

# Investigating Teachers' Understanding of Mathematical Practices and Mathematics Teaching Practices using a Vignette Activity Sequence in a Professional Development Setting

Ryann N. Shelton, Baylor University  
Keith Kerschen, Concordia University Nebraska  
Trena L. Wilkerson, Baylor University

**ABSTRACT:** We investigated teachers' understanding of the Mathematical Practices (MPs; National Governors Association Center for Best Practices & the Council of Chief State School Officers, 2010) and the Mathematics Teaching Practices (MTPs; NCTM, 2014) using a Vignette Activity Sequence within a professional development setting with our Professional Development School (PDS) partners. Although results revealed misconceptions or incomplete understandings participants had about the MPs and MTPs, teachers made connections to their own practice. By highlighting how mathematics teachers at the middle and high school levels view the practices in relation to their classrooms, we were able to target areas to support high-quality teaching and learning of mathematics for future professional development with our PDS partners. This has important implications for mathematics instructional specialists, coaches, and professional development instructors working with teachers and their understanding of the MPs and MTPs.

*NAPDS Essentials: #3 Ongoing and reciprocal professional development for all participants guided by need; #4 A shared commitment to innovative and reflective practice by all participants;*

Many teachers recognize the importance of implementing the Mathematics Teaching Practices (MTPs) identified in the National Council of Teachers of Mathematics (NCTM, 2014) *Principles to Actions: Ensuring Mathematical Success for All* as part of their classroom instruction while also supporting students' Mathematical Practices (MPs; National Governors Association Center for Best Practices & the Council of Chief State School Officers, 2010). While recognizing the importance of the MPs and MTPs is a critical first step, agreeing on what these practices look like in action is a separate challenge. The MPs and MTPs are listed in Table 1. For example, in recent discussions with local teachers in our PDSs, most agreed that productive struggle was necessary in the mathematics classroom, but each described differently what that would look like in their classrooms. Some teachers revealed misconceptions or incomplete understandings concerning supporting productive struggle, the other MTPs, and the MPs in action. These could stem from unproductive beliefs towards mathematics that mathematics teachers may have experienced when learning mathematics as students themselves (NCTM, 2014).

NCTM (2014) defines unproductive beliefs as those which "hinder the implementation of effective instructional practice or limit student access to important mathematics content and practices" (p. 11). For example, NCTM indicates that "Students can learn to apply mathematics only after they have mastered the

basic skills" (p. 11) is an unproductive belief when compared to the productive belief that students can learn through exploration and contextualized mathematics. The beliefs teachers have about their content area significantly impact their instructional practices. Prior research examining mathematics teachers' beliefs towards mathematics has revealed that their beliefs do not always match their instructional practices in the classroom (Beswick, 2012; Cross-Francis, 2015). What mathematics teachers believe about what constitutes each MTP as well as how to support MPs in their students influences how they plan for instruction. Before mathematics teachers can be expected to effectively implement and support these practices in their own classrooms, it is important that they have a firm understanding of the practices.

As university instructors who often work with local school partners to support one another in topics related to teaching and learning mathematics, we developed a professional development series with a focus on MPs and MTPs to support teachers in their professional growth and also to learn from them how they are currently addressing these practices in their work. Our university partners with a number of surrounding districts and their schools, which serve as Professional Development Schools (PDSs). The National Association for the Professional Development Schools (2008) explained that PDS schools were designed to prepare preservice teachers, provide current teachers with ongoing

Table 1. Standards for Mathematical Practices (National Governors Association Center for Best Practices & the Council of Chief State School Officers, 2010); Mathematics Teaching Practices (NCTM, 2014)

---

*Standards for Mathematical Practice*

---

MP 1: Make sense of problems and persevere in solving them.  
 MP 2: Reason abstractly and quantitatively.  
 MP 3: Construct viable arguments and critique the reasoning of others.  
 MP 4: Model with mathematics.  
 MP 5: Use appropriate tools strategically.  
 MP 6: Attend to precision.  
 MP 7: Look for and make use of structure.  
 MP 8: Look for and express regularity in repeated reasoning.

