A PRESERVICE MATHEMATICS TEACHER'S REFLECTIONS AND REFLECTIVE PRACTICES FOCUSING ON STUDENTS' LEARNING[1]

Research article

Zerrin Toker (0000-0001-9660-0403)
TED University, Turkey
zerrin.toker@tedu.edu.tr

Biodata:

Dr. Zerrin Toker got her bachelor's degree from Middle East Technical University, Department of Elementary Mathematics Education. She got an MS and PhD from the same university. She worked as a mathematics teacher from 2004 to 2017. Besides, she served as the head of the mathematics department and as a professional development coordinator. She had an International Baccalaureate (IB) teaching experience in PYP and MYP for more than 10 years. She wrote mathematics textbooks for MoNE. During the 2016-2017 academic year, she worked at Hacettepe University as a part-time instructor. Her field of interests include instructional design, the reflective thinking process of pre-service and in-service teachers, design-based research, interdisciplinary learning, differentiated instruction, and data-driven instructional design.

---

[1] A part of this study was presented as an oral presentation at the scientific meeting called "4th Turkbilmat Conference.

A PRESERVICE MATHEMATICS TEACHER'S REFLECTIONS AND REFLECTIVE PRACTICES FOCUSING ON STUDENTS' LEARNING[2]

Zerrin Toker

zerrin.toker@tedu.edu.tr

Abstract

The study aims to explore how reflections facilitate a preservice mathematics teacher's thinking about students' learning by focusing on (i) what one preservice mathematics teacher studying in a two-year alternative non-typical Teacher Certification Program reflects about students' learning in the context of Practice Teaching, and (ii) how these reflections are revealed in her teaching. The data were gathered through pre- and post-observation conferences (meetings) with the participant based on her observations of 32 lessons and the documents she produced. Inductive coding based on Schön's (1987) reflection-on-action and reflection-in-action framework revealed that the participant's reflections-on-action were about how and what she should improve in her knowledge and practice to address students' learning better, and her reflections-in-action were about how to modify her teaching to address students' differences. She improved her practice gradually based on these reflections, and the focus of these reflections changed throughout the process. The results revealed that mentors and experienced teachers could be instrumental in this process, and systematic, continuous, and supported reflections provide development in reflective practice considering student learning.

Keywords: preservice mathematics teacher; reflection; reflective practice; teaching practice

1. Introduction

Understanding the role of teaching for students' learning is crucial for preservice teachers (PSTs). In their initial teaching experiences, preservice teachers tend to focus on to what extent they have done what they have planned for their teaching practices rather than students' learning (Barnhart & van Es, 2015; Schussler et al., 2010). They generally focus on the curriculum and course materials at the beginning. Adopting reflection as a tool to improve practice could support PSTs when facing challenges in the classroom (Cavanagh & Prescott, 2010, Nagro et al., 2017; Xiao & Tobin, 2018), such as responding to students' learning needs. Practice teaching (PT) in real school environments; where PSTs face examples of students' learning, is an essential and rich context for this (Weber et al., 2019). This study aimed to investigate a Preservice Mathematics Teacher (PSMT)'s reflections and reflective practices concerning students' learning throughout the PT course in a non-typical Teaching Certification Program (TCP).

---

[2] A part of this study was presented as an oral presentation at the scientific meeting called "4th Turkbilmat Conference.

2. Reflection, Reflective Practice, and Preservice Teachers

Dewey (1933) defines reflection as an "active, persistent, and careful consideration of any belief or supposed form of knowledge in light of the grounds that support it and the further consequences to which it leads" (p. 7). For teachers, reflection means thinking critically about teaching (Artzt & Armour-Thomas, 2002) with the goal of improving teaching skills (Tripp & Rich, 2012). Reflective Practice (RP) can be defined as thorough thinking about one's own experiences in applying knowledge to practice (Schön, 1983). It is a recursive and cyclical, indeed spiral (Dewey, 1933; Schön, 1987) knowledge construction process. Therefore, it is an essential tool for learning to teach (Benedict et al., 2016). Accordingly, RP is a critical component of PSTs' development (Körkkö et al., 2016) because it provides the opportunity to make sense of their learning process through reflection on the teaching practices (Rodgers, 2002). In this sense, RP works as a mediator (Nesje & Lejonberg, 2022) in the meaning-making process and in providing development in pedagogical practice (Gaciu et al., 2017) for preservice and in-service teachers.

