International Journal of Progressive Education, Volume 14 Number 6, 2018

Professional Development through a Web-Based Education System: Opinions of Middle School Mathematics Teachers [1]

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Abstract

A web-based education system was designed within the scope of a project to ensure the professional development of middle school mathematics teachers. This system was designed in a way to allow teachers to prepare a Hypothetical Learning Trajectory and lesson plan related to the algebra learning content and also to give feedback to these contents prepared. In this study, it was aimed to determine teachers' opinions about such web-based education system. In line with this aim, at the end of application, semi-structured interviews were conducted with twelve mathematics teachers. In this study, phenomenology, one of the qualitative research designs, was adopted, and thematic analysis was used in the analysis of data. Accordingly, six main themes regarding the process taking place from the design stage to the application stage of the web-based education system were specified to determine the opinions of teachers regarding the system. According to the results obtained, it was observed that teachers generally liked the design of the system. When teachers' opinions about the strengths and weaknesses of the system are examined, the strengths are the facts that it makes teachers prepare lesson plans and that the system enables to revise these lesson plans prepared in line with the reflective questions and feedback received from moderators. Regarding the weak aspect of the system, only one teacher expressed his/her opinion that integrating the theoretical knowledge in the feedback of moderators into the class does not apply to all learning environments. The general opinion of teachers about their satisfaction with the web-based education system is that they are satisfied with the system. They emphasized that teachers get detailed information about certain algebraic concepts and

[1] This research is supported by the Scientific and Technological Research Council of Turkey (TÜBİTAK) under SOBAG 1001 programme.

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integrate this information into their teaching thanks to expert opinions they receive. Furthermore, it was observed that teachers agree that the system is useful in recognising their own shortcomings and mistakes.

Keywords: Professional development, Learning trajectory, Web-based education system, Middle school mathematics teachers, Mathematics education.

DOI: 10.29329/ijpe.2018.179.8

Introduction

Professional development of teachers takes place through formal or informal learning. Formal learning is a structured and organized process, that is, this process is related to a training program received by teachers. Therefore, postgraduate education, in-service training, seminars, etc. are included in this process. However, informal learning, it is related to teachers' *individual experiences* (Gann & Friel, 1993; Grosemans et al., 2015). Both ways of learning affect the teaching and learning process of teachers. However, there is also a need for professional development programs to ensure the continuity of learning and to increase the qualification of teachers. When the related literature is examined, it is observed that there exist studies on professional development in different contexts. It is noteworthy that some of these studies are aimed at professional development of mathematics teachers (Ball & Cohen, 1999; Sztajn, Campbell & Yoon, 2011; Wieland, 2011; Jones & O'brien; 2011; Huber, 2011; Snoek, Swennen & Van Der Klink, 2011; Patel, Franco, Miura & Boyd, 2012; Borko, Koellner & Jacobs, 2014). These studies show that teachers have made progress in the context of pedagogical content knowledge and experienced positive changes in their beliefs and attitudes (Bütün, 2012; Lee-Swars, 2015).In Turkey, the shortcomings in teachers' competences stand out in studies on the pedagogical content knowledge of mathematics teachers (Goulding, Rowland & Barber, 2002; Baştürk & Dönmez, 2011; Gökkurt & Soylu, 2016; Tanışlı, Ayber & Karakuzu, 2018). While a number of of these shortcomings may be related to the quality of the undergraduate education of teachers, a number of of them are related to the efficacy of the individual efforts of teachers to develop themselves after they begin their profession.

The professional development of teachers in Turkey has been ensured by the Ministry of National Education (MoNE) In-service Training Department, and locally by governorates since 1982. In addition to these, professional development activities are maintained through the seminars held within the school, and projects conducted by the MoNE, universities or various institutions (Bümen et al.,, 2012). Nevertheless, in addition to in-service teacher training they receive, it is important to monitor what teachers learn in this training, how they integrate their new knowledge and skills in their classes, how they evaluate their students in this process and how they reflect these evaluations to their own learning. Unfortunately, in-service training carried out in Turkey does not include much of this kind of information. On the other hand, many studies conducted on professional development are not compulsory and usually provided during summer holidays, mid-term breaks, at weekends or outside school hours. Therefore, teachers need to allocate additional time to be part of such activities.

Considering the factors that will obstruct the development of teachers, the most effective and efficient support to them can be provided through web-based education systems in which teachers can get help from the environment in today's world in which the internet and technology are part of our lives. Indeed, it is noteworthy that such systems are used to provide the professional development of teachers and become widespread with each passing day (Kao & Tsai, 2009; Waheed et al.,, 2011; Chien, Kao, Yeh & Lin, 2012). On the other hand, it is observed that these studies are on examining the changes in the attitudes, beliefs, and motivations of teachers (Kao, Wu & Tsai, 2011; Chien, Kao, Yeh & Lin, 2012). Therefore, in addition to these investigations, it can be said that there is a need for studies, which investigate the professional development of teachers through web-based systems with various interactive functions such as discussion environments, investigating course materials and giving feedback, updating and changing these materials, adding videos with classroom practices when needed, and providing feedback upon these videos. In this way, how teachers integrate the training they have received into the classroom environment can be observed.

