PROBLEM-SOLVING AT A DIVERSE SCHOOL: TEACHERS CHARACTERIZE THEIR EXPERIENCES AND THEIR MULTILINGUAL LEARNERS' EXPERIENCES

Richard Kitchen
University of Wyoming
rkitchen@uwyo.edu

"Martinez Elementary" teachers participated in professional development activities during the 2021-22 school year to learn about the Discursive Mathematics Protocol (DMP), a problem-solving based instructional protocol designed specifically for use with multilingual learners (MLs). These activities included training sessions designed to help the teachers learn about the DMP's dual focus on mathematical reasoning and the mathematics register. In this paper, a socio-political framework is used to examine interview data collected from Martinez Elementary teachers to learn how they characterized their experiences and their students' experiences when they implemented the DMP during problem-solving lessons. This study contributes to the research literature by providing insights about how teachers and students at a diverse school characterized their experiences involving problem-solving based instruction.

Keywords: Problem Solving, Equity, Inclusion, and Diversity.

In the study presented here, we use narratives collected from teachers at "Martinez Elementary" to examine their experiences and their students' experiences with problem-solving lessons that were implemented with the aid of an instructional protocol designed specifically for use with multilingual learners (MLs). The protocol, referred to as the "Discursive Mathematics Protocol" (DMP), builds on Pólya's (1945/1986) iconic problem solving heuristic by incorporating research-based "language practices" (LPs) grounded in theories of academic language development and acquisition (Moschkovich, 2015) and "essential teaching practices" (ETPs) (National Council of Teachers of Mathematics [NCTM], 2014). The DMP is intended to be used as a guide by teachers during problem-solving lessons to support students to simultaneously learn the language of mathematics and develop their mathematical reasoning through the implementation of the LPs and ETPs, respectively. The Martinez Elementary teachers' narratives are examined through a socio-political theoretical perspective.

Martinez Elementary is a highly diverse elementary school located in rural, northern New Mexico, USA that serves economically underserved communities populated almost entirely by Hispanic and Native American families (primarily Diné, also known as Navajo). The term "Hispanic" is commonly used in New Mexico to denote individuals and communities of Spanish descent. During the 2021-22 school year, Martinez Elementary teachers participated in professional development (PD) activities to learn about the DMP. These activities included attending PD sessions designed to help the teachers learn about the DMP and how to implement it, participating in both planning and debriefing sessions on six occasions (three times in the fall and three times in the spring) prior to problem-solving lessons during which they used the DMP, and observing instruction in which the use of the DMP was modeled for them during a problem-solving lesson with their students. The research questions addressed in this study are: (1) How did Martinez Elementary teachers characterize their experiences learning about and implementing the DMP during problem-solving lessons? (2) How did teachers characterize how their students experienced problem-solving lessons in which the DMP was used? Prior to presenting the research findings, instructional interventions for MLs and the DMP are

Lamberg, T., & Moss, D. (2023). *Proceedings of the forty-fifth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (Vol. 1). University of Nevada, Reno.

introduced. Brief reviews of the research literature are then provided on problem-solving based instruction and on the historical lack of access that minoritized and economically underserved students like those who attend Martinez Elementary have had to problem-solving based mathematics instruction in the United States.

Mathematics Instructional Interventions for Multilingual Learners

There are a preponderance of interventions designed for use with MLs with learning disabilities (e.g., See Kong & Swanson, 2019). Interventions also exist for "mathematically promising" MLs (Cho et al., 2015). Only a few interventions such as the SIOP (Sheltered Instruction Observation Protocol) Model (Echevarría et al., 2011; Short, 2017) are designed specifically for use with MLs. SIOP can be used in any content area, not just mathematics. Through Dynamic Strategic Math (DSM), teachers modify vocabulary used in mathematical problems to support individual MLs' language proficiency and provide scaffolded instruction so that students can develop strategies to solve problems (Orosco et al., 2011). Culturally appropriate problem-solving instruction (CAPSI) includes explicit vocabulary instruction, schema-based instruction, and video modeling (Luevano & Collins, 2020). Baird et al. (2020) describe a mathematics intervention for MLs referred to as Project Mathematics and English Language Development (MELD). In MELD, significant scaffolds are provided to MLs such as student glossaries, illustrations, and content that is explicitly connected to students' home cultures. The DMP is unique among instructional protocols designed for MLs because of its dual focus on developing students' mathematical reasoning (not simply the learning of math skills) *and* supporting students' learning of the mathematical language.