---

*Mathematical Teaching Practices*

---

MTP 1: Establish mathematical goals to focus learning.  
 MTP 2: Implement tasks that promote reasoning and problem solving.  
 MTP 3: Use and connect mathematical representations.  
 MTP 4: Facilitate meaningful mathematical discourse.  
 MTP 5: Pose purposeful questions.  
 MTP 6: Build procedural fluency from conceptual understanding.  
 MTP 7: Support productive struggle in learning mathematics.  
 MTP 8: Elicit and use evidence of student thinking.

---

professional development, encourage joint school-university investigation of education-related issues, and support student learning.

Our partnership allows the preservice teachers in our teacher education program to be placed with particular teachers in these PDSs. These teachers often attend professional development hosted at the university. One of the nine required essentials of a PDS according to NAPDS (2008) is “ongoing and reciprocal professional development for all participants guided by need” (p. 3). In our teacher preparation program, preservice teachers typically in their junior year, or teaching associates, are placed in a different PDS school each semester to assist in two instructional periods and develop and implement their own instructional unit. The preservice teachers in their senior year, or interns, typically complete their full-year internship in a PDS as well. As university instructors working with preservice teachers in the field, we saw a need to support local classroom teachers in their understanding of the MPs and MTPs, particularly as we were introducing these practices to preservice teachers for the first time in their coursework as teaching associates. The professional development series, which is described in the following section, is one of many of our university programs that aligns with the goals of the PDS model.

In a summer professional development called the Mathematics Teacher Academy held at our university, where we teach courses about teaching and learning mathematics, we hosted 39 teachers from grades 5-12 and their school district leaders. Many of these teachers work with the teaching associates and interns placed in their classrooms as part of our PDS partnership. With the focus of the professional development on algebraic thinking, we provided

opportunities for engaging in tasks that support the MPs<sup>1</sup> and MTPs. The MPs and MTPs are innovative practices within mathematics teaching and learning, and the Mathematics Teacher Academy allowed us to work with our PDS partners in developing a stronger understanding of these practices, again addressing professional development guided by need (NAPDS, 2008).

For many teachers, this was their first time learning about the MTPs. While the teachers were grouped together for our opening meeting for the professional development series and for a number of break-out sessions, often they were separated by grade band, with the middle school teachers and high school teachers working in groups. By highlighting how mathematics teachers at both the middle and high school levels view the practices in relation to their own classrooms, we were able to target specific areas to support high-quality teaching and learning of mathematics. One way we have found to be effective in revealing teachers’ beliefs about the MPs and MTPs is by using a Vignette Activity Sequence.

### Vignette Activity Sequence

To better understand what mathematics teachers believe about the MPs and MTPs in action, we utilized a Vignette Activity Sequence (Wilkerson, Kerschen, & Shelton, 2018). We found this sequence helpful in identifying what teachers believe about the MPs and MTPs. Vignettes, which can be print- or media-based, are short accounts that are useful in supporting discussion about a problem or situation (Jeffries & Maeder, 2011). One benefit of using vignettes is that it allows the designer to focus the situation to highlight a specific concept, such as a MP or MTP. The short nature of vignettes makes them easy to include during professional development or in a professional learning community and are valuable in the collection of data (Kennedy, 1999).

Jochums and Pershey (1993) found that using vignettes in professional development settings with 50 teachers across science, mathematics, social studies, and technology supported their understanding of inter-disciplinary teaching and learning specific content. Furthermore, their vignette method led to affective change and was a productive formative evaluation during the professional development. Similarly, Angelides and Gibbs (2006) argued that vignettes can help teachers learn from their experiences, pointing to patterns and examples of practice. In their use of vignettes, “outsiders” analyzed the vignettes, encouraged teachers to reflect, and worked together to make sense of the situation given in the vignette with a focus on professional practice. When vignettes are directly related to those who will analyze them, the discussions surrounding those vignettes will have better outcomes (Angelides & Gibbs, 2006).

We used the Vignette Activity Sequence in a professional development setting to stimulate discussion for (1) the development of effective MTPs and (2) understanding teacher actions related to student learning and MPs. Because the

<sup>1</sup> We utilized a modified version of the MPs that aligns to our state standards.



