EMPHASIZING PROSPECTIVE SECONDARY TEACHERS' ACTIONS AND IDEAS TO INTRODUCE STUDENT-CENTERED PEDAGOGY IN TEACHING REHEARSALS

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This study investigated the effect of teaching rehearsals on 22 preservice secondary mathematics teachers (PSMTs) who were in their first mathematics pedagogy course. The objective of the teaching rehearsal was to introduce PSMTs to student-centered teaching. PSMTs worked in groups to complete a learning cycle consisting of analyzing a mathematics task, preparing to teach the task, implementing the task with their peers (the teaching rehearsal), and reflecting on their experience. Although PSMTs struggled to teach using student-centered practices, they gained more insight into student-centered practices via self-reflection and class discussion that was centered on PSMT's experiences during the rehearsal. Through the learning cycle, PSMTs also started to develop a vision for creating a classroom culture that values student thinking.

Keywords: High School Education; Instructional Activities and Practices; Preservice Teacher Education; Teacher Educators

Preservice secondary mathematics teachers (PSMTs) bring previous mathematical experiences to their university courses. Many PSMTs experienced a traditional teacher-centered math classroom environment, where direct instruction was prevalent (Prescott & Cavanaugh, 2006). In contrast, the national K-12 mathematics recommendations call for a student-centered approach to teaching mathematics that emphasizes understanding in addition to procedural skill (NCTM, 2014). Moreover, students should be engaged in making conjectures and explaining their reasoning in mathematic courses (National Council of Teachers of Mathematics [NCTM], 2000; National Governors Association Center for Best Practices & Council of Chief State School Officers [NGACBP & CCSSO], 2010).

Recommendations for mathematics teacher preparation programs note that K-12 preservice teachers (PSTs) need to experience student-centered teaching as a learner to be able to enact those practices with their own students (Association of Mathematics Teacher Educators [AMTE], 2017; NCTM, 2014). Furthermore, PSTs need to practice implementing student-centered pedagogy (AMTE, 2017). However, PSTs have few opportunities to enact student-centered pedagogy due to the structure of the practicum experience (Wilson et al., 2002; Winsor et al., 2018) or to the role of the cooperating teacher (Borko & Mayfield, 1995; Solomon et al., 2017). Recently, teacher educators have used teaching rehearsals to increase PST's opportunities to implement student-centered pedagogy (e.g., Arbaugh et al., 2019; Lampert et al., 2013). Prior to this study, our mathematics department did not use teaching rehearsals with PSMTs. We hypothesized that using teaching rehearsals with PSMTs taking an introductory pedagogy class would introduce PSMTs to student-centered practices in a structured environment. The purpose of this study was to investigate how teaching rehearsals focused on student-centered pedagogy might help PSMTs gain an initial understanding of how to implement student-centered pedagogy in future teaching.

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Relevant Literature

Pedagogies of Practice

Teaching rehearsals are often situated within a pedagogies of practice framework, which posits that core teaching practices should be at the center of teacher education programs (see Grossman et al., 2009). Without opportunities to practice student-centered pedagogy, teachers are often unsuccessful at applying student-centered pedagogy in their classroom (Grossman & Dean, 2019). Additionally, because the art of teaching is complex, Grossman and Dean stated that, "Attending to practice links the focus on skill with the focus on knowledge" (p. 158), resulting in teachers viewing their teaching practices as mastered and usable knowledge. Core practices that serve as the focus for pedagogies of practice vary (Grossman & McDonald, 2008). Some core teaching practices include launching an activity, managing student engagement, responding to students, and assessing student understanding (Lampert et al., 2013).

*Principles to Action*s (NCTM, 2014) also emphasized the importance of specific teaching practices that help students develop a conceptual understanding of mathematics. The eight Mathematics Teaching Practices were created to provide teachers with " a core set of high-leverage practices and essential teaching skills necessary to promote deep learning of mathematics" (NCTM, 2014, p.3). Some practices include "Implement tasks that promote reasoning and problem solving", "Pose purposeful questions", and "Elicit and use evidence of student thinking" (NCTM, 2014, p. 8). In both university and classroom settings, the identification of core practices helps break down the complexity of teaching. Moreover, it helps teacher educators focus their efforts on impactful teaching practices.

