provide meaningful learning. At the same time, it is stated that they think this method is not applicable due to the time limitation and the excessive number of topics. On the other hand, prospective mathematics teachers, who are the participants of this study, try to apply this method and enable students to reach and think through exploring without directly giving the correct answer. This may be a reason why all the programs in our country's education system have been prepared in a way to cover contemporary approaches in recent years. As a result of the updates made in the teacher training system, the increasing variety of lessons on contemporary learning and teaching methods may have caused this emphasis. At this point, we see that there are prospective teachers who prefer the traditional method as well as those using the discovery learning method. It is seen that some of the scenarios of prospective teachers included a teachers role in which teacher responded the question directly without giving the student the opportunity to think or find the answer by using hints. This situation can be seen as normal. Prospective teachers have been trained in traditional methods for years and Teacher candidates have been trained in traditional methods for years and are convinced of its accuracy. Of course, direct instruction can be used depending on the nature of the subject or content and the level of the group.

In a thesis study conducted on prospective teachers, it is stated that the participants mostly have positive opinions about research based learning, which is one of the modern approaches, but they still show resistance in the experimental process of the study (Sarica, 2016). In this case, it is stated that the participants are not accustomed to new and different methods, they have been educated with traditional methods starting from primary school and their habits from the past may have an effect. It is seen that prospective teachers try to support students' prediction and reasoning skills in some parts of their scenarios. In a study, it is stated that elementary school students with high predictive skills have high academic success (Tekinkır, 2008). Therefore, it can be said that it is important to develop these skills of students especially in mathematics teaching. Again, it is seen that prospective teachers try to teach their students by revealing their sense of curiosity, even partially in their teaching scenarios. It is a well known fact that learning often begins with a sense of curiosity. The prospective teachers included cognitive items such as reminding pre-learning, having fun, and playing in learning situations, using visuals, using the analogy method. It

was determined that prospective teachers included less affective elements in their scenarios. In some of these scenarios, items such as interest, motivation, attitude, fear, encouragement, and exam anxiety were mentioned. Focusing more on cognitive elements in teaching is actually a common trend among teachers. However, affective elements are as important as cognitive elements, and maybe even a prerequisite for learning. It is a well-known fact that students with intrinsic motivation in education are more successful than those with extrinsic motivation. This also underlines the fact that having an interest in the subject affects learning.

When the findings in triangles and similarity scenarios are examined, it is seen that the themes of teaching dimension, assessment and evaluation dimension, teacher dimension, student dimension and school management dimension emerged. In this respect, it is thought that scenario writing activities can produce rich data not only in training mathematics teachers but also in all areas of education. Regarding the teaching dimension, it is seen that the use of mathematics in daily life and the meaningful learning categories are the most repeated topics. In addition, it has been determined that there are texts and dialogues in many areas such as permanent teaching, solving questions, teaching mathematics outside the classroom, teaching by doing-living, experimenting and observing, and endearing mathematics. In this respect, it can be said that there are many examples in scenarios to give feedback to prospective mathematics teachers in terms of teaching. In many studies based on the development of teaching skills of prospective mathematics teachers and currently working mathematics teachers, it is frequently emphasized to give them feedback about their own practices (Adler, 1996; Stein & Brown, 1997; Graven, 2003; Breen, 1999; Ropohl & Rönnebeck, 2019).

Assessment and evaluation are vital for effective mathematics teaching. A valid and reliable assessment gives feedbacks to teachers on the effectiveness of their own lesson (Nagy, 2020; Kyaruzi, Strijbos, Ufer, & Brown, 2019; Adams & Hsu 1998; Al Duwairi, 2013). In this way, math teachers can get the opportunity to improve their lesson. Another theme identified in triangles and similarity scenarios relates to the assessment and evaluation dimension of education. When this theme is examined, it is seen that the use of multiple choice tests in mathematics teaching is the most common concept in scenarios. Prospective teachers criticized the use of multiple choice questions negatively in the scenarios. When the Table 3 is considered, it is seen that twenty-one different dialogues have been created in mathematics teaching related to test solving consisting of multiple choice questions. It is thought that discussing the use of multiple choice tests for assessment and evaluation in mathematics teaching will be useful in terms of giving examples of various opinions in scenario writing activities. The evaluation of students' mathematics achievement mostly determined by the number of correct answers in multiple choice exams and the dialogues related to this category were examined under the theme of assessment

and evaluation of scenarios. Examples of scenario writing activities can be used in training prospective teachers on the definition of mathematics achievement of success. Mathematics achievement cannot be assessed only by multiple choice questions. Mathematics facilitates our daily life as it has a related structure associated with many other disciplines (Huang, Huang, & Wu, 2014).