Introducing the Discursive Mathematics Protocol

Early iterations of the Discursive Mathematics Protocol (DMP) were created more than a decade ago to address the lack of instructional protocols designed specifically to support mathematics instruction of MLs. The DMP takes advantage of Pólya's (1945/1986) heuristic for structuring problem-solving lessons by incorporating the four stages of the heuristic: (1) Understand the problem, (2) Devise a plan to solve the problem, (3) Carry out the plan to solve the problem, and (4) Reflect back on the plan and solutions derived. The language practices (LPs) and essential teaching practices (ETPs) are then integrated throughout the four stages of Pólya's (1945/1986) heuristic. The LPs are three-fold and are intended to provide teachers with insights about how to intentionally model language to help students communicate and learn (Lee et al., 2013) the language of mathematics. They include: Using instructional strategies designed to develop everyday English language skills (LP#1), engaging students in mathematical discourse (LP#2), and developing language specific to the discipline of mathematics (LP#3). It should be noted that the focus of LP#1 is the development of everyday English skills because in the United States, English is the language of instruction. In settings where English is not the language of instruction, LP#1 could focus on everyday language skills of the language of instruction in that setting.

The three ETPs included in the DMP are derived from the "Mathematics Teaching Practices" described in *Principles to actions: Ensuring mathematical success for all* (National Council of Teachers of Mathematics [NCTM], 2014), a policy document intended to provide guidance for U.S. teachers and policymakers in mathematics education. The ETPs are intended to support the development of students' mathematical reasoning. Mathematical reasoning, broadly defined as "the capacity to think logically and to justify one's thinking" (NCTM, 2014, p. 7), involves

searching for similarities and differences, validating, and exemplifying (Jeannotte & Kieran, 2017). The three ETPs included are: Use and connect mathematical representations (ETP#1), pose purposeful questions (ETP#2), and elicit and use evidence of student thinking (ETP#3). There are many relationships among the LPs and ETPs. For example, posing purposeful questions (ETP#2) is a strategy that teachers can use to initiate discourse (LP#2) with and among students (Kooloos et al., 2020). For additional information about the DMP, see Kitchen et al. (in review).

Problem-Solving Based Instruction

In problem-solving based instruction, much emphasis is placed on students making sense of mathematics by making connections, communicating, and using representations to characterise their ideas (Gamoran et al., 2003). A prominent feature of problem-solving based instruction is the value placed upon mathematical conversations or discourse. During mathematical discourse, the teacher seeks to foster and engage in dialogue with her students (Herbel-Eisenmann & Cirillo, 2009). Through discourse, teachers support students to make sense of mathematical ideas, construct arguments, and justify mathematical claims (Moschkovich, 2015). Engaging students in mathematical problem-solving demands much of teachers. For instance, to help inform instruction during problem-solving lessons, teachers should look for opportunities to elicit and use evidence of students' thinking (Davidson et al., 2019).

Minoritized and Economically Underserved Students Access to Problem-Solving

In the United States, problem-solving based instruction in mathematics has generally not been a priority at diverse schools attended largely by minoritized and economically underserved students such as MLs (Davis & Martin, 2008; Kitchen, 2020). Low academic expectations have historically been the norm at schools attended by minoritized and economically underserved students (Kitchen, 2020; Kitchen et al., 2021). It is also the case that teachers at these schools often do not have the content and pedagogical expertise needed to support the development of their students' mathematical reasoning (Kitchen et al., 2007). Moreover, teachers who work at these schools may not believe that their students can learn via demanding instructional formats such as problem-solving based instruction (Boaler, 2002). There also tends to be an emphasis at these schools on the instruction of procedures over meaning making and understanding (Davis & Martin, 2008). Students who attend schools with such traditional instructional emphases are inclined to develop the belief that they cannot learn mathematics or that mathematics is just not for them (Kitchen, 2003). When professional development activities were initiated at Martinez Elementary to inform the school's teachers about the DMP, it was apparent that teachers at the school were generally not implementing problem-solving based instruction with their minoritized and economically underserved students. The theoretical perspective and research methods used in the study are introduced next.