Schön (1983) stressed the relationship between reflection and experience and differentiated the types of reflection based on the time frames as "reflection-in-action" and "reflection-on-action." Reflections-on-action occur while planning to teach and after the teaching practice (Mulryan-Kyne, 2020), and they may initiate a pre-reflection process of further action or the production of another action (Schön, 1983). Reflections on past and present experiences might take place almost simultaneously and shape the future practice of PSTs (Kaasila & Lauriala, 2012). On the other hand, reflection-in-action is difficult to identify during the active teaching process (Er et al., 2022).

PSTs' reflections focus on issues such as classroom management, the instructional process, and planning (Cavanagh & Prescott, 2010). Their reflections on the planning and teaching process include facilitating active and effective learning, delivering the lesson appropriately, managing the time and dealing with classroom management issues, giving proper instructions, and activating learners (Sağlam Arslan et al., 2022). Thus, PSTs' reflections are limited to naïve issues (Seidel & Stürmer, 2014), and in their initial teaching experiences, they do not focus on deeper issues such as students' thinking (Stockero et al., 2017).

For PSTs, improving teaching and focusing on student learning requires some mechanisms. As one of these, mentors can be the key to supporting PSTs' thinking about students' learning of specific content (Barnett & Friedrichsen, 2015; Ingleby, 2014). Specifically, PSTs' focused conversations with mentors can create an opportunity to learn via reflection (Jarvis & Clark, 2020). When mentoring is intensive and well-organized, even initial teaching practices positively impact students' learning (Stanulis & Floden, 2009), and continuous reflection can provide PSTs with better learning opportunities for students (Aslan et al., 2022). When the PT is longer, PSTs have more time to develop better solutions for the problems they encounter with a mentor's help (Cavanagh & Prescott, 2010). Thus, for PSTs, PT provides different experiential learning opportunities regarding personal, practical, and contextual issues (Österling, 2022) and therefore, it is one of the main opportunities for dealing with concerns regarding the theory-practice gap (McNeilly et al.,2022).

In light of all above, the present study aimed to provide an in-depth description of (i) what one PSMT reflected-on-action and -in-action in her PT about students' learning; and (ii)

what teaching decisions she made and implemented (as indicators of her RP) within the context of the PT course, in which reflection and the guidance of experienced teachers are prioritized. Thus, the research questions of the study are formulated as follows:

1. What does one PSMT reflect-on-action and -in-action in her PT about students' learning?

2. What are the PSMT's RPs within the context of the PT course?

3. Method

The study was a part of an in-depth study focusing on one PSMT's reflections during the PT course. It was designed as a case study of PSMT's reflections within the bounded system (Merriam & Tisdell, 2016) of a PT course in a non-typical TCP.

3.1. Setting and Participant

The study was conducted in a non-typical, 2-year TCP organized as a Master of Arts program at a private university (hereafter "the University") in Turkey. TCPs enrolled graduates of non-education bachelor's degree programs based on the scores of specific examinations determined by the programs. The entire program was in English. Unlike many undergraduate teacher training programs in Turkey, the program was organized as a full-time program and was at the master's level. It had three components: (i) Teaching Certification, which qualified PSTs to teach; (ii) the International Baccalaureate (IB) Teacher Award, which offered PSTs the opportunity to examine the principles and practices associated with the IB Diploma program; and (iii) a Master's Degree. The second and third components did not take place in typical TCPs. There was a considerable focus on the teaching practice in the TCP. PSTs have a School Experience (SE) course in the first year, where they mostly observe experienced teachers. In the second year, they took the PT course, which included course observations, at least 30 hours of teaching practice, departmental activities, and school activities. During this time, PSTs spent almost all of their working days at a cooperative school.

The researcher was a mentor at one of the cooperating schools that worked with PSTs from this TCP at the time of the study. The school components were companion members of the Council for International Schools (CIS), with the High School also a member of the European Council for International Schools (ECIS) and the school was an IB Continuum School (conducting IB programs at all components). The study participant, Ayla (pseudonym), had a bachelor's degree in Mathematics and was in her second year at the TCP. She was one of the eight PSTs taking the PT course in the TCP. She was the only PSMT at the specific collaborating school. The study focused on Ayla for several reasons. She was a typical student in terms of her previous education and experiences in the TCP. As the researcher's expertise and focus were on mathematics education, and there was the opportunity to collect rich data due to the researcher's mentor position at the collaborating school at the time of the study, Ayla was selected as the participant for this study based on her consent.