Figure 1. Vignette Activity Sequence (Wilkerson, Kerschen, & Shelton, 2018)

vignette allows for analysis of both MPs and MTPs, those utilizing it have opportunities for making connections between these practices. Should a teacher choose to focus solely on the MTPs, their students' MPs may become weak links. Likewise, should they only focus on building students' MPs, teachers' MTPs might reveal themselves as weak links. It is vital for teachers to be intentional about the objectives they have for student growth related to the MPs as well as working on their own MTPs. Deliberately building stronger links between the teachers' practices and the students' practices is key. This supports the fourth of the nine required essentials of a PDS according to NAPDS (2008), "A shared commitment to innovative and reflective practice by all participants" (p. 3).

The Vignette Activity Sequence is implemented in five steps (see Figure 1). The first step involves teachers solving a rich mathematical task and engaging in discussion about methods utilized in solving the task. In the second step, teachers read and reflect on a vignette, which involves the mathematical task they previously solved and discussed as well as authentic student work. Steps three, four, and five of the sequence are facilitated with the use of a vignette recording sheet, as the teachers independently reflect on the vignette by responding to the four questions given in Figure 2.

Using Questions 1 and 2, the vignette recording sheet requires teachers to identify and provide evidence for the MPs and MTPs addressed in the vignette. Question 3 specifically relates to the vignette, and it varies, as it may involve analyzing student misconceptions or asking for an instructional decision based on student work, depending on the vignette. Question 4 on the recording sheet facilitates a reflection to connect the events in the vignette to personal experiences and practices. The Vignette Activity Sequence provides one model for teachers to connect effective mathematics teaching practices to productive student mathematical practices. After each teacher has individually completed the vignette recording sheet, the group engages in a discussion of their selection of practices and the evidence provided, followed by a discussion focused on the other questions. For readers who are interested in a more detailed explanation of each part of this activity, see Wilkerson, Kerschen, and Shelton (2018).

## Sample Vignette

In the past, we have utilized both written and video vignettes as part of the Vignette Activity Sequence. Our journey to uncover teacher beliefs about the MPs and MTPs began with using the sequence to analyze the Two Storage Tanks Task found in

NCTM's (2015) online *Principles to Actions Professional Learning Toolkit* and shown in Figure 3. The teachers independently worked through this task designed for middle grades students, and we as the professional development instructors then led the teachers in a short discussion of the problem. As part of this discussion, the teachers shared their various solution strategies.

Next, the teachers watched the first two minutes of a related video clip of students working on the task and were given the accompanying transcript to take notes as they watched. The video clip and its transcript served as the vignette for the Two Storage Tanks Task. As previously explained, vignettes are short accounts useful in supporting discussion about a problem or situation and can be written- or media-based. A vignette could be authored based on a mathematical task, student work, or a classroom situation; it could be adapted from a longer teacher case or other written description; or it could be a video clip. In the past, when we have utilized a video clip to serve as a media-based vignette, we have provided the transcript for the video clip so that viewers can more easily follow along. The vignette utilized in this particular professional development setting was media-based. To mirror the short nature of a written vignette, we showed only a brief portion of the full video clip, the first two minutes. The clip provided the teachers the opportunity to analyze the work of students in the Two Storage Tanks problem. Figure 4 includes the corresponding transcript for this vignette.

After working through the task and watching the video clip, the teachers independently completed the vignette recording sheet (see Figure 2) to indicate the MPs and MTPs that they believed were evident in the vignette and to answer the additional questions. Lastly, we led the teachers in a whole-group discussion about their responses for each of the boxes in the vignette recording sheet.

## Examining Teachers' Responses on the Vignette Recording Sheet

We reviewed the vignette recording sheets to determine which MPs and MTPs we might need to address further with teachers as part of professional development. We also examined the teachers' responses related to how the vignette might impact their practice. Our findings are shared in the following sections.