Socio-political Theoretical Perspective

Gutiérrez' (2013) framed the "socio-political turn" that has taken place in the mathematics education research community as the need to "transform mathematics education in ways that privilege more socially just practices" (p. 40). From a socio-political theoretical perspective, educational policies and practices are studied from the viewpoint that differential access to educational opportunities is grounded in differences based on racialized and classed experiences (Battey, 2013). In the United States, White and Asian middle class and upper-middle class students have historically had more opportunities to learn challenging mathematical content than

minoritized and economically underserved students (Schmidt & McKnight, 2012). A socio-political lens places the economic, social, cultural, and political contexts of teaching and learning in the foreground when considering phenomena such as whether minoritized students and economically underserved students such as MLs have access to rigorous mathematics instruction (Chirinda et al., 2022). A socio-political theoretical perspective was used in this study to examine the research participants' narratives vis-à-vis their experiences implementing the DMP with their minoritized and economically underserved students. It was also used to examine teachers' narratives regarding how their students responded to problem-solving based instruction in which the DMP was used.

Methods and Data Sources

Research strategies employed in narrative inquiry (Riessman, 1993) were used to solicit and examine Martinez Elementary teachers' narratives collected from focus group interviews conducted with them. The use of narrative inquiry is an intentional strategy used by social scientists to acknowledge the need to understand people's perspectives through their experiences (Pinnegar & Daynes, 2007). In this approach, I make use of stories told by the participants to make sense of underlying meanings that they communicated via their narratives (Riessman, 1993). Teachers' narratives were examined through a socio-political lens to understand teachers' perspectives. Using this lens, particular attention was paid to the teachers' narratives regarding educational opportunities afforded to them and to their students in mathematics.

Participants

All of the teachers at Martinez Elementary, not including instructional aides, were invited to participate in a focus group interview at the conclusion of the 2021-22 school year. Out of the 20 teachers at the school, 11 elected to participate in the focus group interview. Seven of the eight teachers whose narratives are featured here had taught for at least eight years. Five of these eight teachers had taught exclusively at Martinez Elementary or at a school in the town where Martinez Elementary is located. Thus, the narratives featured here are from teachers who had significant teaching experience at Martinez Elementary or the community it served. In addition, "Janine," "Angelo" and "Gabriel" (all teacher names used throughout are pseudonyms). had been recruited from their home country of the Philippines to teach at Martinez Elementary. At the time this study was undertaken, the school district in which Martinez Elementary is located recruited teachers from the Philippines to teach in the district because of teacher shortages they were experiencing. Similar to other teachers at Martinez Elementary, these three Filipino teachers had minimal experiences with problem-solving based instruction both as pre-tertiary students themselves and as teachers.

Data Collection

Semi-structured interviews were carried out via Zoom with participating teachers in April 2022. Four focus groups of teachers were interviewed, with each group consisting of 2-3 teachers from across the varying grade-levels found at the school (grades 4-6). Teachers were randomly placed in a group, though priority was given to having teachers from differing grade-levels in each group. Each interview was recorded and lasted between 60 and 75 minutes. Ten interview questions were asked, four with a pre-determined probe question (also known as a follow-up question). The following is an example of a question asked: "How helpful did you find following the four stages of Pólya's problem-solving heuristic during the problem-solving lessons?" A goal of the interviews was to engage participants in a conversation through the use of open-ended

questions that prompt the teachers "to construct answers," (Riessman, 1993, p. 54) in collaboration with the interviewer, a goal of narrative inquiry research.

Data Analysis

Participating teachers' narratives were examined through a socio-political lens. I analyzed the teachers' narratives using a thematic analysis approach in which the focus is more on what is said rather than on how it is told (Riessman, 1993). I engaged in an iterative process of examining themes that emerged across the interviews, reflecting upon, and then clarifying participants' views. With a thematic analysis, the goal is to first collect the stories, then to inductively group similar stories, and finally to select key narratives for illustration purposes (Riessman, 1993).

Results

Two major themes were identified related to teachers' experiences implementing the DMP during problem-solving lessons and what they learned from using it: (1) Participants experienced a paradigmatic shift implementing the DMP, and (2) Participants' instruction changed through their experiences implementing the DMP. One major theme was identified about how teachers characterized their students' experiences vis-à-vis problem-solving lessons in which the DMP was used: Students were empowered. I now share narratives for the two themes that address the first research question, followed by the theme found to address the second research question.