The researcher was a mathematics teacher at the collaborating middle school and a mentor for the PSTs, such as Ayla, at study time. The supervisors were the teachers who met

and supported the PSTs on a lesson basis. A preservice teacher had one mentor and generally several supervisors.

3.2 Data collection procedure

The data were obtained through the Pre-Observation Meeting (Pre-OM) and Post-Observation Meeting (Post-OM) and observations within Ayla's RP cycles after the ethical and administrative permissions were granted. There were 32 RP cycles where 32 lessons were observed, and 64 pre- and post-OMs were conducted in 6 weeks. Ayla taught 15 lessons at four different high school classrooms at all grade levels and 17 lessons at two different middle school classrooms at the 5th and 7th grade levels. Secondary data sources were the documents created to meet the PT requirements.

In the pre-OMs, there are eight main questions focusing on the (1) objectives, (2) content of the lesson, (3) materials to be used, (4) anticipated problems during teaching and possible solutions, (5) organization of the learning activities, (6) questions to be asked, (7) control of whether goals were reached or not, and (8) the alternative plan. Then, Ayla taught the lessons, and the researcher observed her teaching and wrote extensive notes on the running commentary form. The post-OMs had eight main questions about (1) the extent of the achieved objectives, (2) the delivery of the content, (3) students' participation, (4) students' learning process, (5) the strengths of the lesson, (6) action plans regarding the implementation, (7) predicted or unforeseen problems, and (8) intentions for the future teaching. The researcher also asked questions about possible reflection-in-action instances during Ayla's teaching based on the notes she took.

The researcher was conducting pre- and post-OMs with the preservice teachers as a part of her mentorship duties in the years before the study, with a focus on their practices and related reflections. It can be said that Ayla went through the normal PT process through semi-structured interviews (pre- and post-OMs) with the same questions and room for additional ones. Additionally, all meetings were audio-recorded based on Ayla's consent for research purposes.

3.3. Data Analysis

An inductive coding study (Miles et al., 2014) was conducted to investigate Ayla's reflections focusing on students' learning and how she used this reflection for her teaching. After a thorough study of the data set, the researcher conducted an initial open coding, and a list of codes and their descriptions were composed. Then, another researcher (who is the first researcher's PhD advisor) worked on one randomly selected data set, including pre-OMs, observation notes, and post-OMs, and composed a code list and their descriptions. The code-description lists were compared and discussed by the two researchers, and a codebook was established.

The two researchers then coded the entire set of data using this codebook, and the coded data were compared. A complete inter-rater agreement was reached in the double-coding of the data set after a few disagreements were resolved. Emerging themes concerning students' learning, such as students' differences in learning, about which Ayla reflected, were decided. Ayla's reflections-on-action themes were revealed in the pre- and post-OMs when she planned a lesson or after she taught a lesson. When the researcher asked her about her actions

in the lessons she taught (and the researcher observed), those in her reflections-in-action were detected in the post-OMs.

The researcher worked as a mathematics teacher at the collaborating middle school for 12 years and as a TCP mentor for eight years when she conducted the study. She had extensive knowledge of the TCP procedures, an in-depth understanding and knowledge of the context, and a ground for the thick description of the multiple contexts in which the study was conducted. She ensured to pursue the two roles of being a researcher and being a mentor separately by employing different strategies. The different data sources utilized for the study helped the researcher converge and corroborate the findings in multiple ways. The data collection, analysis, and interpretation of the findings were closely monitored by an experienced researcher, and another researcher accompanied the analysis process. The participant in this study, Ayla, was able to (member) check the preliminary analysis and the interpretations.

4. Findings

Ayla shared her lesson plans with the mentor before their meeting and explained the elements she added to the lesson plan and why she added them in the pre-OMs. After the completion of the teaching process, Ayla met with the mentor to discuss the effective aspects of the course and the aspects that needed improvement. Thus, Ayla's reflections-on-action were documented in the findings *before* and *after* her teaching. Her reflection-in-action was presented as her reflections *during* teaching. Her teaching choices and follow-up actions informed by her reflections were recorded as indicators of her RPs.