### Investigating MPs and MTPs to Reinforce

Teachers attending the professional development who were less familiar with the MPs and MTPs seemed to struggle with making connections with the practices on their vignette recording sheets

<p>1. Identify any <u>Mathematical Practices</u> practiced by the students illustrated in the vignette. Provide evidence from the vignette to justify the Mathematical Practices you selected. Please connect your evidence to discussions or research.</p>	<p>2. Identify any <u>Mathematics Teaching Practices</u> practiced by the teacher that is illustrated in the vignette. Provide evidence from the vignette to justify the Mathematics Teaching Practices you selected. Please connect your evidence to discussions or research.</p>
<p>3. If you could change one question that the teacher asked or add an additional question, what would it be and why?</p>	<p>4. How does reflecting on this vignette inform your own practice? What will you take away from this vignette, or what connections can you make to your own teaching or future teaching?</p>

Figure 2. Vignette Recording Sheet

for the Two Storage Tanks Task vignette. While they were able to indicate how they would take particular tasks and technology back to their own classrooms on Question 4 of the vignette recording sheet, it was not clear if they made connections with the practices when identifying and providing evidence for the MPs and MTPs targeted in the vignettes in Questions 1 and 2. For example, several teachers identified the MP 1: Make sense of problems and persevere in solving them, in the vignette when responding to Question 1 on the vignette recording sheet. However, many did not provide evidence to support their selection, or their evidence was vague: “Throughout whole scene” or “Student familiar with the problem.” Similarly, when answering Question 2 on the vignette recording sheet, many teachers recognized MTP 2: Implement tasks that promote reasoning and problem solving as being present in the vignette. When asked to provide evidence, teachers often simply indicated that the task was assigned, offering little or no explanation of the qualities of the problem that promoted reasoning and problem solving.

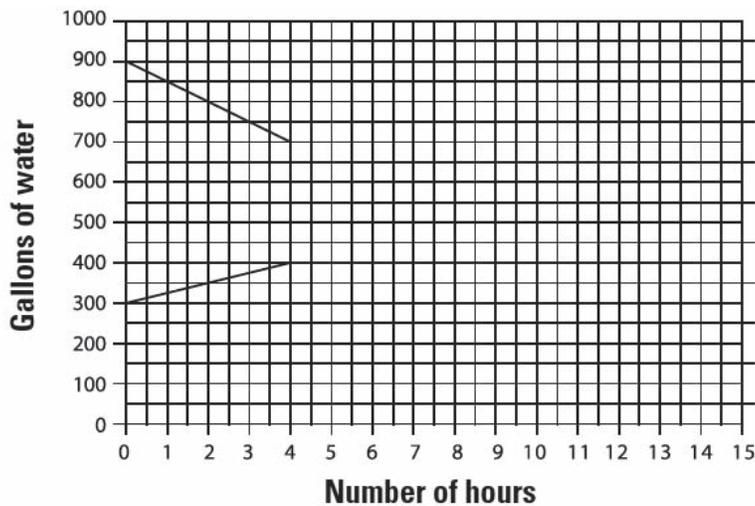
In the Two Storage Tanks vignette, one of the targeted MTPs was MTP 5: Pose purposeful questions. Almost 80% of the teachers identified MTP 5 as being practiced in the vignette. While

some teachers did not provide evidence to justify their selection of MTP 5, the teachers who did provide evidence were able to identify specific questions that they felt the teacher in the vignette asked purposefully. For example, one Algebra I teacher identified the following question posed by the teacher in the vignette as evidence of a purposeful question, “Where is the 900 on the graph? I don’t see 50 anywhere. Can you show/tell me where that comes from?” With the participant providing the specific question used by the teacher in the vignette as evidence of purposeful questioning, we as the professional development instructors could consider specific ways to further support this teacher in understanding the MPs and MTPs. Other teachers provided more general responses for their evidence, including, “Advanced student reasoning to understand the activity” and “Teacher uses questions to lead the students.” Both responses seemed to reveal that teachers felt the questions posed in the vignette were purposefully used to help students understand the task.

A key aspect of posing purposeful questioning, according to NCTM (2014), is differentiating between *funneling* and *focusing* questions. The first response, “Advanced student reasoning to understand the activity” could prompt professional development

### The Two Storage Tanks Task<sup>1</sup>

Two large storage tanks, T and W, contain water. T starts losing water at the same time additional water starts flowing into W. The graph below shows the amount of water in each tank over a period of time. Assume that the rates of water loss and water gain continue as shown.



