Educational Sciences: Theory & Practice - 13(2) • Spring • 1295-1303

www.edam.com.tr/estp

Investigation of Using Online Video Case Discussions in Teacher Education: Sources of Evidence of Mathematics Learning*

Aslıhan OSMANOĞLU[a]
Trakya University

Yusuf KOÇ[b]
Gaziantep University

Mine IŞIKSAL[c]
Middle East Technical University

Abstract

The purpose of this study was to explore pre-service and in-service mathematics teachers' analyses of student learning in a video case of mathematics instruction via an online learning forum. The study was conducted in the context of three different mathematics methods courses in a 4-year college in the Midwestern United States. Twenty-six students (19 undergraduate and 7 master's students) participated in the study. As a course assignment, the participants were asked to watch and discuss a video case of mathematics instruction. During the discussions, the instructor and participants posted 57 online messages in total. To analyze the data, the content analysis technique was employed. As the initial coding framework, National Council of Teacher of Mathematics [NCTM] Process Standards including problem solving, reasoning and proof, communication, connections, and representation were selected. The analysis of the data revealed that effective student participation, the importance of communication among the students as well as between the students and their teacher, the necessity of using connections among mathematical ideas, use of manipulative, using what students have already learned in a new situation, and building knowledge through problem solving were identified as evidence of mathematics learning by the participants.

Key Words

Online Discussion, Video Cases, Mathematics Learning, Pre-service Teachers, In-service Teachers, Evidence of Learning.

Case studies have long been employed in teaching in several disciplines such as law, medical education, business, and management (Masingila & Doerr, 2002; Shulman, 1992; Sowder, 2007). Their use in teacher education is also not new (Merseth, 1999) although it became more common in past decades (Darling-Hammond & Hammerness, 2002; Merseth, 1996). Shulman defines case methods as "…the methods of pedagogy employed in conjunction with teaching cases" (p. 19). What makes a case

* This paper was revised after being presented at 6th International Computer and Instructional Technologies Symposium, Gaziantep, Turkey, 4-6 October 2012.

a **Aslıhan OSMANOĞLU, Ph.D.**, is currently an assistant professor at the Department of Elementary Education. Correspondence: Assist. Prof. Aslıhan OSMANOĞLU, Trakya University, Faculty of Education, Department of Elementary Education, Edirne, Turkey. E-mail: aslihanosmanoglu@trakya.edu.tr Phone: +90 284 212 0808.

b Yusuf KOÇ, Ph.D., is currently an associate professor at the Department of Elementary Education. Contact: Assoc. Prof. Yusuf KOÇ, Gaziantep University, Faculty of Education, Department of Elementary Education, Gaziantep, Turkey. E-mail: kocyusuf@gmail.com

c Mine IŞIKSAL, Ph.D., is currently an associate professor at the Department of Elementary Education. Contact: Assoc. Prof. Mine IŞIKSAL, Middle East Technical University, Faculty of Education, Department of Elementary Education, Ankara, Turkey. E-mail: misiksal@metu.edu.tr

is the knowledge it represents, and the instructive power of a case lies in its structure, purpose, and content (Merseth, 1996). Teaching cases are constructed to be used in teacher education and they describe teaching (Sykes & Bird, 1992). They are opportunities for reflection, and understanding teaching (Merseth, 1996). In other words, cases are seen as a way of learning as they describe teaching, and help teachers with reflecting on teaching. Either they are text-based cases, video-based cases, or multimedia cases; cases are seen as a way of learning as they help teachers with reflecting on teaching.