4.1. Ayla's Reflections-on-action about students' learning

4.1.1. Reflections before teaching

Ayla reflected on students' learning in general and in specific ways before her lessons. In the general sense, she described how students should learn mathematics: *"We want students to construct their knowledge. I believe that students learn the best when they are actively involved in learning and when they experience, search, discuss, and realize the relationship of mathematics with other disciplines."*

This conception of mathematics learning prompted her to reconsider her knowledge for teaching in light of it.She considered what materials and activities would be beneficial, as well as how she could ensure that mathematics lessons led to such learning: *"I believe I need to be able to design more content-rich lessons and know which activity is suitable for which lesson content. Moreover, I need to work more on what types of materials are needed at different levels."*

She considered students' grade level to decide when to use manipulatives in the middle school grades. She expressed that she needed to improve herself to select activities for the students. Ayla also emphasized group work and expressed several factors about students and their learning in groups in her reflections. It was critical for her to form groups in which students could learn effectively: *"In this age group, boys and girls are very different. I consider their algebraic and problem-solving skills to be a priority. Then I considered whether they were girls or boys."*

Yet, her plans for group work were highly affected by the content she taught. She did not want to conduct group work at the beginning of a new concept: *"I will not be doing group work in the next lesson. "Although the students can learn from each other in group work, a tree diagram is a new subject, so I believe it is better to contact students individually."*

The mathematics content Ayla taught was important in her reflections. Her decisions on how to organize her teaching of a specific topic were related to the students and their existing knowledge: *"I would give less time to exercises. I gave it such a long time since I did not know how good the students were at algebraic expressions."*

The importance of problem-solving for students' mathematics learning was apparent in Ayla's reflections on how problem-solving should be in the classroom. She wanted students to deal with problems that required different skills and prioritized students' use of different problem-solving approaches: *"For example, problem solving needs very different skills, which require thinking. Some students may come with very different questions."*

The analysis showed that the content of Ayla's reflections on students' learning was based on her conceptions and concerns about students' learning of mathematics, her knowledge about students' learning, the teaching approaches that would maximize their learning, and the mathematics content at a particular grade level. Her reflections on students' learning seemed to be affected by the students' characteristics and her knowledge of them.

4.1.2. Reflections after teaching

Ayla reflected on both lesson-specific and general issues about students' learning after the lessons. She evaluated how she taught and how this possibly affected (or did not) students' learning, often regarding lesson plans and materials she prepared. She also referred to students' reactions to her tasks: *"If one group completed the task and the others did not, then there must be an additional task to assign to that group; I should plan that as well, or I should find another way, I think."*

She emphasized students' learning through connecting the new mathematical knowledge with their previous knowledge to serve their future learning:*"If I did not insist on the parts students struggled with, if I taught as planned, they would struggle in the following lessons."*

Ayla referred to teaching approaches about students' learning. She emphasized providing challenging learning opportunities for students and using different representations: *"In my opinion, students should be challenged to be able to learn. While I was preparing this worksheet, I thought they would be challenged."*

Sometimes, her reflections included explicit concerns about students' learning. One issue was providing students with opportunities for procedural fluency: *"We discussed the subject with students, but we did not perform the practice. So I was not sure whether the students understood or not."*

Ayla reflected on how mathematics teaching and learning should be in a more general sense in her post-OMs. Her reflections focused more on future directions to improve herself as a teacher based on students' learning: *"In my opinion, effective teaching is student-centered teaching. Instead of transferring the knowledge to the students, letting the students build that knowledge themselves and leaving it—maybe not all of it, but most of it—to the students is one of the building blocks of effective teaching."*

Some of these reflections seemed to be related to her concerns about improving her knowledge and skills about mathematics teaching with student-centered approaches: *"I need more improvement in providing interactive self-learning environments for students. Furthermore, I need to improve my ability to predict where students might make mistakes."*

Ayla's lesson-specific reflections on students' learning were framed by comparing her lesson plan to her teaching. This helped her evaluate her classroom actions and determine if her teaching was as effective for students' learning as she anticipated. After the lessons, she reflected on her future teaching, and the nature of mathematics teaching and learning.

4.2 Ayla's Reflections-in-action about students' learning

Ayla's presumed reflections-in-action during the lessons were noted in the researcher's observations on the running commentary form and were discussed in the post-OMs. No specific questions were asked in these discussions. Instead, what happened and why she reacted in the way she did at the specific moments that the researcher noted were clarified.