1. When will the two tanks contain the same amount of water? Explain how you found your answer and interpret your solution in terms of the problem.
2. If you have not already done so, write an equation for each storage tank that can be used to determine the amount of water in the tank at any given number of hours.
  - a. Explain what the different parts of each equation mean in terms of the problem.
  - b. Explain what the different parts of each equation mean in terms of the graph.

<sup>1</sup> Adapted from NAEP Released Items, 2003-8M10 #13.

<http://nces.ed.gov/NationsReportCard/nqt>

Figure 3. The Two Storage Tanks Task (NCTM, 2015)

instructors to ask for further evidence or clarification. It would be helpful to ask the teacher who responded this way, “How did the teacher in the vignette advance student reasoning?” The second response, “Teacher uses question to lead the students,” seems to illustrate the funneling pattern of questioning. Thus, while the teacher was able to identify an appropriate MTP in action, the evidence they provided could represent an unproductive belief about the MTP. This illustrates the power of using vignettes to explore mathematics teachers’ understanding of the MTPs in professional development settings and how to respond to their analyses of the vignette to further support their understanding.

Vignettes allow us to focus on a short account from a mathematics classroom. By narrowing the focus of the account, we can elicit what teachers identify as MPs and MTPs and the evidence they believe justifies their presence. Giving evidence is a critical component of the activity, as teachers may be able to identify a targeted MP or MTP, but the evidence they provide may reveal a misconception, an incomplete understanding, or an unproductive belief. Further, the format of the vignette recording sheet provides a method for teachers to reflect on the MPs and MTPs separately, then to subsequently make connections among these practices.

### Connecting MPs and MTPs with Current Classroom Practices

The final aspect of the Vignette Activity Sequence has teachers reflect on connections between the vignette and their own classroom practice. In many cases, teachers provided responses connecting the MPs and MTPs they identified in the vignette to what they could be doing differently in their own classrooms. One eighth grade teacher who identified MP 1: Make sense of problems and persevere in solving them in the vignette, upon reflection, explained the importance of “questioning that promotes perseverance and academic grit.” One seventh grade teacher who identified MTP 5: Pose purposeful questions as being present in the vignette favored how the teacher in the vignette encouraged students to justify their responses by pointing out parts on the graphs, explaining, “Too often, I see the right answer and assume I don’t need to probe or have my students justify, but they may not have deep or complete understanding.” Allowing teachers to connect the vignette to their own practice provides another opportunity for them to further develop their understanding of the MTPs and examine what they could do in their own teaching to support these practices. Additionally, they may help teachers see connections between their MTPs and their students’ MPs.

### Planning Ahead for Professional Development

The Vignette Activity Sequence provided teachers with opportunities to learn more about the MPs and MTPs as part of their

professional development. Additionally, we found that teachers’ responses to these vignettes were an effective formative assessment in the planning for further professional development. This sequence provided a snapshot of what teachers believe about the MPs, the MTPs, and what they look like in action. Teachers across grade levels responded positively to participating in the Vignette Activity Sequence, indicating that the problem in the vignette was rich, could be used in multiple grade levels, and that they particularly valued the discussion held around their responses on the vignette recording sheet.

One teacher who teaches across several grade levels explained that the Vignette Activity Sequence was “relevant, interesting, useful as thought-provoking exercise about instructional practices.” A seventh grade teacher indicated that it “started the thinking and showed a variety of questioning techniques that helped push me,” while a Geometry teacher wrote, “I enjoyed the discourse between the teachers and students [in the vignette]. It gives me hope that I can have these conversations in my class.” Based upon their responses, it seems the Vignette Activity Sequence was well-received and perhaps useful to teachers as they learned more about the MPs and MTPs.