There are several studies in the literature on the use of cases in teacher education. Some of these studies indicate that cases allow both pre-service and in-service teachers to reflect on student thinking and learning (Masingila & Doerr, 2002), and they are expected to prompt discussion and collaborative reflection (Arellano et al., 2001; McGraw, Lynch, Koc, Budak, & Brown, 2007; Shulman, 1992). Among these studies, Van Es and Sherin's (2010) study investigated teachers' attention to student thinking, and revealed how teachers were developed professionally through the video clubs. This study suggested that through the video club engagement, teachers started to focus more on students' mathematical thinking. In another study (Koc, Peker, & Osmanoglu, 2009), pre-service and in-service teachers with the inclusion of the video case teacher reflected on a video case through online discussions. In that study, Koc et al. concluded that student understanding was among the most discussed topics, and collective engagement of both pre-service and in-service teachers provided a strong support for professional development of teachers. In another study (Osmanoglu, Isiksal, & Koc, 2012) it was found out that when pre-service teachers are provided with an environment to analyze real mathematics classroom videos through online discussions, they can reflect on several issues related to students and to their learning. Masingila and Doerr's (2002) study also contributed to the research on the effectiveness of the use of cases in teacher education. The study findings indicated that multimedia case study promoted the reflection among prospective teachers, and opportunities for pre-service teachers to reflect on student thinking via analyzing expert teachers' lessons are needed for the development of the teachers. In Stockero's (2008) study, the researcher investigated how the use of video cases develops habits of reflection in pre-service mathematics teachers. The researcher examined the changes in participants' reflection as they analyzed the classroom interactions in the videos in terms of instructional decisions and student thinking. He concluded that via the use of video-case curriculum, the prospective mathematics teachers reflected more, they started to consider alternative instructional moves to improve student understanding, and they focused more on student thinking. In sum, research studies conducted with pre-service or in-service teachers indicated that the use of cases in teacher education allows teachers to analyze and reflect on student thinking (Masingila & Doerr, 2002).

Computer-Mediated Communication and Online Discussions

As mentioned above, some of the studies in the literature on the use of cases in teacher education employed online discussions for teacher development. Discussion forum is one of the communication tools in computer-mediated communication (CMC) (Herring, 2001). CMC is an alternative to traditional communication in which people communicate through computers in anywhere and anytime in order to share and build new ideas, knowledge, and skills (Harasim, Hiltz, Teles, & Turoff, 1995). In discussion forums, people post email messages on discussion lists, and asynchronously comment on each other's messages. The asynchronous discussion is advantageous in the sense that it does not asks people to be online at the same time, and also gives more time to think (Connor, 2003; Harasim et al.).

Recent developments in information technology have deeply influenced the traditions of educational sciences. The use of CMC in educational settings has especially impacted on teaching and learning. There is evidence that CMC has the potential to promote learning (Ellis, Calvo, Levy, & Tan, 2004; Machtmes & Ashmer, 2000; Rosse, 2006). As a consequence of widespread use of information technologies in formal educational contexts, CMC has become an important teaching and learning tool in higher education (Barab, MaKinster, Moore, & Cunningham, 2001; Ellis, et al., 2004; Hara, Bonk, & Angeli, 2000; Hiltz, 1997). The present study aims to bring both pre-service and in-service teachers together to discuss an online video case via an online professional development forum. The video case was used as a reflection and professional development tool. It may serve as a venue for teachers to improve their knowledge on student learning and assessment. Thus, the findings of this study might shed light into how teachers identify evidences of student learning when they watch a video from a

mathematics classroom and discuss it online. This particular characteristic of the study is unique since there are only few studies on what teachers learn from hypermedia case-based teaching (Boling, 2007). Furthermore, Ellis, et al. underline that more evidence is needed on the contribution of communication technologies to learning through discussion. Similarly, Llinares and Valls (2010) suggest that more research employing new communication tools other than face-to-face instruction should be conducted to understand how teaching skills are developed. As a case of utilizing communication technologies on teaching and learning, the present study sets up an online professional development context where teachers investigate learning of middle school students in a mathematics classroom.

Lloyd (1999) underlines that via collaborative analysis, teachers can face and develop multiple perspectives on teaching and learning, and "…may learn to more carefully observe and listen to students, and as a result, expand their conceptions of students and how they learn mathematics" (p. 250). In another study (McGraw et al., 2007), the authors concluded that collaborative reflection within a group composed of members with diverse backgrounds brings rich and critical discussions of teaching and learning. Similarly the present study brings pre-service and in-service teachers together, and creates an environment for collaborative reflection.