Along this direction, in the context of this paper, a web-based education system that is independent of time and place was developed, and a two-year project study was planned to ensure the professional development of mathematics teachers. The scope of the project is to design a web-based portal to ensure professional development of mathematics teachers, where the teachers design their own Hypothetical Learning Trajectories (HLT) (Simon, 1995) regarding teaching-learning algebra activities in Turkish middle school mathematics context. HLT was first suggested by Simon (1995) for the literature on mathematics education. The HLT can be expressed as creating educational activities

that make students understand the mathematical concept more deeply by describing the *learning routes* of students with regard to a mathematical concept, in other words, defining a *roadmap* for their progress in the process of learning (Simon, 1995; Zembat, 2016). Within the scope of this project, each teacher designed HLT through web-based system by interacting with mathematics teacher educators for each step (as will be described later) considering learning goals, student backlog and use of appropriate materials and activities. The pilot study of the project (i.e. the first year of the project) has been completed, continues.

In this article, it was aimed to both introduce the design and application process of the web-based education system and determine the opinions of the middle school mathematics teachers who use a web-based education system and participate in the pilot study. The answer to the following research question was sought in this context:

What are the opinions of middle school mathematics teachers on ensuring their professional development through a web-based education system?

It is believed that this study will serve as an example to similar projects to be newly designed by presenting the design of a practical and ergonomic web-based education system based on HLTs. It is also believed that this study is important in terms of both making the system more functional and ensuring the participation of teachers in similar studies in line with the opinions to be taken from teachers.

Designing a Web-Based Education System

Three stages were taken into consideration when designing a web-based education system named XXXX (the Programme for Supporting the Professional Development) developed within the scope of the project. In the first stage, the content was prepared which included the introductory video of the project, theoretical perspectives (constructivism and learning trajectory presentation) and examples (hypothetical learning trajectories and lesson plans) aiming to inform the participants about the project, and this content prepared was transferred to the Web environment under the name of the relevant website xxxxx.edu.tr

As provided in Figure 1, the introductory video of the project was placed on the main page of the web-based education system. Furthermore, buttons, which enable the teachers who wish to participate in the project to register in the system and then log in, were placed on this page.

Figure 1. The Main Page Screen with the Project's Introductory Video

Presentations on how teachers can use the system as the participants of the project, theoretical perspectives that constitutes the content of the project, and the examples prepared were placed on the

main page immediately after the introductory video for teachers to access them easily all the time (Figure 2). Furthermore, a membership automation system was created on the website for security purposes, and the activities of the participants (teachers) were taken under control by the administration panel and admin (project coordinator).

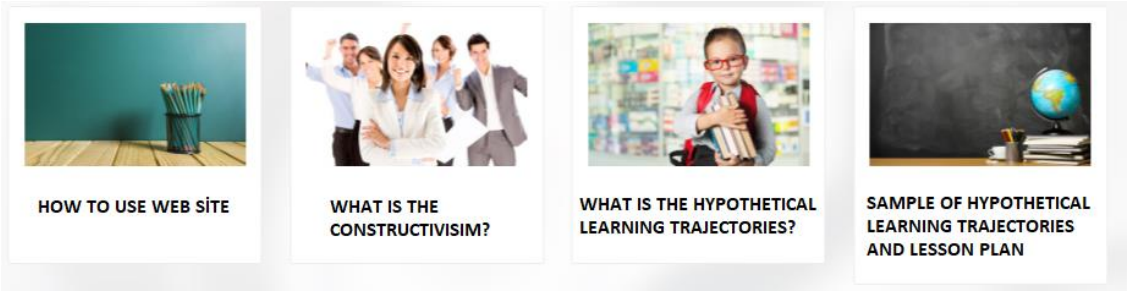

Figure 2. Section with Theoretical Information and Examples on the Main Page

The communication component of the system was addressed in the second stage of the design of the web-based education system. In this context, the membership of twelve teachers, who were determined as project participants, was activated, and other memberships were made passive. Twelve teachers who were determined as the participants of the project were assigned randomly to three researchers, who were moderators in the system, and the processes of the teachers were made available for monitoring by the researchers through the moderator interface. In addition to this, a connected users tab, which allows four participants assigned to each researcher.

The third stage of the design of the web-based education system, which is the management component, is the part in which the task cycle and the processes in this cycle are designed. In this context, three different designs were created: admin, moderator and user interfaces. The admin interface is the section where all the settings in the application are performed. The moderator interface is the section where the moderators can monitor the processes of the users (i.e. teachers). In this process, the moderator can examine the learning objectives entered into the system by teachers and give feedback with regard to these learning objectives. Then, by examining the lesson plans prepared by teachers according to the provided feedback, they receive (modified) learning objectives. Moreover, the moderators can ask reflective questions to teachers with regard to such lesson plans and give feedback according to given responses of reflective questions. In addition to this, moderators can watch the classroom videos through the portal where the teachers upload to the system.