We as professional development instructors know we need to offer more opportunities within our professional development for teachers to reflect on the MPs and MTPs as well as to support experiences to identify these practices. If teachers identify with unproductive beliefs about the MTPs or struggle to provide appropriate evidence for the presence of the MTPs, for example, we know that we need to adjust by planning for additional professional development opportunities and work with district leaders to address this. We can also address misconceptions or incomplete understandings related to the MPs and connections among these practices. For the teachers revealing a strong understanding of the MPs and MTPs, we can work to continue their learning and further develop their understanding by supporting them in seeking additional connections among these practices that they may not have previously considered. With the help of district leaders, we invited and supported some of these teachers to lead sessions in subsequent summers of the Mathematics Teacher Academy. As researchers, we are interested in observing all of the teachers who participated in the professional development series to learn more about their understanding of the MPs and MTPs, particularly as they address them in their lesson plans and classroom instruction.

This Vignette Activity Sequence may be used by mathematics instructional specialists or coaches as part of professional learning communities or in department meetings to further teachers’ understanding of the MPs and MTPs. For more ideas related to this, see McGatha, Bay-Williams, Kobett, and Wray (2018). Highlighting mathematics teachers’ understanding may help mathematics instructional specialists, coaches, and professional development instructors provide targeted support to address misconceptions or incomplete understandings teachers may have about the MTPs.

**INSTITUTE for LEARNING**

**Two Storage Tanks**  
**Teacher: Elizabeth Brovey**  
**District: Pittsburgh Public Schools**  
**Grade: 8**

1 *Student:* Well 900, well 900 is the head start on this one right here, and it subtracts by 50  
2 and uh the third one- uh, is, uh.

3 *Teacher:* Okay, can I stay with this one and ask you about this one? You said that 900 is  
4 the head start. What does the 900 mean for the problem? What is that 900?

5 *Student:* It's- it's for the gallons of water.

6 *Teacher:* For which tank?

7 *Student:* The... water... loss

8 *Teacher:* Can you show me where it's at? The water loss, I can take that. So where is this  
9 900 on that graph that you're talking about? Okay. Nicole the next thing he said  
10 was about the minus 50. Where, I don't see the minus 50.

11 *Student:* Cause it starts from 900, and then it subtracts 50 within like... it starts losing 50  
12 every single time

13 *Teacher:* Okay, you say it starts losing 50 every single time. Can you be more specific  
14 about how [Inaudible]

15 *Student:* Every time the uh, water starts flowing into tank "W".

16 *Teacher:* So as the water's flowing in, this water's flowing out. And you're saying that's  
17 losing 50 as this water's flowing in?

18 *Student:* Yeah.

19 *Teacher:* What's that time she's talking about?

20 *Student:* Every hour.

21 *Teacher:* Every hour. Remember what we discussed yesterday? When things happen,  
22 there has to be a relationship. It's not just the one thing happening, it's  
23 happening at the same time something else is. So this is every hour.

24 *Student:* Every hour.

© 2007, 2009, 2010, 2014, 2015 UNIVERSITY OF PITTSBURGH Clip ID 2402

Figure 4. Two Storage Tanks Transcript (NCTM, 2015)

**INSTITUTE for LEARNING**

- 25 *Teacher:* Okay, so that's where that 50 comes from. Okay? Marshall can you relay back  
26 where that 50 comes from?
- 27 *Student:* It- it's the, um, hours.
- 28 *Teacher:* Fifty is the hours?
- 29 *Student:* Hold on. She, she meant like, every time- every time that it goes down it minus  
30 by 50 at each hour.

Figure 4. Continued

The Vignette Activity Sequence could be used with preservice teachers as well. For more information about utilizing the Vignette Activity Sequence with preservice teachers, see Wilkerson, Kerschen, and Shelton (2018). Because of our partnership with PDSs and because we also work with preservice teachers in learning about the MPs and MTPs, we believe professional development in this area allows us as university instructors, teachers, and preservice teachers to share a common language, particularly when preservice teachers have also utilized the Vignette Activity Sequence. An additional research focus might be to see how this professional development supports preservice teachers who are teaching associates or interns, as they are learning about the MPs and MTPs for the first time.