Purpose

The purpose of this study was to explore pre-service and in-service mathematics teachers' analyses of student learning in a video case of mathematics instruction via an online learning forum. More specifically, our aim was to investigate how the participants identified evidences of student learning as they reflected on a video of a seventh grade mathematics classroom. The following research questions guided our study:

1) What types of evidence regarding student learning of mathematics did pre-service and in-service teachers identify during an online discussion of a video case of mathematics instruction?

2) How pre-service and in-service mathematics teachers differ with respect to the types of evidence they identified in the video case?

Method

Participants

This study was conducted in the context of a mathematics methods course in a 4-year college in the Midwestern United States. A total of 26 pre-service and in-service mathematics teachers participated into the study. Among all the participants, 19 of them were pre-service teachers and 7 were in-service teachers. The pre-service teachers were taking content and pedagogy courses with a field experience component in their third year of study; so, they would be doing their student teaching the following year. The in-service teachers were teaching mathematics in local public schools. They were masters' students in the college where the study was conducted.

The Course

The participants were enrolled in a mathematics teaching methods course where the second author was the course instructor. The purpose of the course was to help the students teach mathematics for understanding. The readings and classroom discussions were centered on how to promote mathematical understanding. In addition to various in-class activities, there were online activities embedded into the classroom tasks. One of these was to engaging in online discussion of a video case of mathematics instruction. The pre-service and in-service teachers were asked to view the video of a seventh grade mathematics classroom and engage in a week long online asynchronous discussion by posting a minimum of two messages. The main purpose of the case discussion was to reflect on student learning; more specifically, to explore and reflect on possible evidence of learning occurred in the video case classroom. The participants engaged in the case discussions in different groups. While pre-service teachers were together, the in-service teachers were placed in another group. The instructor moderated the online discussions by following the participants' messages and encouraging them to engage in the discussion of the video case. More specifically, the instructor encouraged the students to respond to each other, rather than posting a new topic each time. Enhancing peer interaction in online discussions was a goal of the online element of the course. Sample instructor messages are provided in table 1.

Table 1.
Sample Instructor Messages

Messages
· Right...Perhaps, we should look at student works to collect some evidences of student learning...
· Jessica, you wrote, "I know why she chose to video tape this class." What would happen if she chose a non-honors class?
· "I think it is hard for an observer to determine whether learning occurred, especially not knowing the children" I think Jean's above statement is really important.... We must know our students to understand their learning...But, how are we going to know them? "Knowing students" always reminds me of understanding students' thinking...For example, if I know how my students would solve a math problem, I can say that I know some about my students... What do you think?

The Video Watched

In the present study, the participants viewed a video case of a seventh grade mathematics classroom. Ms. Judy, the teacher, was teaching mathematics in middle schools for about 8 years. Ms. Judy was enthusiastic about improving her professional knowledge of teaching and she was actively participating in various in-service training programs. At the time of the video recording, she was involved in a teacher development project, a joint venture of the local university and the local school district.

The purpose of the video lesson was to help seventh grade students write and solve two-step algebraic equations through multiple representations. At the beginning of the lesson, the teacher introduced variables and expressions, and explained how to represent them using algebraic methods. Students modeled a word problem that would represent a given equation. At the end of the lesson, they were given the opportunity to explore relationships between numbers and variables, and understand what algebraic symbols mean.

Coding Framework

To create our coding framework, we employed National Council of Teacher of Mathematics [NCTM] Process Standards including *problem solving, reasoning and proof, communication, connections*, and *representation*. We selected these standards as they are believed to be in the core of teaching mathematics for student understanding (NCTM, 2000).

The five NCTM process standards has been our initial coding schema. Later on, we refined our coding schema to represent more details of the discourse. To ensure coding reliability, as a team, we tried different procedures. First, we individually coded the entire data and we came up with about 70% match across our codings. After individual coding, we narrowed some codes while we added new ones in order to increase the percentage of the units matched. More specifically, we added *using manipulative* and *engagement* categories to our schema as they emerged in the data, and we eliminated the *reasoning and proof* category as there was no reference to this theme. We coded the entire data set in a two-way conference by going over messages, and sharing and discussing our coding with each other. Finally, we reached an 80% agreement. At the end, we came up with 6 codes or activities as indications of mathematical learning: *problem solving, communicating, building connections, using representations, using manipulative*, and *engagement*. The final codes with their descriptions are presented in table 2.