Ayla's reflection-in-action focused mostly on multiple student-related factors, such as students' knowledge, differences, and characteristics. The differences in students' existing knowledge were significant for her during the lesson reflections. She prioritized this as an essential part of her knowledge of students: *"I could not conduct other parts of the lesson because of the students' lack of knowledge of arithmetic. Although students [had] more complex [knowledge], they could not make cross products; they put multiplication on the other side of the equation. [...] I spent much more time in the lesson [than I planned for this]."*

As Ayla familiarized herself with the students in the classes she taught, she used her knowledge of them continuously and mainly at the moment to differentiate the learning opportunities for them as much as she could. Although she prepared questions to ask before the lesson in her lesson plans, she decided which question to ask during the lesson based on her knowledge of the students. Ayla tried to adjust different levels of questions to students' success levels, asking advanced-level questions to more successful students and more straightforward questions to less successful ones: *"I selected quiet and non-focusing students to read or solve the problems. I tried to focus on each of their projects individually.In this way, I tried to understand whether he was quiet because he did not know the answer or because he liked being quiet and did not want to talk even though he knew the answer."*

Ayla changed not only the questions but also her teaching method based on the students' learning during the lesson. She appeared to be thinking about this at the time and putting alternative plans in place when the activity she implemented did not go as planned.Nevertheless, she reflected at that moment, considering multiple factors, such as the students' difficulties, the nature of the mathematical task, and her broader goals, and she did not make any changes to her teaching method: *"I realized during half of the second lesson that the students had difficulties with questions. At that point, I thought about ending the group work and solving problems by discussing with the students. Then, I thought that the groups could support each other in understanding the problem while discussing, and I could control them by walking around them. So, I gave up [the canceling idea] because I thought they had some difficulties."*

4.3. Ayla's RPs focus on students' learning

Ayla reflected on her progress in teaching mathematics throughout the PT period. She reflected on the areas where she felt strong, such as selecting appropriate materials to improve students' learning, and the areas where she felt she needed improvement, such as managing students' differences, based on the difficulties she had. This part explains how she elaborated and employed these reflections for her development as a teacher to reveal her RPs.

Ayla was specific in describing her difficulties when she reflected on them. For example, especially at the beginning of the PT, Ayla had difficulties outlining the group work and planning how to provide equal opportunities for each student's participation in the groups while controlling the groups and the whole class. She reflected on the nature of the group work that she planned for the lesson and why she could not manage it frequently: *"I did not define the sequence of the groups' presentations. I decided to give them a place to raise their hands and volunteer to present [their work]. However, four students from four different groups raised their hands at the same time. [Then,] I decided to identify the sequence beforehand."*

She also considered supervisors' comments: *"When he observed my lesson, my supervisor told me that I did not deal with the groups equally. He stated that I supported some groups and was not interested in others."*

She used these reflections and comments to improve her group work practice in the classroom, as observed by the researcher. She also started to think about how to employ certain practices from which she had benefited in her future teaching: *"I may be able to remember things about students now because I only teach in a few classes, but when I teach in more classes in the future, written notes will come in handy."*

Ayla used the supervisors' and the mentor's feedback and thought about improving the directions she provided for the students during the lesson. The following exemplifies her reflections and efforts to make it work for the students: *"For example, I explain that it might be necessary to repeat it 2-3 times verbally there. In order to ensure that every student understands the directions, I should do something else."*

Ayla's reflections, which were triggered by some general concerns about students' learning, such as providing an essential learning environment for each student, directed her towards improving her practice in several ways. She let students use materials from lower grade levels, guided them in thinking about concepts and questions, and provided them with more time for this. Ayla improved her guidance of students in learning mathematics during the lesson as the PT progressed. Observations revealed that students began to think more about the questions she posed before answering and explaining their reasoning: *"Students were asking questions; they were willing to discuss. There were some misconceptions, and there were good answers to them. Sometimes, I observed that students who were not motivated at the beginning of the lesson were more active in the question part of the lesson."*

Ayla's reflection-in-action seemed to provide her with the necessary next steps in her lessons, especially when students did not give anticipated responses to her planned activities. She mainly relied on her reflections on students' learning during these incidents to identify what she needed to improve for both that moment and the future. Her reflections provided the rationale for her subsequent actions: *"I think, thinking about my lessons is very helpful for me.*

As a result, I saw things more clearly this way. I think I know and evaluate the pros and cons of ideas I try to apply."