In addition to the NCTM's *Principles to Actions Professional Learning Toolkit* (2015), we have also used other resources to create vignettes, including:

- Mathematics Assessment Project, <http://map.mathshell.org/index.php>
- Implementing the Mathematical Practices Standards, <http://mathpractices.edc.org/>
- Annenberg Learner, <https://www.learner.org/>

Longer case studies can also be shortened and adapted to be utilized as vignettes. We have adapted case studies from books such as *Motivation Matters and Interest Counts: Fostering Engagement in Mathematics* (Jansen & Middleton, 2011) as well as *The Impact of Identity in K-8 Mathematics: Rethinking Equity-Based Practices* (Aguirre, Mayfield-Ingram, & Martin, 2013).

## Conclusion

In planning for professional development for teachers, we must consider their current understanding as it relates to beliefs about MPs, MTPs, and the connections between these practices. If the teachers work with preservice teachers as part of a PDS partnership, it is also important to support understanding related to particular concepts and to develop a common language that can be shared among university instructors, teachers, and preservice teachers. In our case, we focused on the MPs and MTPs. This may benefit teachers in supporting the preservice teachers who are placed in their classes either as a teacher associate or during their internship, particularly as they are learning in their university education courses how to support students in MPs and develop their own MTPs. Supporting teachers in realizing potential connections between their MTPs and students' MPs may also help them in their planning and ultimately affect students' mathematical understanding. A focus on these practices means we can work together as partners to foster effective teaching practices and to ensure that students develop mathematical practices. <sup>SUP</sup>

## References

- Aguirre, J., Mayfield-Ingram, K., & Martin, D. B. (2013). *The impact of identity in K-8 mathematics: Rethinking equity-based practices*. National Council of Teachers of Mathematics.
- Angelides, P., & Gibbs, P. (2006). Supporting the continued professional development of teachers through the use of vignettes. *Teacher Education Quarterly*, 33(4), 111-121.
- Beswick, K. (2012). Teachers' beliefs about school mathematics and mathematicians' mathematics and their relationship to practice. *Educational Studies in Mathematics*, 79(1), 127-147. doi:10.1007/s10649-011-9333-2
- Cross-Francis, D. I. (2015). Dispelling the notion of inconsistencies in teachers' mathematics beliefs and practices: A 3-year case study. *Journal of Mathematics Teacher Education*, 18(2), 173-202.
- Jansen, A., & Middleton, J. A. (2011). *Motivation matters and interest counts: Fostering engagement in mathematics*. National Council of Teachers of Mathematics.
- Jeffries, C., & Maeder, D. W. (2011). Comparing vignette instruction and assessment tasks to classroom observations and reflections. *The Teacher Educator*, 46(2), 161-175. doi:10.1080/08878730.2011.552667
- Jochums, B. L., & Pershey, E. J. (1993). Using the vignette method in formative evaluation. *Evaluation Practice*, 14(2), 155-161.
- McGatha, M. B., Bay-Williams, J., Kobett, B. M., & Wray, J. A. (2018). *Everything you need for mathematics coaching: Tools, plans, and a process that works for any instructional leader, grades K-12*. Corwin.
- National Association for Professional Development Schools. (2008). *What it means to be a professional development school*. Retrieved from <https://napds.org/>
- National Council of Teachers of Mathematics. (2014). *Principles to actions: Ensuring mathematical success for all*. Author.
- National Council of Teachers of Mathematics. (2015). *Principles to actions professional learning toolkit*. Retrieved from <http://www.nctm.org/PtAToolkit/>
- National Governors Association Center for Best Practices & the Council of Chief State School Officers. (2010). *Common core state standards for mathematics*. Retrieved from <http://www.corestandards.org/Math>
- Wilkerson, T., Kerschen, K., & Shelton, R. (2018). Preservice teachers' critical connections to effective mathematical teaching practices: An instructional approach using vignettes. *Action in Teacher Education*, 40(4), 358-373. doi:10.1080/01626620.2018.1512430



**Ryann N. Shelton** is a lecturer in the Department of Curriculum and Instruction at Baylor University. She teaches courses in education and conducts research related to secondary mathematics methods courses.

**Keith Kerschen** is an assistant professor of education at Concordia University Nebraska. He directs field experiences and teaches several undergraduate courses in education.

**Trena L. Wilkerson**, Professor of mathematics education in the Department of Curriculum and Instruction at Baylor University, teaches and conducts research related to mathematics teacher education.