Data Analysis

In order to investigate how the participants identified evidences of student learning as they reflected on a video of a seventh grade mathematics classroom, we employed content analysis technique (Neuendorf, 2002). The data of this study consisted of participants' responses to a video case of 7th grade mathematics lesson on algebraic equations. The focus of the data analysis was the 49 messages sent by the participants during the online discussions. More specifically, case discussions of 26 participants throughout online forum discussions were examined in detail to make sense of the data.

The participants posted their messages online via a teacher professional development discussion forum. The postings were downloaded and categorized by participants' names. We selected entire messages sent by participants as our unit of analysis since messages sent by the participants mostly included more than a single idea which were generally intertwined. In a message, there was usually more than one theme.

Results

The analysis of the data indicates that the instructor and participants posted 57 online messages in total during the online discussions. Among these messages, 49 of them were posted by participants (35 by

Table 2.
Descriptions of the Coding Categories (from NCTM [2000])

Coding categories	Descriptions
Problem solving	Building new mathematical knowledge through problem solving Solving problems that arise in mathematics and in other contexts Applying and adapting a variety of appropriate strategies to solve problems Monitoring and reflecting on the process of mathematical problem solving Moving from concrete to abstract while problem solving
Communicating	Organizing and consolidating their mathematical thinking through communication Communicating their mathematical thinking coherently and clearly to peers, teachers, and others Analyzing and evaluating the mathematical thinking and strategies of others Using the language of mathematics to express mathematical ideas precisely. Sharing solutions and explaining their thinking to others
Building connections	Recognizing and using connections among mathematical ideas Understanding how mathematical ideas interconnect and build on one another to produce a coherent whole, and transferring knowledge Recognizing and applying mathematics in contexts outside of mathematics Retaining knowledge from previous lessons
Using representations	Creating and using representations to organize, record, and communicate mathematical ideas Selecting, applying, and translating among mathematical representations to solve problems Using representations to model and interpret physical, social, and mathematical phenomena
Using manipulative	Engaging with manipulative Using manipulative enough before moving to abstract Moving to abstract without the use of manipulative
Engagement	Keeping on task

pre-service teachers and 14 by in-service teachers) and 8 of them were posted by the instructor. Below, the examination of the content of the discussions among the participants is provided.

Evidence of Student Learning

The examination of the content of the discussions indicates that the participants talked about six different activities reflecting the kinds of evidence of student learning: problem solving, connections, communication, manipulative, engagement, and representation. More specifically, the content analysis shows that the participants signified the six activities as evidence of mathematical learning. They further expressed that when students engage in any of these six activities, there is a possibility of learning mathematics.

Considering the volume of the discourse on each activity, it was found out that *communicating* was the most dominant element of teacher discourse representing mathematics learning, *problem solving* was the second most common part of the discourse, the third most discussed theme was *building connections* while they reflected on *using representation*, *engagement* and *using manipulative* almost equally; but, less than others as evidence of mathematics learning.

More specifically, analysis of the data revealed that *communicating* (40%) was the most discussed activity. This means that 40% percent of the coded data (53 codes) was on communication. While pre-service teachers contributed seventy five percent of the data on *communicating* (40 codes), in-service teachers contributed the rest (13 codes).

The following excerpt illustrates how a pre-service teacher identified *communicating* as an evidence of mathematics learning while reflecting on the video case:

> I believe not only could you gauge the student's learning by looking at their use of manipulative, but also at the student's answers and explanations. The students seemed to be answering the questions not only with answers, but with explanations from their findings. The class was able to interject their ideas, give alternate views, and correct each other (Pre-service #2).