5. Conclusion, Discussion and Recommendations

This study aimed to reveal one PST's reflections and RPs in the context of PT that took place within the non-typical TCP process. While Ayla's reflections-on-actions were about the what and how of planning and implementation regarding students' learning, her reflections-in-action process was about the actions and changes that address student differences. The presence of a mentor in the study and the systematic and continuous reflection played a role in the occurrence of these results. PSTs could reflect on and in their teaching practices about students' learning when the PT provides them with support from experienced teachers and well-designed written tasks, as revealed in the study. Ayla's reflections about students' learning were initiated by what she perceived as problematic or encouraging (Dewey, 1933) in the relationship between her teaching and students' mathematics learning. Her reflections-on-action focused on the possible effects of her teaching on students' learning and improving her teaching consequently. Her reflections-in-action were mainly about students' characteristics and knowledge and her related teaching decisions in order to enhance students' learning.

What made Ayla's reflections about students' learning rich and genuine was her willingness to think reflectively about her teaching (Rodgers, 2002) and her observations of teachers and students. These reflections led to reflective practices, which were the adjustments and alternative approaches she gradually included in her practice (Schön, 1983) and positively affected students' learning. Thus, PT was a learning environment where she constructed her knowledge about teaching mathematics through iterative cycles (Dewey, 1938; Schön, 1987). This PT context had important interrelated components: the intensive PT requirements and the support from experienced teachers.

Ayla was required to teach 32 hours of mathematics lessons in six different classrooms over the course of six weeks, as well as to continuously reflect on her practice to the researcher who served as her mentor. After reflecting on her recent lesson and identifying what she needed to improve or change in her future lessons, she immediately had to plan a new lesson with the challenge of putting her previous experiences into practice at a different grade level and/or for different students. Dealing with this challenge made Ayla more aware of her students and forced her to make quick decisions during the lesson. The specific PT was not as long as suggested for better reflection opportunities (Cavanagh & Prescott, 2010), however, it was intensive and required continuous reflection, which helped Ayla make better teaching decisions for students' learning (Aslan et al., 2022).

Ayla was supported during the PT by the mentor and the supervising teachers closely and continuously. The intensive and continuous mentorship and support from these experienced teachers seemed to affect Ayla's reflective practices and positive learning outcomes in the students (Stanulis & Floden, 2009). The recurring pre- and post-OMs with the mentor focusing on the practices, decisions, and reasons seemed to help Ayla express her reflections more rigorously for herself and the mentor and, therefore, employ them to improve her other practices. The mentor seemed to be the critical person because she asked important questions continuously, observed Ayla's teaching for possible reflection-in-action moments, and supported her while she was trying to make sense of her teaching to improve the next one (Gaciu et al., 2017). The mentor was an experienced mathematics teacher encouraging Ayla

to think about her practice and students' learning about the specific content (Barnett & Friedrichsen, 2015), which pointed to the importance of content-based mentorship. Thus, mentor-preservice teacher conversations provided opportunities for dealing with deeper issues (Jarvis & Clark, 2020; Stockero et al., 2017).

Ayla did not reflect much on the assessment concerning students' learning. It is possible that she prioritized certain features of her teaching, such as how to make group work more effective, more than the others. It is also possible that Ayla thought about assessment as being rather distant from teaching and learning because she did not have much training on the role of assessment in learning or the relationship between student learning and assessment during education (Stiggins, 2002). If this is the case, then this presents feedback for the TCP that there should be more emphasis on assessment as an integral and important part of the teaching and learning process.

The data set in the study was limited in several ways. There was only one PST in a non-traditional TCP. Focusing on three time frames (before, during, and after) in the analysis showed that PSTs' reflections at these periods could be rich as they tend to reflect simultaneously on their past, current, and future teaching (Kaasila & Lauriala, 2012). Focusing on PSTs in different contexts for longer periods and in their initial years would enhance the findings of this study and provide new knowledge for the field. The specific TCP and PT were exceptional contexts to explore PSMTs' reflections and RPs. There was a well-established collaboration between the school and the TCP. Still, the findings may help other teacher education programs and TCPs prepare tasks that encourage PSTs to focus on the crucial issues of teaching and think deeply about students' learning before, during, and after teaching. Teacher education programs should emphasize the importance and practice of reflection to increase PSTs' awareness and, eventually, their reflection and RP. The programs must include reflection as a part of their evaluation of PSTs' teaching practices to improve their teaching.