Approximations of Practice: Teaching Rehearsals

One way for PSTs to learn a core practice is through an approximation of practice. Ghousseini and Herbst (2016) defined approximations of practice as "activities in which novice teachers engage in experiences akin to real practice that reproduce some of the complexity of teaching" (p. 83). Teaching rehearsals are considered an approximation of practice and are structured as part of a learning cycle that requires the PSTs to interact with the practice, teach using the practice, and then reflect on their experience (Kazemi et al., 2016). Janssen et al. (2015) noted that teaching rehearsals can vary according to their level of focus, level of authenticity, and level of scaffolding.

Focus. The level of focus in a teaching rehearsal can vary from focusing on a single component of a practice to focusing on a full practice (Janssen et al., 2015). Many reported teaching rehearsals have focused on one specific teaching practice during the learning cycle (e.g., Arbaugh et al. 2019; Lampert et al., 2013). At the secondary level, Campbell and Elliott (2015) focused on having PSMTs build a definition of a mathematics topic from an investigation. Arbaugh et al. (2019) focused on specific kinds of questions PSMTs could use to elicit student thinking while engaged in problem solving.

One challenge of focusing on a particular practice is that the PSMTs may miss how teaching practices, such as NCTM's (2014) Mathematics Teaching Practices, are interdependent. Smith and Stein (2018) noted that teaching practices do not occur in isolation. For example, one of NCTM's (2014) practices is that teachers facilitate meaningful mathematical discourse. Teachers who effectively facilitate mathematical discussions do so in part because they use three other practices: they have clear goals for the lesson, they ask purposeful questions, and they elicit and use student thinking (Smith & Stein, 2018). Additionally, these afore mentioned teaching practices depend on implementing a high-level task (Smith & Stein, 2018). Tasks classified as high-level are more likely to help students reason mathematically, have multiple entry points,

have varied solution strategies, and promote connections between mathematical ideas (NCTM, 2014; Smith & Stein, 2018).

Authenticity. The level of authenticity of teaching rehearsals depends on where preservice teachers implement their practice lessons. Previous studies (e.g., Campbell & Elliott, 2015; Lampert et al., 2013) valued a high level of authenticity while implementing practice lessons. In those studies, PSTs engaged in teaching rehearsals in a controlled environment before also implementing the lesson in front of actual students. Campbell and Elliott (2015) found that implementing a practice lesson in an authentic setting allowed PSMTs to be responsive to a particular classroom environment, which they noted is an important part of teaching.

However, other studies did not have PSMTs teach in an actual classroom (e.g., Arbaugh et al., 2019; Dotger et al, 2014). Dotger et al. (2014) purposefully used clinical simulations to give PSMTs a shared experience. They found that the use of the simulation, along with the collective reflection, illuminated the PSMTs "mathematical knowledge, instructional abilities, and practices in need of refinement" (p. 599). Arbaugh et al. (2019) used mathematics education graduate students as practice secondary students so that the PSMT would have a "low-risk approximation of practice" (p.24). The authors found evidence of PSMTs' growth in several dimensions of teaching, such as increased knowledge of students and connecting knowledge of students with specific teaching practices.

Scaffolding. Finally, the level of scaffolding can vary with the level of feedback and support the teacher educator gives during the teaching rehearsal (Janssen et al., 2015). Many teacher educators pause preservice teachers' teaching during their rehearsal to give feedback (Arbaugh et al., 2019; Averill et al., 2016; Lampert et al., 2013). Lampert et al. (2013) used scaffolding during rehearsals to draw the PSTs' attention to certain practices, pausing the PSTs during the rehearsal to suggest a next teaching move, or to give an evaluation of a certain teaching move employed by the PST.

In contrast, Peercy and Troyan (2020) have suggested that a lower amount of scaffolding during rehearsal may be beneficial. They found that directive statements from the mathematics teacher educators led to the teacher educators being positioned as the expert and the contributions of PSMTs to be less emphasized. Conversely, when discussions of the teaching enactment emphasized PSMTs' contributions, the PSMTs "had more opportunities to engage and consider questions about the work of teaching" (p. 10). In short, Peercy and Troyan (2020) suggested that mathematics teacher educators must carefully consider and respond to PSMT thinking during approximations of practice in a similar manner to how they ask PSMTs to respond to student thinking.