In the above message, the pre-service teacher noted that the quality of the students' sharing of their solutions and explanations indicated an evidence of learning. In addition, it was mentioned that the students analyzed and evaluated others' mathematical thinking and strategies as another evidence of communication that fostered mathematical learning. In the following messages, a pre-service and an in-service teacher reflected on communication as evidence of learning:

> When the students worked in pairs and the teacher went around asking them individual questions, they were able to explain their an-

> swers to her. There was one student who really had difficulty grasping the problem about the string. Her peers showed understanding by explaining to her the concept. This was evidence that the students were actually learning what the teacher was teaching them (Pre-service, #10).

Similar to the previous message, this excerpt indicates that the students explained their solutions to the teacher and each other. This sharing was noted as an evidence of students' communication of their mathematical thinking.

> I do believe, however, that too much information is being shared. It is interfering with opportunities for students to solve the problem in their own way. By giving them too much information, it does not allow the students to reflect or communicate their own ideas with one another (In-service, #16).

It was also clear from the above excerpt that the participants wanted to see students reflecting or communicating about their thinking for understanding mathematics.

The discussion on other facets of mathematics learning showed that participants were motivated to identify instances of *problem solving* as evidence of mathematics learning (22%; 29 codes). Among 29 codes, 14 of them were contributed by the pre-service teachers (48%) and the rest were posted by in-service teachers (52%). To illustrate the discourse on problem solving:

> ….I did see some evidence of student learning when the students would give different methods of solving a problem… (Pre-service, #9)

The preceding quotation by a pre-service teacher illustrates how the participants identified engaging in problem solving as an evidence of student learning. In particular, the participant emphasized the importance of applying and adapting various strategies to solve mathematics problems.

In addition to the *communicating* and *problem solving* categories, eleven percents of all codes (15 codes) were categorized under the *building connections* category. While 6 of the codes were belonged to pre-service teachers, nine of them were belonged to in-service teachers. Thus, the in-service teachers focused on *building connections* more than the pre-service teachers.

In the following excerpts, a pre-service and an in-service teacher noted the importance of transferring knowledge, building connections between mathematics and real life contexts, and relating previous learning to newly acquired knowledge for student learning. These observations about *building connections* from the video case could be regarded as an evidence of student learning.

> Algebra is probably a more difficult concept to develop authentic tasks, but with the models she asked the children to create...She was not far from making the experience real. This real experience would have allowed for far greater student learning possibilities which would have provided better evidence of student learning (In-service, #25).

> I saw evidence of student learning in Judy's video from the responses the students were giving. Students were able to transfer their learning to other situations when they were doing the word problems on their own (Pre-service, #10).

Participants were also successful in identifying instances of *using representation* as evidence of mathematics learning (9%; 12 codes). Among 12 codes, 4 of them were contributed by the pre-service teachers and the rest were posted by in-service teachers. Thus, the pre-service teachers put more emphasis on the use of representations as evidence of learning. To illustrate, with respect to the *using representation* category, a pre-service teacher reflected that:

> Allowing the students to use either the cups or an equation - 2 different methods – was a good way to see if the students understood the concept through multiple means (Pre-service, #22).

In another message an in-service teacher was also reflecting on *representation* as a source of student learning as below:

> The students are able to take a situation and apply the algebraic equations required to solving them. I like the problem that asked students to draw a picture of an above problem to represent the situation. I really think this shows a higher level of thinking which would, in my opinion, provide a greater sense of confidence for me that the children are understanding the concept (In-service, #25).

In these messages, participants reflected that creating and using representations, and also making translations among multiple representations were important indicators of student learning.

Similar to the *using representation* category, *engagement* was also identified as an evidence of student learning by 9% of the participants (12 codes). Among the 12 codes, 10 of them were contributed by the pre-service teachers (83%) and 2 of them were posted by in-service teachers (17%). From

here, we see that engagement theme was mostly discussed by pre-service teachers. To give an example, a pre-service teacher reflected that:

> The students worked in their groups, discussed with each other, and seemed to be focused on the problem while working together. Judy toured the classroom and made sure the students were working and focusing on the problem (Pre-service, #11).