References

Aslan, A., Erten, İ.H., & Dikilitaş, K. (2022). In-service EFL teachers' engagement in reflexive practice via video enhanced observation, *Reflective Practice, 23(3)*, 422–436. https://doi.org/10.1080/14623943.2022.2042240.

Artzt, A. F., & Armour-Thomas, E. (2002). *Becoming a reflective mathematics teacher: A Guide for observations and self-assessment.* Lawrence Erlbaum Associates Publishers.

Barnett, E., & Friedrichsen, P. J. (2015). Educative mentoring: How a mentor supported a preservice biology teachers' pedagogical content knowledge development. *Journal of Science Teacher Education*, *26,* 647–668. https://doi.org/10.1007/s10972-015-9442-3.

Barnhart, T., & van Es, E. (2015). Studying teacher noticing: Examining the relationship among preservice science teachers' ability to attend, analyze and respond to student thinking. *Teaching and Teacher Education, 45,* 83–93. https://doi.org/10.1016/j.tate.2014.09.005.

Benedict, A., Holdheide, L., Brownell, M., & Marshall Foley, A. (2016). *Learning to teach: Practice-based preparation in teacher education* [Special Issues Brief]. Collaboration for Effective Educator Development, Accountability, and Reform (CEEDAR). https://gtlcenter.org/sites/default/files/Learning_To_Teach.pdf.

Cavanagh, M., & Prescott, A. (2010). The growth of reflective practice among three beginning secondary mathematics teachers. *Asia-Pacific Journal of Teacher Education, 38*(2), 147–159. https://doi.org/10.1080/13598661003678968.

Chikiwa, S. & Graven, M. (2021). How Pre-service TeachersReflect on their own Mathematics Teaching Practice Compared with the Practice of Others, *African Journal of Research in Mathematics, Science and Technology Education*, 25(2), 211–224, https://doi.org/10.1080/18117295.2021.1968164.

Dewey, J. (1933). *How We Think*. Heath and Co.

Er, S. , Toker, Z. & Yücelyiğit, S. (2022). In-service Teachers' Opinions about the Use of Video-based Self-reflection for Pedagogical Development. *Journal of Theoretical Educational Science ,* 15 (3) , 639-660 . https://doi.org/10.30831/akukeg.1039752

Gaciu, N., Dalzell, L., Davis, J., Diamond, A., & Howard, S. (2017). Trainee Teachers' Reflections on Approaches to Enhance their Subject Knowledge in Physics and Mathematics. *Teacher Education Advancement Network Journal, 9*(1), 36–44.

Ingleby, E. (2014). Developing reflective practice or judging teaching performance? The implications for mentor training, *Research in Post-Compulsory Education, 19*(1), 18–32. https://doi.org/10.1080/13596748.2014.872917.

Jarvis, J., & Clark, K. (2020). *Conversations to change teaching*. Critical Publishing.

Kaasila, R., & Lauriala, A. (2012). How do preservice teachers' reflective processes differ in relation to different contexts? *European Journal of Teacher Education, 35*(1), 77–89. https://doi.org/10.1080/02619768.2011.633992.

Körkkö, M., Kyrö-Ämmälä, O., & Turunen, T. (2016). Professional development through reflection in teacher education. *Teaching and Teacher Education*, *55*, 198–206.

Levin, D. M., Hammer, D., & Coffey, J. E. (2009). Novice teachers' attention to student thinking." *Journal of Teacher Education, 60*(2), 142–154. https://doi.org/10.1177/0022487108330245.

Liu, K. (2015). Critical reflection as a framework for transformative learning in teacher education. *Educational Review*, *67*(2),135–157. https://doi.org/10.1080/00131911.2013.839546.

McNeilly, E., Nickel, J., Burns, A., Danyluk, P., Kapoyannis, T., & Kendrick, A. H. (2022). The Canadian preservice teacher education practicum: An examination of fostering university and school collaboration, mentor teacher guidance, and re-centring the practicum. *Interchange*, 1–10. https://doi.org/10.1007/s10780-022-09455-7.

McTighe, J. (2008). Making the most of professional learning communities. *The Learning Principal, 3*(8), 3–7.