Paradigmatic Shift

Teachers shared in their narratives that learning how to implement the DMP during problem-solving lessons was a paradigm shift for them; many had not been trained about how to implement problem-solving based instruction. Jim shared how teaching problem-solving using the DMP as a guide meant moving away from instruction in which students are first shown how to compute or solve a problem:

> I struggled at first to implement the DMP. I definitely like struggled the first couple times even wrapping my head around what we were doing. It was a break from the I do, we do, you do together, you do alone, which was kind of the bedrock since I started teaching. And so, that was a hard shift at first for me to even grasp. And then, once I kind of saw how it worked, I started implementing it in any subject that I could.

Both Suzie and Gloria shared what a big change it was for them to teach problem-solving. Suzie said, "I think it was kind of different because of the way we've taught for so long." Gloria shared that,

> … even though it was math, it was almost like going in somewhere and someone speaking a foreign language, that's how we felt at first. It was completely changing a lot of the ways we had been told we have to teach, which ended up being a good thing, but at the front, it was kind of, you know, different.

From a socio-political perspective, these narratives reflect how teachers at Martinez Elementary had limited opportunities themselves to experience and learn about problem-solving based instruction in a teacher education program or through PD. However, as they continued to learn about the DMP and implement more tasks, they became more comfortable using problem-solved based instruction as their students adapted to their instruction.

Changed Instruction

Gloria talked about how the DMP PD sessions and support provided had empowered her as an instructor: "It was really empowering for me to know that we could give them that power and let them [the students] work through a problem, and I think that's what I took out of it the most." Alana described how she learned about the importance of giving students the space to struggle to solve problems, rather than focusing simply on covering content:

> It helped me slow down too as a teacher and think that sometimes it's okay for them [her students] to struggle, it's okay if my kids don't have standard algorithms. Let them solve it [the problem], and then we can always come back and talk about it, instead of what's the more efficient way achieving our goal, or whatever.

Alana also provided some insights about how using the DMP impacted her instruction:

> [I started to] really explain and make sure that they understood the task [a feature of the DMP], because sometimes I feel like we just give the task and say, 'Okay, you should know how to do this.' Also, making sure that they all have the vocabulary, the math register they need, was super helpful. And giving them the opportunity to solve it in any way they choose, because when we teach in class, it seems like we're teaching a certain skill or objective, and so we want them to do it this way. But these tasks gave them the opportunity to just use what they had, use their knowledge.

Through the DMP trainings, Jim learned about the value of constructing and using what he termed "bite-sized" questions: "Yeah, I'm now using bite-sized questions, that's what I'm going to call it." The second ETP in the DMP is posing purposeful questions, something that Jim admitted he rarely did in his mathematics lessons prior to learning about the DMP. Posing purposeful questions and prompts involves more than simply eliciting information from students; such questions invite students to explain and potentially justify their thinking (Davidson et al., 2019). Analogous to the previous section, from a socio-political perspective the teachers at Martinez Elementary had had limited opportunities to learn about problem-solving based instruction (Kitchen, 2020). For them, learning about asking purposeful questions during mathematics lessons was a transformational experience that promoted their students regularly sharing their mathematical ideas with them and their students in class. Moreover, there was a sense of empowerment among the teachers to improve their mathematics instruction because their abilities, confidence, and motivation had increased (Kitchen, 2020) through the use of the DMP.

Students Were Empowered

When reflecting upon his experiences implementing the DMP, Angelo discussed how his students had learned strategies that they could use to solve problems:

> We can again say that our kids really improved their mathematical thinking in attacking a word problem. [When you] compare how students did in the past with task number one with how they did with the last tasks, they now have the skills to attack problems. For me, as their teacher, it's [engaging in problem-solving] been effective for our kids.

Similarly for Suzie, she was pleased that her students were learning how to think through engaging more in mathematical problem-solving:

> I saw kids do things that I don't think I would have seen, like if we just gave the regular problems or whatever. You start seeing kids really thinking differently, you're seeing the kids

> open up and show how they do it, and then I feel like the kids start feeling more confident and trying different things, too.