The user interface is a section where teachers enter their learning objectives, lesson plans, practices into the system and get feedback from the moderators. The processes (Creation of learning objectives, Preparation of the lesson plan, Implementation of the lesson plan, and Adding the video of the lesson) which the teachers go through when creating their learning trajectories. In this cyclical structure, teachers must successfully complete the previous process in order to pass to the next process, and the moderator must approve the teachers' processes. Taking the moderators' approve can be considered as a key tool in the context of the web portal.

The processes appear in grey if the teacher who has started the task cycle does not enter any data (see Figure 3). When one of the processes is completed, it turns yellow, and the moderator is expected to provide feedback on the completed process and ask the reflective questions. After evaluating and approving the process by the moderator, it turns green and allows the teacher to move on to the next process.

Figure 3. Functioning of the Task Cycle through the portal

In the web-based education system, communication between moderators (researchers) and users (teachers) is provided through feedback and reflective questions. In this direction, when teachers are asked reflective questions or given feedback by moderators, teachers can follow these feedback and reflective questions from the task cycle on their screens as shown in Figure 4. Furthermore, moderators are automatically informed by e-mail of the interactions of teachers regarding the system, similarly, the teachers are automatically informed of the interactions of moderators by e-mail.

Figure 4. Appearance of the Feedback and Reflective Questions in the Task Cycle

Methods, Research Design

In this study, phenomenology among qualitative research designs was used since it was aimed to determine the opinions of middle school mathematics teachers on the professional development over the web-based education system. Phenomenology is a qualitative research model that examines in depth the phenomena that we are aware of but are not knowledgeable enough, or we do not think enough about (Creswell, 2009; Frankel & Wallen, 2000; Yıldırım & Şimşek, 2013). Phenomenology is also expressed as cases when all participants experience a common phenomenon (Creswell, 2012), and phenomenological studies investigate the perceptions and thoughts of the participants about these situations they experience and how they create awareness in themselves by structuring them (van Manen, 2007). In this context, the perceptions of middle school mathematics teachers of the web-based education system in which they have experience were considered as a phenomenon each, and phenomenology design was adopted in this study to determine how they perceive this system and which common themes were achieved.

Participants

Phenomenological research describes the common meaning of several people's experiences with regard to a phenomenon or concept (Creswell, 2013). Therefore, data sources in phenomenological studies are individuals or groups who have experienced the phenomenon that the research focuses on, and who can express or reflect this phenomenon (Yıldırım & Şimşek, 2011). In this context, the participant group of this study which aims to determine the opinions of middle school mathematics teachers on the web-based education system consists of 12 teachers working at middle schools in Eskişehir province, teaching mathematics to 6th-grade students in the 2017-2018 academic year and selected using the maximum diversity sampling method (Creswell, 2013). The information on the teachers who participated in the study is presented in Table 1.

Table 1. Demographic features of the participants

Code	Graduation	Education Level	Experience (year)
T_1	Faculty of Education	Bachelor	10
T_2	Faculty of Education	PhD Canditate	4
T_3	Faculty of Education	PhD Canditate	7
T_4	Faculty of Education	PhD Canditate	11
T_5	Faculty of Education	Bachelor	6
T_6	Faculty of Education	Bachelor	1
T_7	Faculty of Education	Master of Science Canditate	4
T_8	Faculty of Education	Bachelor	15
T_9	Faculty of Education	Master of Science	3
T_{10}	Faculty of Education	Bachelor	13
T_{11}	Faculty of Education	PhD Canditate	10
T_{12}	Faculty of Education	Bachelor	5

Data Collection Tools

The semi-structured interview technique that provides flexibility to the researcher (Yıldırım & Şimşek, 2011) was used as the data collection tool in the study to obtain the opinions of the teachers regarding the use of web-based portal. In this context, a semi-structured interview form was prepared by the project coordinator for the problems and opinions regarding the functioning of the system, its context, strong and weak aspects. The interview questions in the form were then presented to two faculty members together with the expert opinion form, who are experts in mathematics education and having roles as researchers in the project. Examples of the questions in semi-structured interview form and together with expert opinion form are presented in Table 2. The interview form was revised according to the expert opinions.

Table 2. Examples of the interview questions asked to teachers and expert evaluation form

Examples of the Semi-Structured Interview Questions	It can be taken as it is.	It should be arranged as explained.	It should be removed from the form for the following reason.
Could you use the content on the introductory page of the system in the project process? Do you think it was sufficient?		Could you use the content on the introductory page of the system (introductory video, presentations, sample lesson plans, and trajectories) in the project process? Do you think it was sufficient? If you think that it is not sufficient, what kind of content do you suggest be added?	