Centra and Potter (1980) stated that there are many factors that affect student success and one of these factors is the teacher. In many studies, it has been found that student success mostly results from teachers (Good, 1979; Lamb & Fullarton, 2002). Marshall (1993) stated that if the teacher has effective features, they can eliminate the disadvantaged aspects of children from poor families. Within the scope of the research, many scenario contents were determined regarding the teacher dimension of education. When these opinions are examined, it is seen that the dialogues in the theme of "pressure on teachers" are the most used topic in the scenarios. The negative aspects of the "memorization in mathematics teaching" approach were also highlighted in the scenarios by prospective teachers. In the triangles and similarity scenarios, there are also elements related to "how should be the undergraduate education of teaching" and "what should be the role of the teacher who is effective in students' lives". These resulting dialogues can be used as a discussion tool in education on how to be an effective teacher in teaching mathematics. It has been determined in many studies that teacher factor is very important especially in mathematics lessons (Good & Grouws, 1979; Lamb & Fullarton, 2002). It is understood that there are also elements of dialogues with innovativeness and professional orientation, even if they are rarely mentioned compared to others.

According to Vygotsky (1986), there is a strong interaction between a child's social world and cognitive development. Students from different social backgrounds show different achievements and skills in education. The aim of education is to provide these students with some knowledge and skills, regardless of their different backgrounds. Situations regarding the student dimension of teaching were also used in the scenarios by prospective teachers. There are some parts that emphasize the acquisition of skills such as commenting, questioning, communication, mathematical thinking, and abstract thinking, although their numbers are few. These sections can be useful in training teachers to evaluate students' dimension of education. In addition, it was seen that students' intensive, tiring and stressful programs, low academic achievement and parent factor were mentioned in the scenarios. These findings show that scenario writing activities provide rich content about the skills that prospective teachers should acquire. In teacher training institutions, comments and evaluations about these issues can be made and used as real examples to raise awareness.

School management should be in close cooperation with teachers and parents to ensure suitable and appropriate education. If there are inconsistencies between the school administration's understanding of education and teachers' attitude

towards education, this situation may negatively affect the academic success of the school. The impact of the school on success is closely related to the characteristics of the school. In a study by Mortimore et al. (1988), they found that the effect of school on mathematics lesson was ten times higher than that of the family. School and class processes have been found to be more effective than the social, economic and ethnic backgrounds in student success (Charlton & George, 1996). In the scenarios written by prospective teachers, elements related to school management were also identified. When these are examined, the dialogues of the principal's understanding of education, the image of the negative principal, the prestige and advertisement of the school and the attitude of the principal towards the students were determined. They have revealed situations that can be used to train teachers in the faculties of education during the pre-service period.

Prospective teachers reflect the pedagogical elements that they construct in their minds in the form of dialogues during the scenario writing process. In this process, their creativity comes to the fore. It also requires deep thinking about the theme of the script. It is thought that these processes can be explained in the literature with the concept of "dialogic reflection". Prospective teachers transfer the situations they constructed from their minds to the scenarios. From this point of view, it can be said that they make a "dialogic reflection" in a sense. Dialogic reflection requires teachers to evaluate their own practices by talking to others (Mann & Walsh, 2013). The prospective teachers evaluate the practices that they designed in their mind during the script writing process as if they were talking to others. Similarly, Bailey (1996) stated that prospective teachers' collaborative speeches on how to teach a subject are a very useful method in teacher education. The only difference in scenario writing activities is the transfer of the situations that the prospective teacher constructs in the mind to the conversation process. In this study, it is concluded that general evaluations such as class discussion can be made on these conversations in some selected scenarios. This discussion process can actually be evaluated within the definition of "dialogic reflection" on a virtual scenario that the prospective teacher has built.

Conclusion

Future research may focus on whether scripting activities are a useful tool in other topics and areas. The "car travel" scenario in this research is given within the scope of the theme which includes only two people and a limited environmental interaction. The second scenario presented in this study is the triangles and the similarity scenario. In the second scenario, the role of a teacher who conducts applied and real-life education outside of school is defined. While giving other scenarios, teacher candidates may be asked to write a script by giving themes. However, further researches can be conducted on the use of script writing activities in the teaching of subjects at high school and secondary school level. In addition, it is stated that it is important to include students'

expectations in learning-teaching situations (Sarica, 2020). Therefore, opinions of prospective teachers can be consulted on subjects such as content and form features of the scenarios. Scenario work can be further customized. For example, prospective teachers may be asked to work in certain contexts or on scenarios where certain learning-teaching methods are used. For example, it has been reported that a different and rich learning environment is created thanks to the technologies used in flipped classroom environments (Özbay & Sarica, 2019). A scenario study can be made for teacher candidates to teach a subject in a flipped classroom environment.

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