Research Question

Previous studies involving teaching rehearsals were designed to include a narrower focus (Arbaugh et al., 2019; Campbell & Elliott, 2015; Lampert et al., 2013), an authentic setting (Campbell & Elliott, 2015; Lampert et al., 2013), and a high level of scaffolding (Arbaugh et al., 2019; Averill et al., 2016; Lampert et al., 2013). However, we hypothesized that a broader focus might give PSMTs in their first pedagogy course a better idea of what student-centered teaching entails. Additionally, we hypothesized that a controlled setting—having PSMTs teach their peers—might create a low-risk teaching environment for the PSMTs. Our research question was: How do PSMTs react to participating in a teaching rehearsal focused on implementing a high-level task using student-centered pedagogy?

Methods

Participant and Course Description

This study took place at a midwestern university with 22 PSMTs who were in their first secondary mathematics pedagogy course. The overarching goal of the course was to introduce PSMTs to the field of mathematics education via examination of *Principles and Standards for School Mathematics* (NCTM, 2000). The second author served as the instructor of the course. His pedagogy consisted of having PSMTs experience standards-based teaching, read about and discuss different pedagogical moves, and implement student-centered pedagogy. The first author attended the course both as an observer and researcher, working closely with the second author to design the teaching rehearsal and learning cycle.

Research Design

We designed the learning cycle to have PSMTs interact with the content of the lesson, plan to teach the lesson, teach the lesson (the teaching rehearsal), and then reflect on their experience (Kazemi et al., 2016). However, to elevate the voices and ideas of the PSMTs (Peercy & Troyan, 2020), we included an additional part of our learning cycle, based on observations of PSMTs' teaching and their initial reflections. The final part of our cycle included a whole-class discussion, asking PSMTs to read and respond to an article on eliciting student thinking (Reinhart, 2000), and providing PSMTs feedback on their rehearsal. To close, PSMTs reflected on the final segment of the teaching cycle.

To begin the learning cycle, PSMTs worked in groups of four to analyze a preselected high-level task. Prior to the learning cycle, the instructor chose six articles from *The Mathematics Teacher* that included a high-level task, instruction for implementing that task, and focused on using student-centered practices (NCTM, 2000, 2014). PSMTs analyzed the task by completing the tasks, developing learning goals based on the task, and describing how the task differed from a more traditional lesson on the mathematical concept.

During the planning phase of the cycle, the PSMTs were to plan their lesson using the launch-explore-discuss model (Smith & Stein, 2018). PSMTs continued to work in groups of four, planning the launch of the task, questions they would pose to students, and writing a description of how they would facilitate a whole-class discussion.

PSMT groups taught their lessons to fellow PSMTs, who were instructed to act as students. PSMTs started each lesson by stating what grade level the lesson was intended for, which allowed their classmates to act appropriately. We did not give feedback during the PSMTs' implementation of the task to give more weight to the PSMTs' own thoughts and actions (Peercy & Troyan, 2020).

After implementing the high-level task, PSMTs completed a written reflection on what they learned from planning and implementing their task. PSMTs also reflected on their experience as "students" and how they might use that information as a teacher. We used observations of PSMTs' teaching and their initial reflections to inform the design of the final part of the cycle. For the final part of the learning cycle, we started by having a whole-class discussion that was focused on their actions as teachers and ideas they referenced in their initial reflections. We also had the PSMTs read an article that focused on specific teaching practices that teachers can use as they plan questions that elicit student thinking (Reinhart, 2000). Then we gave each group written feedback on their lesson implementation related to those practices. Finally, we asked PSMTs to write a final reflection related to feedback received and the article's content.

Data Collection

During the learning cycle, the first author observed all class sessions and took field notes. From each group of PSMTs, we collected their task analyses, lesson plans, and initial reflections as teachers. From each individual PSMT, we collected their initial reflections as student participants and their final reflections. We also videotaped each group's teaching rehearsal and the whole-class discussion. For the purposes of this paper, we focused on the lesson videos and the three reflections completed by the PSMTs.