Do the screens that you enter your content (learning objectives, lesson plans) allow you to work comfortably? What kind of a data entry screen would allow you to work more comfortably?	X	
Could you monitor the processes of your partner with whom you were matched in the system?		Could you monitor the processes of your partner with whom you were matched in the system? Did you benefit from monitoring your partner's processes? What kind of benefits did you get?
Do you think you took into consideration the feedback on your lesson plan? Could you revise your plan in accordance with the feedback?	X	

The pilot trial of the revised interview form was carried out by the project coordinator with a teacher. In accordance with the pilot trial, repetitive questions were removed from the form and questions that could not be answered were revised. Therefore, in the light of obtained feedbacks, final version of the form was prepared for implementation. Although the interviews were planned to be conducted via the web-based education system, they were conducted face-to-face, and audio recordings were taken by taking into consideration the possibility of the teachers not responding over the system in detail.

Data Analysis

In the study, thematic analysis technique was used in the analysis of data obtained as a result of semi-structured interviews (Liamputtong, 2009). In this context, six main themes were determined with regard to the process from the design stage of the web-based education system to its implementation to determine the opinions of the teachers on the system as shown in Figure 5. These themes are the design and interface, content of the system, functioning of the system, strong and weak aspects of the system, satisfaction and suggestions.

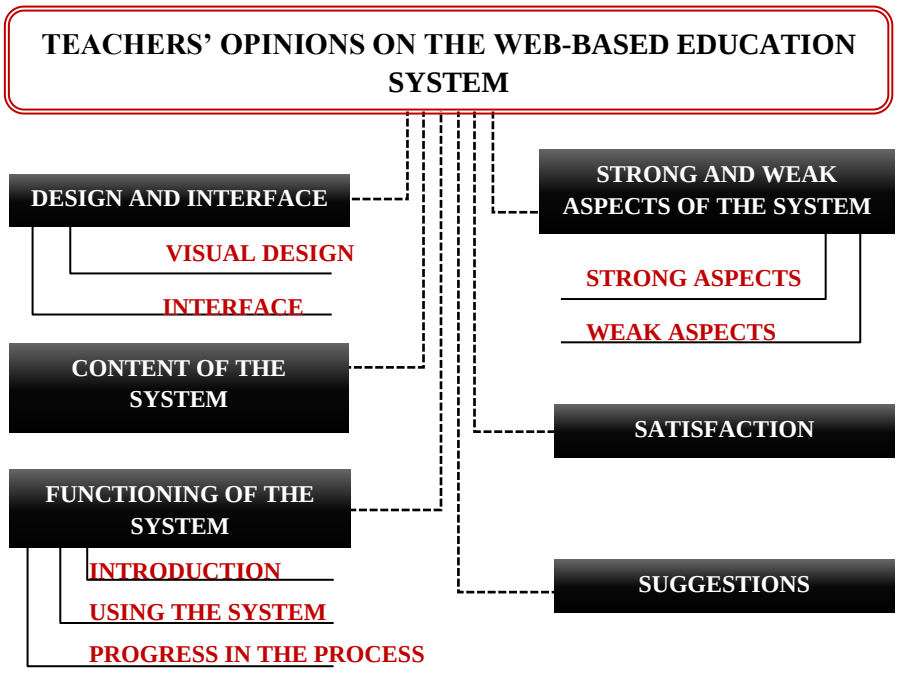

Figure 5. Themes under which the Data were Analysed

The coding and theme development process were carried out independently by three mathematics educators, and reliability of 81% was ensured by calculating reliability (Miles & Huberman, 1994, p. 64). The themes and sub-themes were presented as diagrams in the findings, and coding such as T_1 was used for the candidates.

Findings

Semi-structured interviews were conducted with 12 teachers participating in the study following the pilot study to determine the opinions of the teachers on the web-based education system and to make the necessary arrangements by taking such opinions into consideration for the main implementation of the web portal with a large setting. The data obtained from the interviews were gathered under six main themes related to the process from the design stage to the implementation stage of the web-based education system as shown in Figure 6. Some themes were divided into sub-themes since they contain several different components.