Another pre-service teacher also reflected on *engagement* where she underlined that the students were on track and enjoying the experiments during the lesson:

When I observed regular classes compared to honors classes, they seemed like they enjoyed to do these kinds of experiments and focus on staying on track (*Pre-service, #14).*

From the above excerpt, we understand that working and being focused on the task as well as enjoying it were noted as evidence of student learning by participants.

Participants also identified *using manipulative* as evidence of mathematics learning (8%; 10 codes) where all the codes were contributed by the pre-service teachers. To give an example, a pre-service teacher reflected on this category as follows:

> Another thing that showed evidence of learning was how the students were able to go from using the cups and chips to using the measuring stick. They were then able to forgo the tools altogether and do the problems in their heads. This showed that they understood the algebraic concept that was being taught. They needed the tools initially to learn the concept, but once it was learned tools were no longer needed (Pre-service, #10).

In another excerpt, a pre-service teacher noted:

> Awesome job!!! The manipulative really helped the kids understand an abstract idea. They could see that one would have to do the same thing to each side of the equation in order to make it equal (Pre-service, #23).

The above excerpts indicate that for the pre-service teachers, use of manipulative was an important indication of student learning. Pre-service teachers also reflected that engaging with manipulative and using them for moving to abstract concepts were among the indicators of student learning.

Overall, the data analysis showed that in many messages, pre-service and in-service teachers were able to identify various evidence of student learning. They were able to connect theoretical concepts in NCTM standards (NCTM, 2000) to the video case. With the facilitation of the instructor, participants were able to make these connections.

Revisiting Differences between Pre-service and In-service Teachers

With respect to the differences between pre-service and in-service teachers in terms of the sources of evidence identified, we analyzed the postings of pre-service and in-service separately. Accordingly, the analysis revealed that in-service teachers mostly indicated *problem solving* as a source of student learning while pre-service teachers mostly focused on *communication* issue. Additionally, *manipulative* dimension was only mentioned by pre-service teachers, and *engagement* dimension was mostly mentioned by pre-service teachers. To sum, in-service teachers reflected on the importance of *problem solving* on student learning while pre-service teachers mostly preferred to focus on the role of *communication*. It is interesting that only pre-service teachers focused on the role of *manipulative* on student learning. In addition, *engagement* dimension was mostly indicated as a source of student learning by pre-service teachers.

Discussion and Implications

Literature indicates that the use of case-based pedagogy helps teachers discuss issues related to students and to how they learn. Masingila and Doerr (2002) indicate that cases allow both pre-service and in-service teachers to analyze and reflect on student thinking. Accordingly, via collaborative analysis, teachers can experience and develop multiple perspectives on teaching and learning, and can enhance their conceptions of students and of their learning. In our study, we found out that pre-service and in-service teachers identified several issues as evidence of student learning through collaborative discussions. They mostly identified communication as evidence of student learning. They also reflected on the importance of problem solving on student learning. In addition to these sources of evidence of student learning, they also discussed the role of making connections, using multiple representations, engagement, and using manipulative for student learning. All these themes are known as being the core issues of mathematics learning (NCTM, 2000; TTKB, 2006). From here, it might be deduced that the use of video cases with online discussions may provide environments for teachers with rich and collaborative discussion.

The findings strength the claim that the use of cases provides a context for collaborative reflection (Arellano et al., 2001). As stated before, several studies in the literature indicate that collective engagement of pre-service and in-service teachers provides a strong support for professional development of teachers (Koc et al., 2009), and engaging in video clubs provides teachers with more focusing on students' mathematical thinking (van Es & Sherin, 2010). Additionally, studies indicate that pre-service teachers can reflect on several issues related to students and to their learning when they analyze real mathematics classroom videos through online discussions (Osmanoglu et al., 2012), and via the use of video-case curriculum, pre-service mathematics teachers can consider alternative instructional moves to improve student understanding, and focus more on student thinking (Stockero, 2008).