Data Analysis

We analyzed data at two points in the study. Our initial analysis included generate themes from the teaching rehearsal videos and the initial reflections. We used the generated themes to inform the structure of the whole-class discussion and the final reflection of the learning cycle. Because we did not have preconceived notions of what kind of themes we were looking for, we used open coding (Merriam & Tisdell, 2016) to analyze the data and then combined the codes into themes. For the second analysis, we analyzed their final reflections and coded according to the themes we found in the initial analysis. We then compared how the PSMTs discussed the generated themes in their initial reflections to how they discussed them in their final reflections.

Findings

Two broad themes emerged from our initial data analysis. The first theme of eliciting and using student thinking (NCTM, 2014) was based on the disconnect between our observations and their initial reflections as teachers during the teaching rehearsal. The second theme of student engagement and learning was based on their reflections as student participants. We used these themes to structure our whole-class discussion. One part of our discussion focused on recognizing how different types of questions promoted or hindered student thinking. The second part of our whole-class discussion focused on the level of student engagement in response to using a high-level task or the implementation of the task by the teachers.

In the following section, we organized our findings based on the themes we generated. We include a brief description of key findings at each stage of the learning cycle. Our intent in presenting the findings in this manner is to illustrate differences between PSMTs actions as teachers and their responses throughout their reflections.

Eliciting and Using Student Thinking

PSMT actions as teachers. In the initial analysis, we found that PSMTs struggled to ask open-ended questions during their lesson to elicit student thinking. At the conclusion of each teaching rehearsal, the PSMTs tended to ask closed-ended questions, most requiring one-word responses, to their students (fellow PSMTs). When the PSMTs did pose an open-ended question, they often offered little wait time before they rephrased the question, making it easier for the students to answer. For example, in Group 5, the PSMT leading the discussion started by asking students how they would know where to shade when graphing a linear inequality. After a brief pause where no one answered, the PSMT followed up with: "Which region would you shade?" Then continuing to provide little wait time, the PSMT asked, "Would you shade above the line or below the line?" which relegated the question to a single-word answer.

PSMTs seemed to overlook the importance of using student thinking as they led whole-class discussions. PSMTs circulated around the class during the student work time but did not document any student work or comments that could be used during the whole-class discussion. Five of the six groups started their whole-class discussion by asking for volunteers without purposefully highlighting student work they had seen as they walked around.

Initial reflections. In their initial reflections as teachers, PSMTs were not able to critique themselves about the ways they elicited (or failed to elicit) student thinking during their lessons. When asked about the strengths and weaknesses of their lessons, PSMTs focused on external factors like timing or how well the groups worked together, making no mention of how their teaching actions might have influenced student learning.

Several PSMTs did note, however, how anticipating student thinking before the lesson would have benefitted their teaching. Group 1 said, "We learned that preparation is key…If we prepare for multiple scenarios, it will increase our chances of being able to help students complete high-level tasks." Group 4 said that "When preparing the task, you almost want to know how your students will answer," and Group 5 added that "It would also be good to think ahead about some possible problems that may arise and think about how to solve them."

Final reflections. As part of the final reflection, PSMTs were asked to reflect on what changes they would make to their lesson, based on instructor feedback and ideas found in the article. In the final reflection, PSMTs were more specific about the ways they struggled to elicit student thinking while teaching, when compared to their initial reflections. Two PSMTs observed how their whole-class discussion became more of a lecture. One PSMT noted, "A lot of the class discussion was just me talking and a lot of that was because we were running out of time, but also I didn't know how to get the students to actually respond." Several PSMTs noted that the article helped them realize lecturing or asking closed-ended questions requires students to do little thinking. One PSMT even said the article "helped me realize how little many students do think."

Several other PSMTs commented on the need for planning more intentional questions to pose during the lesson because they realized their questions did not require much student thinking. One PSMT realized they were "asking a lot of questions that required one-word answers instead of whole responses. We weren't asking the right questions since we were clearly asking students to regurgitate something from memory and not to really answer and consider the question." The idea of preparing questions beforehand seemed new to most of the PSMTs, with one of them commenting, "I always just assumed questions were something that came up when students were confused and weren't planned ahead to invoke specific kinds of thinking. I really like this idea, though!"