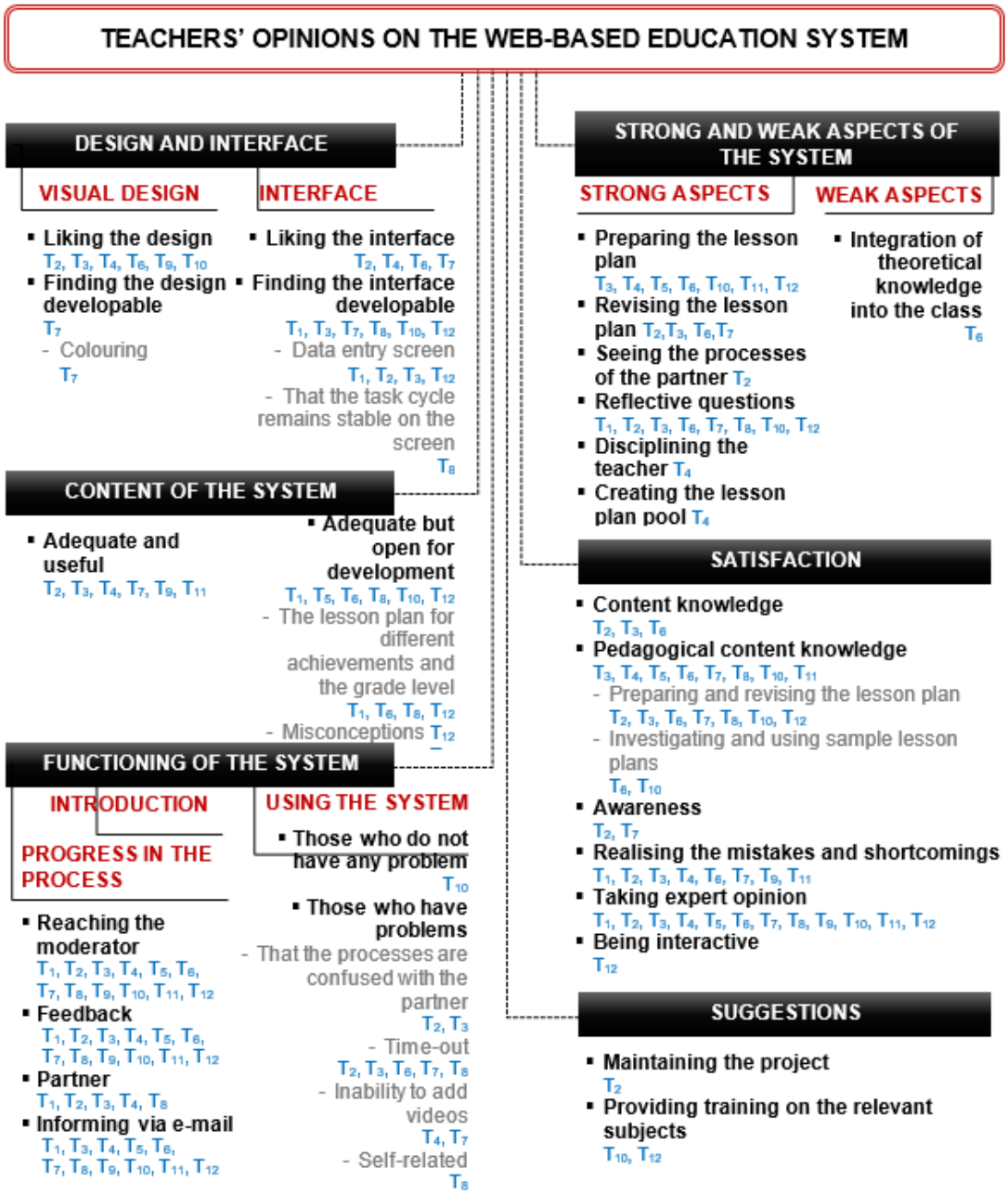

Figure 6. Opinions of the Teachers on the Web-Based Education System

As a result of the interviews, when the design of the web-based education system was evaluated, as seen in Figure 6, the teachers generally liked the design, and one of the teachers thought that it could be improved. The suggestion of this teacher for the improvement is that the design should be more colourful and interesting. Regarding the interface of the portal, the teachers also stated that the interface could be improved. The suggestions for the improvement of the interface were to develop the data entry screens and the task cycle remaining stable in the interface.

When the opinions of the teachers regarding the content of the system were examined, it was observed that two different opinions emerged. As seen in Figure 6, half of the teachers found the content downloaded in the system adequate and useful, while the other half found it useful but lacking. Two of the teachers, who found it adequate and useful, stated that they applied the sample lesson plans in the system that were prepared for guiding the teachers when preparing their own lesson plans in their class. The statements of one of these teachers are as follows.

> ***Researcher:*** *Could you use the content on the introductory page of the system (introductory video, presentations, sample lesson plans, and trajectories) in the project process?*
>
> ***T_6:*** *Yes, I did. It was the subject of areas. I checked it before the lesson. I took notes, and I even checked these notes when teaching the subject area.*

The teachers who found the contents downloaded in the system useful but not adequate. One of the points they found inadequate is that the sample lesson plans for different grades and different achievements are not included in the system. Furthermore, they emphasized that they had difficulty in determining the misconceptions, which are one of the components of the lesson plan and demanded to provide training on this.

An introductory meeting on the functioning of the system was held before starting the application, and the researchers explained the functioning of the system to the participant teachers in detail. In the interview conducted at the end of the application, the teachers were asked whether this introductory meeting was sufficient for them, and 11 teachers stated that it was sufficient. One teacher stated that it was not sufficient and that more detailed training could be provided especially on the preparation of a lesson plan.