As stated before, through collaborative analysis, teachers can face and develop multiple perspectives on student learning (Lloyd, 1999). Especially, when members with diverse backgrounds come together in an online environment, they can reflect on and discuss real classroom situations more effectively (McGraw et al., 2007). In our study, we created an environment where pre-service and in-service teachers had a chance to reflect on a mathematics classroom through online discussions. We believe that not only diversity among the members, but also the structure of the discussion environment created the rich reflection environment. Use of computer technologies makes it easier to bring members with diverse backgrounds together, and thus enriches the collaborative reflection. Also, online discussion forums provide communication in anywhere and anytime. Not being had to be online at the same time, asynchronous discussion lets pre-service and in-service teachers easily comment on each other's messages. Via utilizing CMC, we believe that our findings shed light into how teachers identify evidences of student learning when they watch and discuss a video from a mathematics classroom.

In sum, an examination of the results indicated that online video cases together with forum discussions have potential to create promising learning opportunities for both pre-service and in-service teachers. When the case scenario is analyzed with a relevant theoretical frame that is known to participants, it provides teachers with a mental guide for interpreting the video. Especially, when pre-service and in-service teachers reflect on a video case through collaborative discussion, it may bring about a richer environment for professional development. In other words, when pre-service and in-service teachers collaboratively focus on and discuss student learning, they can develop *professional vision for reform teaching* (van Es & Sherin, 2008, p. 244). As van Es and Sherin (2002) claim, teachers can learn to look "…at a teaching situation for the purpose of understanding what happened, what students think about the subject matter, or how a teacher move influenced student thinking…" (p. 575) when they get engaged in video-case based discussions.

Future research is suggested to assess the effectiveness of online professional development environments with different frameworks in order to strengthen the conclusion that the use of cases in teacher education provides opportunities for teachers to reflect on student learning. Furthermore, as the number of studies bringing pre-service and in-service teachers together in the same learning environment is limited, more research is suggested to be conducted. Also, analyzing the difference between pre-service and in-service teachers' reflections on the sources of student learning more deeply is recommended.

References

Arellano, E. L., Barcenal, T. L., Bilbao, P. P., Castellano, M. A., Nichols, S., & Tippins, D. J. (2001). Case-based pedagogy as a context for collaborative inquiry in the Philippines. *Journal of Research in Science Teaching, 38* (5), 502-528.

Barab, S. A., MaKinster, J. G., Moore, J. A., & Cunningham, D. J. (2001). Designing and building an on-line community: The struggle to support sociability in the inquiry learning forum. *Educational Technology Research and Development, 49* (4), 71-96.

Boling, E. C. (2007). Linking technology, learning, and stories: Implications from research on hypermedia video-cases. *Teaching and Teacher Education, 23*, 189-200 (doi:10.1016/j.tate.2006.04.015).

Connor, C. (2003). Virtual learning and inter-professional education: Developing computer-mediated communication for learning about collaboration. *Innovations in Education and Teaching International, 40* (4), 341-347 (doi: 10.1080/1470329032000128379).

Darling-Hammond, L., & Hammerness, K. (2002). Toward a pedagogy of cases in teacher education. *Teaching Education, 13* (2), 125-135 (doi: 10.1080/1047621022000007549).

Ellis, R. A., Calvo, R., Levy, D., & Tan, K. (2004). Learning through discussions. *Higher Education Research and Development, 23* (1) (doi: 10.1080/0729436032000168504).

Hara, N., Bonk, C. J., & Angeli, C., (2000). Content analysis of online discussion in an applied educational psychology course. *Instructional Science, 28* (2), 115-152.

Harasim, L. M., Hiltz, S. R., Teles, L., & Turoff, M. (1995). *Learning networks: A field guide to teaching and learning online*. Cambridge, MA: MIT Press.

Herring, S. C. (2001). Computer-mediated discourse. In D. Tannen, D. Schiffrin, & H. Hamilton (Eds.), *Handbook of discourse analysis* (pp. 612-634). Oxford: Blackwell. Retrieved from http://odur.let.rug.nl/~redeker/herring.pdf

Hiltz, S. R. (1997). Impacts of college-level courses via asynchronous learning networks: Some preliminary results. *Journal of Asynchronous Learning Networks, 1* (2), 1-19.