Student Engagement and Learning

PSMT actions as teachers. In the initial analysis, PSMTs tended to revert to traditional teaching methods during their teaching rehearsals, rather than student-centered teaching practices. Despite engaging in discussions focused on launching a high-level task, several groups altered the task, lowering the cognitive demand of the task, making the task easier for the students to solve. Many groups seemed uncomfortable with student struggle. For example, Group 5 began their lesson with a review of mathematical concepts instead of a launch question. Group 2 posed a launch question but quickly transitioned to showing examples because they sensed confusion among the students.

Several groups also reverted to lecturing at some point during their lesson. PSMTs in Groups 4 and 5 both attempted posing questions to elicit student thinking but ended up offering their own lengthy explanation instead. During a task focused on determining the distance formula by deriving it from the Pythagorean Theorem, Group 6's whole class discussion focused on presenting the connection versus allowing students to share their own discoveries.

Initial reflections. We were surprised by PSMTs' reflections about their experiences as "practice students". Even though PSMTs struggled to identify and critique student-centered

practices in their own teaching, they were able to identify benefits of experiencing student-centered practices as students. One PSMT said, "It [the task] made me think through the process of finding possibilities on my own and not just being given information and memorizing it," and another said she learned to "ask what they [students] see rather than telling them what they're supposed to see." Other PSMTs noted the benefits of not telling students the answers right away, with many discussing how figuring out something on their own or in a group led to better understanding of the topic. PSMTs also expressed the importance of students having a conceptual understanding, rather than just a procedural understanding. PSMTs noted how the tasks in which they engaged fostered connections which led to that deeper understanding. One PSMT commented that "As a teacher, I want to make sure to integrate the "how" of math more often into my lessons than my own high school teachers did."

Final reflections. Several PSMTs, in their comments on the article, referenced giving students time and space to think and struggle during a task. One PSMT said the article helped her learn that "students are capable of a lot and if teachers just give them all the answers, then students will never learn how to do it on their own." A few PSMTs commented that in high school they were not given enough time to think through problems, which resulted in a lack of understanding and waiting for teachers to provide the students with a method and solution. PSMTs noted that as teachers they want to provide students with sufficient time to think though problems to promote learning and understanding.

Additionally, many PSMTs discussed the desire to establish a classroom culture focused on students' conceptual understanding. PSMTs mentioned wanting a classroom where students are comfortable sharing ideas and asking questions. One PSMT noted that, in his future classroom, he wanted to "replace lectures with sets of questions. Just like the author says, my initial instinct is to teach a concept in the form of a lecture where I can just tell the students what they should know. However, this does not encourage critical thinking."

Discussion

Teaching a lesson that had the structure of launch-explore-discuss allowed PSMTs to experience aspects of student-centered instruction. During their lessons, PSMTs struggled implementing student-centered practices, specifically, eliciting and using student thinking. This was not surprising because it was likely these PSMTs' first time implementing a high-level task. Moreover, we did not focus on specific practices of the lesson beforehand, which may have led to PSMTs' struggles.

On their initial reflections, PSMTs commented favorably about experiencing student-centered practices as a learner during the teaching rehearsal but struggled to give specific critiques of their own teaching. Prescott and Cavanaugh (2006) note that preservice teachers view their past school experiences "through the lens of the student rather than the teacher" (p. 429). PSMTs did not have enough teacher knowledge/experiences to effectively critique themselves.

In their final reflections, PSMTs were able to identify more specific teaching practices they could employ during teaching rehearsals. Consequently, PSMTs began developing a vision for their future classrooms that went beyond specific practices and instead focused on a classroom culture that values and uses student thinking.

The structure of the learning cycle helped facilitate PSMTs' understanding of student-centered instruction. The broad focus of the teaching rehearsal allowed the PSMTs to experience of the complexity of student-centered teaching. Moreover, PSMTs started to understand the kind

of classroom culture that promotes student thinking. Although other studies using rehearsals have successfully targeted a single teaching practice (e.g., Arbaugh et al., 2019; Campbell & Elliott, 2015; Dotger et al., 2015), this study demonstrates that a broad focus can also be beneficial.