As a result of the questions asked to evaluate the functioning process of the system, it was found out that the teachers encountered some problems while using the system as shown in Figure 6. Two of the teachers stated that the learning objectives that they entered into the system were confused with the learning objectives of their partner, and five of them stated that the website timed out at the beginning of the application, so they had to enter the data once more. One teacher stated that he/she had difficulty in the use of the system because he/she was not good at technology, while the other one stated the same on the grounds of not following the informative e-mails. Both teachers had problems with uploading the videos to the system. The teachers communicated these problems to the moderators during the implementation process, and these software-related problems were solved by sharing them with the web developers. One of the teachers stated that he/she did not encounter any problem in the process.

When evaluating the process of functioning of the system, the teachers were also asked the question *"Could you easily access the researchers during the process when you needed them?"*, and in line with the answers received, it was found out that the teachers agreed with the opinion that they could easily access the moderators they were assigned to. T_6 stated that he/she received the response very quickly, while the teacher coded T_1 stated that the WhatsApp application facilitated and accelerated this process. Regarding the question *"Could you benefit from the feedback you received from the researchers?"* asked in this direction, all the teachers stated that this feedback was helpful, and three of the teachers stated that the feedback given was quite detailed. The answer given by T_6 to this question *"Yes, I even wrote it. I read it again and again and checked it. I used it in that way. It included quite useful information. I even had a flash of insight. I thought, wow, is this like that. For*

example, the patterns were never explained like that before, introduction to algebra from patterns. I thought how related they are…" shows how useful this feedback is. In addition, the teachers were asked whether they could follow the processes of their partners with regard to the functioning of the process and if they did, whether it was helpful or not. Except one of the teachers, the others followed their partners' processes, and the teacher who did not follow them did not realize that they could see their partners' processes in the system. Four of the teachers who followed the processes stated that it was useful to examine the lesson plans of their partners in preparing their own plans, and two of the teachers stated that examining the feedback their partners received from the moderators was useful in applying the lesson plan. Two teachers said that the ability to see the processes of their partners motivated them, while the teacher coded T_4 among these teachers explained the case saying "*It was useful for me in terms of motivating. Thinking that I should not be late as he/she did it a long time ago.*"

The teachers were asked whether they were informed via e-mail in the process after the reflective questions or feedback that the moderators entered into the system. Ten teachers stated that they received these e-mails, one teacher stated that he/she noticed the e-mails after a long time, and one teacher stated that he/she did not need any e-mail since he/she constantly checked the system.

The teachers were also asked about the strong and weak aspects of the system. One of the strong aspects of the system in accordance with the teachers' opinions on this subject was determined as having the teachers prepare a lesson plan. The teacher coded T_{10} expressed his/her thoughts on this as follows:

> *"Unfortunately, our teachers no longer get prepared for the lesson. I mean, a lesson plan is not prepared beforehand. I can say quite comfortably that this rate is 80%. There are teachers who enter the class by taking their pencil case only. Unfortunately, readily available sources also lead to this. So, they use what's in the source book. Or, ready-made software files, software on the computer. They prevented teachers from getting prepared for the lesson and making a lesson plan. They no longer do it. Therefore, the contents of the lesson remain a little empty. But in your plans, I've seen so many things. I've seen many things that we missed. All of them were about permanent learning. I especially liked the sample lesson plans for this purpose."*

Another strong-looking point is that the system allows revising these lesson plans in accordance with the reflective questions and feedback received from the moderators. T_1 expressed his/her opinions on this as follows: *"The feedback of the system, the reflective questions, and so on, were very useful for us to see our mistakes and shortcomings."* The teacher coded T_2 considered having a partner in the system as one of the strong aspects of the system by stating his/her opinions as follows: *"It was also nice to have a partner. I haven't thought of it at all, but now I'm thinking about the question asked. I wonder what it would be like if I were on my own. But I think it's a nice idea to be matched."* According to the opinion of the teacher coded T_4, it is one of the strong aspects of the system that it disciplines teachers in preparing a lesson plan. Finally, in accordance with these lesson plans prepared by the teachers, the creation of a lesson plan pool was defined as one of the strong aspects of the system by the teacher coded T_5.

As for the weak aspect of the system, only one teacher expressed his/her opinion. This teacher stated that integrating the theoretical knowledge in the feedback of the researchers into the classroom does not apply to each learning environment. The teacher coded T_{10} expressed this as follows: "*The weak aspect is that we cannot convert the process to the format you want as we are in the field. It is difficult to implement in the classroom environment."*

Moreover, the teachers were asked whether they were satisfied with this web-based education system that they participated in. The general opinion of the teachers is that they were satisfied with the system. They emphasized that they obtained detailed information about certain concepts especially thanks to the expert opinions they received and integrated this information into their teaching. In

addition, they stated that they obtained detailed information on how to teach the algebra learning domain to their students. The teacher T_6 expressed his/her opinion on this subject as follows: "*I am really satisfied with it. I learned how to explain algebra in my professional life. It has been a very useful system.*" Furthermore, it was observed that the teachers agreed that the system was useful in recognizing their own shortcomings and errors. T_2 stated that he/she entered the lesson in a more conscious way as a result of this application and expressed his/her satisfaction with the system as follows.