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative Research: A Guide to Design and Implementation* (4th ed.). Jossey-Bass.

Miles, M. B., Huberman, M. A., & Saldana. J (2014). *Qualitative Data Analysis: A Methods Sourcebook and the Coding Manual for Qualitative Researchers* (3rd ed.). Sage.

Mulryan-Kyne, C. (2020). Supporting reflection and reflective practice in an initial teacher education programme: An exploratory study. *European Journal of Teacher Education.* https://doi.org/10.1080/02619768.2020.1793946.

Nagro, S. A., deBettencourt, L. U., Rosenberg, M. S., Carran, D. T., & Weiss, M. P. (2017). The effects of guided video analysis on teacher candidates' reflective ability and instructional skills. *Teacher Education and Special Education*, *40*(1), 7–25. https://doi.org/10.1177/0888406416680469.

Nesje, K., & Lejonberg, E. (2022). Tools for the school-based mentoring of pre-service teachers: A scoping review. *Teaching and Teacher Education*, *111*, 103609. https://doi.org/10.1016/j.tate.2021.103609.

Österling, L. (2022). inVisible theory in pre-service mathematics Teachers' practicum tasks. *Scandinavian Journal of Educational Research,* 66(3), 519–532. https://doi.org/10.1080/00313831.2021.1897874.

Rodgers, C. (2002). Defining reflection: Another look at John Dewey and reflective thinking. *Teachers College Record, 104* (4), 842–866. https://doi.org/10.1111/1467-9620.00181.

Sağlam Arslan, A., Aslan. A., & Arslan, S. (2022). Investigating pre-service mathematics teachers' self-assessment process. *Bartın University Journal of Faculty of Education, 11*(1), 137–150. https://doi.org/10.1016/buefad.1000182.

Schön, D. A. (1983). *The Reflective Practitioner: How Professionals Think in Action.* Basic Books.

Schön, D. A. (1987). *Educating the Reflective Practitioner.* Jossey Bass.

Schussler, D. L., Stooksberry, L. M., & Bercaw, L. A. (2010). Understanding teacher candidate dispositions: Reflecting to build self-awareness. *Journal of Teacher Education*, 61, 35–50. https://doi.org/10.1177/0022487110371377.

Seidel, T., & Stürmer, K. (2014). Modelling and measuring the structure of professional vision in preservice teachers. *American Educational Research Journal, 51*(4), 739–771. https://doi.org/10.3102/0002831214531321.

Shandomo, H. M. (2011). The role of critical reflection in teacher education. *School-University Partnerships, 4*(1),101–113.

Stanulis, R. N., & Floden, R. E. (2009). Intensive mentoring as a way to help beginning teachers develop balanced instruction. *Journal of Teacher Education*, *60* (2), 112–122. https://doi.org/10.1177/0022487108330553.

Star, J. R., Lynch, K. & Perova, N. (2011). Using video to improve preservice mathematics teachers' abilities to attend to classroom features: A replication study. In M. G. Sherin, V. R. Jacobs, & R. A. Philipp (Eds.), *Mathematics Teacher Noticing: Seeing Through Teachers' Eyes*, 117–133. Routledge.

Stiggins, R. J. (2002). Assessment crisis: *The absence of assessment FOR learning*. Phi Delta Kappan. https://doi.org/10.1177/003172170208301010.

Stockero, S. L., Rupnow, R. L., & Pascoe, A. E. (2017). Learning to notice important student mathematical thinking in complex classroom interactions. *Teaching and Teacher Education, 63,* 384–395. https://doi.org/10.1016/j.tate.2017.01.006.

Tripp, T. R., & Rich, P. J. (2012). The influence of video analysis on the process of teacher change. *Teaching and Teacher Education*, *28* (5), 728–739. https://doi.org/10.1016/j.tate.2012.01.01.

Weber, K. E., Gold, B., Prilop, C. N., & Kleinknecht, M. (2018). Promoting pre-service teachers' professional vision of classroom management during practical school training: Effects of a structured online- and video-based self-reflection and feedback intervention. *Teaching and Teacher Education, 76*, 39–39. https://doi.org/10.1016/j.tate.2018.08.008.

Xiao, B. & Tobin, J. (2018) The use of video as a tool for reflection with preservice teachers. *Journal of Early Childhood Teacher Education, 39*(4), 328–345. https://doi.org/10.1080/10901027.2018.1516705.