The lack of scaffolding during the teaching rehearsal, in addition to the broad focus, allowed us to build on practices and ideas that were lacking in PSMTs teaching and initial reflections as we designed the end of the learning cycle. This served to "create room for TL [teacher learner] voices in the pedagogies of rehearsal" (Peercy & Troyan, 2020). The whole-class discussion, our feedback, and reading the practitioner article helped PSMTs focus on specific teaching strategies. PSMTs were then able to critique in their own teaching and reflect on how to use student-centered pedagogy. The actual teaching experience gave PSMTs a reference point during discussions focused on teaching at the conclusion of the learning cycle because it was no longer hypothetical for them. In the final reflection, PSMTs' comments about future practices were tied to their experience as teachers during the rehearsal, to our whole-class discussion, and to the feedback.

Additionally, although Campbell and Elliott (2015) noted that "practice-focused designs are better tied to and derived from the activity of teaching in schools" (p. 151), the lack of authenticity did not seem to have negative consequences in this study. Rather, PSMTs were able to experience teaching in a low-risk setting with no pressure to "get it right" when they taught the lesson again in front of students. The low-risk setting gave PSMTs more time and space to reflect on their teaching. The final reflection at the end of the learning cycle seemed to prompt new understanding of ways to change their teaching moving forward. This finding is similar to studies that show the value of PSMTs reflecting on their own beliefs and being given space to examine and challenge those beliefs (Conner et al., 2011; White et al., 2005).

Conclusion

PSMTs had many favorable reactions to participating in a teaching rehearsal focused on high-level task implementation. They had a chance to experience teaching for the first time in a student-centered manner. PSMTs were able to use their teaching experience to reflect on the kinds of teaching practices and classroom cultures that elicit student thinking. One limitation of the study was that PSMTs did not complete a second teaching rehearsal. In their final reflections, PSMTs were able to describe specific practices they would like to use in their future teaching. Another teaching rehearsal would have provided PSMTs the chance to use those practices.

This study furthers the field of teaching rehearsals. The teaching rehearsal in this study differed from rehearsals in previous studies in its level of focus, scaffolding, and authenticity. An implication of this study is that a broad level of focus in a teaching rehearsal could help PSMTs gain a sense of the complexity of student-centered instruction. Additionally, a low level of scaffolding during the rehearsal allows for highlighting PSMTs' own ideas and actions. Finally, the lack of authenticity did not detract from the experience of PSMTs, which suggests that other universities may find it helpful for PSMTs to have similar experiences early in their university programs.

References

Arbaugh, F., Graysay, D., Konuk, N., & Freeburn, B. (2019). The three-minute-rehearsal cycle of enactment and investigation: Preservice secondary mathematics teachers learning to elicit and use evidence of student thinking. Mathematics Teacher Educator, 8(1), 22–48. https://doi.org/10.5951/mathteaceduc.8.1.0022