> *"In the continuation of this system, I think that it will reflect in my next plan prepared more positively both on my lesson and me. I'm glad I joined the system. I think this made progress in me … I realized this progress when teaching the lesson. I realized that I entered the class more consciously and that the lesson plans I prepared before were in the wrong direction or were not detailed. That's why this system has been beneficial for me, I'm satisfied with it."*

T_{12} stated that he/she was satisfied with the fact that the system is web-based and carried out interactively. Finally, the teachers were asked whether they had general suggestions with regard to the system. A teacher stated that the continuation of the processes in the system would be more beneficial for their professional development. The statements of T_3 *"I can say this. For example, if we look at the first and third plans, I made this revision more consciously in the third plan. I considered the feedback more consciously. I mean, if I had a fourth plan, I think I would do better"* seems to support this opinion. Another suggestion for the system is the training of teachers on the relevant subjects before the implementation begins. For example, T_{12} stated that he/she had difficulty when determining the misconceptions, did not know what to write, and training on this subject at the beginning of the application would be useful.

Discussion and Conclusion

According to the findings of the study, it was determined that most of the teachers liked the design and interface of the web-based education system. On the other hand, half of the teachers found the content loaded to the system adequate and useful, while the other half found it useful but lacking. Among those teachers who found the content adequate and useful, the teachers coded T_6 and T_{12} stated that they applied the sample lesson plans found in the system that were prepared for guiding the teachers in their classes. Although the sample lesson plans for different learning domains loaded to the system are intended to guide teachers in preparing their lesson plans, it is noteworthy that the teachers applied these plans in their classes. This situation suggests that teachers need well-prepared lesson plans, and if they can achieve such plans, they are willing to perform their teaching using these plans. Indeed, as it is also expressed by Arends (1988), lesson plans significantly contribute to creating well-managed and more disciplined learning environments. Moreover, the studies conducted show that a well-planned lesson reduces the waste of time (Clark & Peterson, 1986; Driscoll & Freiberg, 1996; Strinfield & Teddlie, 1991; quoted by Johnson, 2000), ensures that students internalise and better comprehend what they learn (Driscoll & Freiberg, 1996; Walberg, 1991, quoted by Johnson, 2000). Teachers' requests for existence of exemplary lesson plans for different grade levels in the system seems to support research findings in the related literature. Furthermore, the fact that Konyalıoğlu, Konyalıoğlu and Işık (2002) found out in their experimental study that the learning success of the group in which the lesson is taught using a plan is significantly higher than the learning success of the group, in which the lesson is taught without using a plan is a result that is parallel to obtained situation.

In the evaluation of the functioning process of the system, the teachers stated that the feedback they received from their moderators was detailed and it was very useful in their teaching. In addition, they emphasized that it ensured that they became aware of their own teaching, established a relationship between the concepts that they previously could not relate, and saw their mistakes and shortcomings. Therefore, these opinions of the teachers support the view that the academic support they receive after the beginning of their profession contributes to their professional development. Indeed, as it is also mentioned in the literature, mentorship is important for teachers who are new to

the profession to continue their professional development in a healthy way and contribute to the success of students and institutions (Blackhurst, 2002; Sorcinelli & Yun, 2007; Wilson et al., 2002). Moreover, it is a fact that novice teachers experience some problems in the adaptation process and in their teaching. These problems manifest themselves more clearly, especially in the first years when they start their profession (Ostroff & Kozlowski, 1993). In the study, the fact that the teachers T_2 and T_6 with less professional experience clearly stated that the feedback of the moderators was effective and useful supports this opinion.

Another condition which is evaluated in the process of the functioning of the system is that teachers can follow the processes of their partners. The teachers stated that the examination of the lesson plans of their partners was useful in preparing their own plans, and as well as examining moderators' feedback of their partners. These positive opinions of the teachers about partnership attract attention to the professional development model of the lesson study. The lesson study creates an environment that enables questioning the teaching approaches of the teachers of one another and in which teachers can benefit from each other's experiences (Özen, 2015; Boran and Tarım, 2016). Teachers begin the lesson study cycle with the preparation of the lesson plan aimed at the achievements they will teach, then discuss these lesson plans with other teachers. In this context, it can be said that the first stage of the lesson study was partially carried out by establishing a partnership over the web-based education system, xxxxx, in avirtual environment.