Koc, Y., Peker, D., & Osmanoglu, A. (2009). Supporting teacher professional development through online video case study discussions: An assemblage of preservice and inservice teachers and the case teacher. *Teaching and Teacher Education, 25 (*8), 1158-1168 (doi:10.1016/j.tate.2009.02.020).

Llinares, S., & Valls, J. (2010). Prospective primary mathematics teachers' learning from on-line discussions in a virtual video-based environment. *Journal of Mathematics Teacher Education, 13*, 177-196 (doi: 10.1007/s10857-009-9133-0).

Lloyd, G. M. (1999). Two teachers' conceptions of a reform-oriented curriculum: Implications for mathematics teacher development. *Journal of Mathematics Teacher Education, 2*, 227–252 (doi: 10.1023/A:1009965804662).

Machtmes, K., & Ashmer, W. (2000). A meta-analysis of the effectiveness of telecourses in distance education. *The American Journal of Distance Education, 14* (1), 27-46.

Masingila, J. O., & Doerr, H. M. (2002). Understanding pre-service teachers' emerging practices through their analyses of a multimedia case study of practice. *Journal of Mathematics Teacher Education, 5*, 235-263.

McGraw, R. H., Lynch-Davis, R. K., Koc, Y., Kapusuz-Budak, A., & Brown, C. A. (2007). The multimedia case as a tool for professional development: An analysis of online and face-to-face interaction among mathematics pre-service teachers, inservice teachers, mathematicians, and mathematics teacher educators. *Journal of Mathematics Teacher Education, 10* (2), 95-121.

Merseth, K. K. (1996). Cases and case methods in teacher education. In J. Sikula (Ed.), *Handbook of research on teacher education* (pp. 722-746). New York: Macmillan.

Merseth, K. K. (1999). Foreword: A rationale for case-based pedagogy in teacher education. In M. A. Lundeberg, B. B. Levin, & H. Harrington (Eds.), *Who learns what from cases and how: The research base for teaching and learning with cases* (pp. ix-xv). Mahwah, NJ: Lawrence Erlbaum Associates.

National Council of Teachers of Mathematics (NCTM). (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

Neuendorf, K. (2002). *The content analysis guidebook*. Thousand Oaks, CA: Sage.

Osmanoglu, A., Isiksal, M., & Koc, Y. (2012). Prospective teachers' noticing with respect to the student roles underlined in the elementary mathematics program: Use of video-cases. *Education and Science, 37* (165), 336-347.

Rosse, M. (2006). A review of research methods for assessing content of computer mediated discussion forums. *Journal of Interactive Learning Research, 17* (3), 243-267.

Shulman, J. H. (1992). Teacher-written cases with commentaries: A teacher-researcher collaboration. In J. H. Shulman (Ed.), *Case methods in teacher education* (pp. 131-155). New York: Teacher College Press.

Sowder, J. T. (2007). The mathematical education and development of teachers. In F. K. Lester (Ed.), *The second handbook of research on mathematics teaching and learning* (pp. 157-224). CT: Information Age.

Stockero, S. L. (2008). Using a video-based curriculum to develop a reflective stance in prospective mathematics teachers. *Journal of Mathematics Teacher Education, 11*, 373-394 (doi: 10.1007/s10857-008-9079-7).

Sykes, G., & Bird, T. (1992). Teacher education and the case idea. *Review of Research in Education, 18*, 457-521.

Talim Terbiye Kurulu (TTKB). (2006). *MEB müfredat geliştirme süreci*. Retrieved May 01, 2008, from http://ttkb.meb.gov.tr/programlar/

van Es, E. A., & Sherin, M. G. (2002). Learning to notice: Scaffolding new teachers' interpretations of classroom interactions. *Journal of Technology and Teacher Education, 10* (4), 571-596.

van Es, E. A., & Sherin, M. G. (2008). Mathematics teachers' learning to notice in the context of a video club. *Teaching and Teacher Education, 24*, 244-276 (doi: 10.1016/j.tate.2006.11.005).

van Es, E. A., & Sherin, M. G. (2010). The influence of video clubs on teachers' thinking and practice. *Journal of Mathematics Teacher Education, 13*, 155-176 (doi: 10.1007/s10857-009-9130-3).