Association of Mathematics Teacher Educators. (2017). Standards for Preparing Teachers of Mathematics. https://amte.net/standards
Borko, H., & Mayfield, V. (1995). The roles of the cooperating teacher and university supervisor in learning to teach. Teaching and teacher education, 11(5), 501–518. https://doi.org/10.1016/0742-051X(95)00008-8
Campbell, M. P., & Elliott, R. (2015). Designing approximations of practice and conceptualizing responsive and practice-focused secondary mathematics teacher education. Mathematics Teacher Education and Development, 17(2), 146–164.
Conner, A., Edenfield, K. W., Gleason, B. W., & Ersoz, F. A. (2011). Impact of a content and methods course sequence on prospective secondary mathematics teachers' beliefs. Journal of Mathematics Teacher Education, 14(6), 483–504. https://doi.org/10.1007/s10857-011-9186-8
Dotger, B., Masingila, J., Bearkland, M., & Dotger, S. (2015). Exploring iconic interpretation and mathematics teacher development through clinical simulations. Journal of Mathematics Teacher Education, 18(6), 577–601. https://doi.org/10.1007/s10857-014-9290-7
Ghousseini, H., & Herbst, P. (2016). Pedagogies of practice and opportunities to learn about classroom mathematics discussions. Journal of Mathematics Teacher Education, 19(1), 79–103. https://doi.org/10.1007/s10857-014-9296-1
Grossman, P., Hammerness, K., & McDonald, M. (2009). Redefining teaching, re-imagining teacher education. Teachers and Teaching: Theory and Practice, 15(2), 273–289. https://doi.org/10.1080/13540600902875340
Grossman, P., & Dean, C. G. P. (2019). Negotiating a common language and shared understanding about core practices: The case of discussion. Teaching and Teacher Education, 80, 157–166. https://doi.org/10.1016/j.tate.2019.01.009
Grossman, P., & McDonald, M. (2008). Back to the future: Directions for research in teaching and teacher education. American Educational Research Journal, 45(1), 184–205. https://doi.org/10.3102/0002831207312906
Janssen, F., Grossman, P., & Westbroek, H. (2015). Facilitating decomposition and recomposition in practice-based teacher education: The power of modularity. Teaching and Teacher Education, 51, 137–146. https://doi.org/10.1016/j.tate.2015.06.009
Kazemi, E., Ghousseini, H., Cunard, A., & Turrou, A. C. (2016). Getting inside rehearsals: Insights from teacher educators to support work on complex practice. Journal of Teacher Education, 67(1), 18–31. https://doi.org/10.1177/0022487115615191
Lampert, M., Franke, M. L., Kazemi, E., Ghousseini, H., Turrou, A. C., Beasley, H., Cunard, A., & Crowe, K. (2013). Keeping it complex: Using rehearsals to support novice teacher learning of ambitious teaching. Journal of Teacher Education, 64(3), 226–243. https://doi.org/10.1177/0022487112473837
Merriam, S. B., & Tisdell, E. J. (2016). Qualitative research: A guide to design and implementation (4th ed.). Jossey-Bass.
National Council of Teachers of Mathematics. (2000). Principles and standards for school mathematics.
National Council of Teachers of Mathematics. (2014). Principles to actions: Ensuring mathematical success for all.
National Governor's Association Center for Best Practices & Council of Chief State School Officers. (2010). Common Core Standards for Mathematics. http://www.corestandards.org/Math/Practice/
Peercy, M. M., & Troyan, F. J. (2020). "Am I doing it wrong?" Critically examining mediation in lesson rehearsal. Teaching and Teacher Education, 93, 1–12. https://doi.org/10.1016/j.tate.2020.103082
Prescott, A. E., & Cavanagh, M. (2006). An investigation of pre-service secondary mathematics teachers' beliefs as they begin their teacher training. In Conference of the Mathematics Education research Group of Australasia. MERGA.
Reinhart, S. C. (2000). Never say anything a kid can say!. Mathematics Teaching in the Middle School, 5(8), 478–483. https://doi.org/10.5951/MTMS.5.8.0478
Smith, M. S., & Stein, M. K. (2018). 5 practices for orchestrating productive mathematics discussions. National Council of Teachers of Mathematics.
Solomon, Y., Eriksen, E., Smestad, B., Rodal, C., & Bjerke, A. H. (2017). Prospective teachers navigating intersecting communities of practice: Early school placement. Journal of Mathematics Teacher Education, 20(2), 141–158. https://doi.org/10.1007/s10857-015-9327-6
White, A. L., Way, J., Perry, B., & Southwell, B. (2005). Mathematical attitudes, beliefs and achievement in primary pre-service mathematics teacher education. Mathematics Teacher Education and Development, 7, 33¬–52.
Wilson, S. M., Floden, R. E., & Ferrini-Mundy, J. (2002). Teacher preparation research: An insider's view from the outside. Journal of teacher education, 53(3), 190–204. https://doi.org/10.1177/0022487102053003002

Winsor, M. S., Kirwan, J. V., & Ssebaggala, L. (2018). What do we know about secondary mathematics teacher preparation in the United States? The Mathematics Educator, 27(2), 73–106.