It is expected that a teacher primarily has content knowledge and integrates this knowledge into many components such as teaching strategies, student and program knowledge in the context of pedagogical content knowledge (Shulman, 1986; Ball, Thames & Phelps, 2008). In the study, the fact that T_6 stated that integrating theoretical information in the feedback of the moderators into the classroom is a situation that does not apply to each learning environment is a noteworthy result. This statement of the teacher shows that he/she has difficulty in converting the content knowledge he/she has into pedagogical content knowledge and cannot revise the lesson plan he/she has prepared in accordance with different situations he/she encounters. Nevertheless, as it is also stated by Schoenfeld (2006), it is necessary for teachers to leave from determined plan and revise their lessons in line with the aims of the lesson when necessary. It can be thought that the fact that the teacher with such an opinion is novice teacher may be a factor in developing such an opinion. Indeed, in their study, Peterson, Marx and Clark (1978) reported that experienced teachers consider the problems that may be encountered during the lesson in their plans, and when compared to novice teachers, they focus on the rules with regard to the activities and the feedback to be given to students more. Furthermore, the fact that two teachers with less professional experience stick to the lesson plan and follow the order of teaching (i.e. Eroğlu, 2016).

Moreover, in the interviews conducted, the teachers stated that they had difficulty in determining the misconceptions in their lesson plans and did not know what misconceptions students might have. However, student knowledge is important in terms of affecting the pedagogical content knowledge development of teachers, and consequently, ensuring their professional development. As it is also expressed by Simon (2006), as the student knowledge develops, the teacher's knowledge also changes simultaneously, and this change affects the learning of the teacher about learning, teaching, and the learning of students regarding their mathematical thoughts. Teachers' opinions that training on this subject would be very useful support the researchers' statements.

As a result, the general opinion of the teachers is that they are satisfied with being a part of the project and maintaining their professional development by using the web-based education system. They emphasized that they realized their shortcomings in their relevant content knowledge, especially regarding certain concepts, and they could integrate this information into their teaching by completing these shortcomings in line with the feedback they received from the moderators. They also stated that it was an opportunity for them to work with faculty members who are experts in their field. On the other hand, the teachers expressed their satisfaction with the system's being web-based and interactive implementation of the system. They also presented their suggestions for the project they participated in. One of these suggestions is that the trajectories and lesson plans they prepared and implemented for

the achievements in the system are not limited only to the algebra context but are also aimed to extend other contexts such as geometry. They even stated that it would be useful to perform it at other grade levels. Another suggestion is that providing more detailed training on the relevant subjects before starting the application will make the process more effective.

In summary, the opinions of the teachers on the web-based education system show that it contributes to their professional development. This result is in line with the findings of the studies in which teachers who were taught over the mathematical thinking of students could integrate this knowledge into the plans they prepared in the learning and teaching process and, above all, they could contribute to the concept development and problem solving success of students in their classes in the programs developed for contributing to the professional development of teachers (Fennema et al., 1996; Franke, Carpenter, Levi and Fennema, 2001; Kazemi and Franke, 2004; Sherin and Van Es, 2009). Moreover, teachers' positive opinions on the education system's being web-based are parallel to other research findings that suggest that providing teachers' professional development in web-based environments will be an effective way (Kao and Tsai, 2009; Waheed, Salami, Ali, Dahlan and Rahman, 2011; Chien, Kao, Yeh and Lin, 2012).

Suggestions

Within the scope of the study, it was determined that the teachers implemented the sample lesson plans related to different learning contexts and were intended to guide them in preparing their lesson plans. This attitude of the teachers shows that they need lesson plans in their teaching processes and they are willing to apply these lesson plans in their classrooms if they can access them. It is interesting that teachers tend to apply ready-made lesson plans instead of preparing their own plans. Conditions that cause teachers to develop an attitude in this direction can be examined through other studies.

Another interesting result of the study is related to the feedback that the teachers received from the moderators. The teachers emphasised that they found this feedback useful in the subject they taught, they realized that they had shortcomings especially in their content knowledge with regard to certain concepts, and they could complete these shortcomings in line with the feedback they received from the moderators, and they could integrate it into their teaching. They also stated that they had difficulty in defining the misconceptions and situations in which students might have difficulty while preparing their lesson plans. These statements of the teachers suggest the question about the reasons for the shortcomings in the content and pedagogical content knowledge of a novice teacher. Accordingly, studies should be carried out to investigate the factors causing the shortcomings of teachers in the profession rather than studies conducted with pre-service teachers, and new ideas should be created to eliminate these shortcomings. In this case, it may be an option to develop a system in which the content and pedagogical content knowledge of teachers in the profession can be measured at regular intervals, and teachers with shortcomings are determined and given in-service training. Moreover, teachers' opinions that the academic support provided contributes to their professional development is an indicator that they need a mentor. In this respect, programs can be developed in which the Ministry of National Education of Turkey provides academic support especially to novice teachers in cooperation with the education faculties of universities.

The teachers also stated that it was also useful to follow the processes of their colleagues with the partnership system within the scope of the project. However, environments and educational programs in which teachers in Turkey can work together with their colleagues and exchange their ideas are quite limited. Accordingly, projects can be developed to create an environment in which teachers can examine, evaluate and discuss each other's teaching processes, and the number of academic studies conducted in this context can be increased.

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