Sara shared how the COVID-19 pandemic had negatively affected students' learning and how engaging students in problem-solving via the DMP had made a difference in terms of helping students have more confidence in mathematics: "I think it's starting to build that confidence in these kids. That's a great thing to see [after the damage caused by the pandemic]. Gloria described how the changes in her instruction changed how her students responded to mathematics:

> Instead of me just getting up there and rushing through the lesson and this is how you do it, hopefully you'll remember it [based on what I show you to do]. I thought that [solving problems] was a little bit more helpful for my students and they seem to enjoy it a lot more. And then that way, as I was walking around the room during [problem-solving lessons], I could just prompt here and there, asking students to explain to me what you're doing just like we did with the big math tasks that you did, they liked it. By the end of the year, every single kid, even my low math kids, they are all asking can I do it on the board. Can I show them how to do this. They gained so much confidence this year, compared to any other year.

Rather than showing students how to solve a problem, Gloria believed she was now able to empower her own students to solve challenging problems without providing lots of instructional scaffolds. Alana agreed with Gloria, and shared the following:

> [I found] giving them the opportunity to solve it in any way they choose [was also empowering for her and her students], because when we teach in class, it seems like you know we're teaching a certain skill or objective, and so we want them to do it this way. But these tasks gave them the opportunity to just use their knowledge. I loved how kids went up [in front of the class to the board] and there would be four or five different ways [that her students solved the task]. And the kids, I think, were really empowered by that, especially the lower kids, I mean the kid that maybe sat there and did repeated addition 25 times. Like they got it correct, and so the fact they got the chance to go up there, I think, was big.

Alana's narrative also highlights how some students at Martinez Elementary were not be mathematically challenged, but were being relegated to continually practicing math skills. Gabriel expressed satisfaction with the PD he had experienced during the year to learn about the DMP and how it had affected his students:

> It's been a thrilling experience for me as a teacher doing the DMP. For some kids, this [type of instruction] is new to them, and they will do almost all the tasks, they will almost do all the work. [They're used to] teachers just presenting at the board, giving examples. But this time [with the DMP], they get to think, find answers by themselves, and explain to their classmates. So, just what Angelo said, at first they were somewhat confused about what to do [to solve a problem], but as the time goes by, every time that we implement those tasks they are getting better now and getting the procedure, the process of the DMP and it has helped them a lot. We saw the great progress of our students, not only in presenting their ideas, but with how they solved problems and how they do that on their own. So, the growth of the students is so amazing, the jump of their thinking skills, the progress. And it's also shown in our [test] scores that students can now construct their sentences really well, express their ideas to their classmates. Overall, it has been an amazing experience.

As reflected in Gabriel's response, he believed that students' learning had progressed through the course of the academic year and that this growth was also demonstrated through improved scores on a mathematics assessment that the school district administered. Janine shared how her students' experiences during problem-solving lessons had progressed:

> The tasks we solved early in the year, they were like hesitant to answer. As time has gone by, they're used to it. Now, they want to solve [the tasks] and they like to share with their group. They really love it!

Discussion

Though the DMP is designed for use specifically with MLs, the teachers at Martinez Elementary used it during problem-solving lessons that they implemented with all their students, including their MLs, in all their mathematics classes on six occasions during the 2021-22 school year. Through learning about the DMP and how to use it during problem-solving lessons, the teachers became empowered to teach using new instructional strategies. The teachers expressed how much they learned from incorporating the DMP as a guide during problem-solving lessons and even how, in Alana's case, it had influenced her mathematics instruction in general. To change their instruction, teachers experienced a paradigmatic philosophical shift to come to value problem-solving based instruction. This shift resulted in teachers generally focusing less on showing students how to do mathematics. Instead, teachers were learning how to engage students in mathematics inquiry, something that many of them had never experienced as students themselves. From a socio-political perspective, the teachers' narratives help to illuminate the limited opportunities that they had prior to participating in the DMP trainings to experience and learn about problem-solving based instructional formats. Given that all but one of the teachers whose narratives were included here had significant teaching experience, it was the case that teachers at Martinez Elementary generally lacked experience with problem-solving based instruction. Teachers at Martinez Elementary were simply not well-acquainted with this type of instruction. According to the teachers, it was also the case that students at Martinez Elementary were empowered through their experiences in the problem-solving based lessons. Teachers talked about how students learned mathematics and new problem solving strategies from these lessons, enjoyed these lessons, wanted to share their new mathematical insights with their peers, and were mathematically empowered through their experiencing with this novel instructional approach. From a socio-political perspective, the diverse student population at Martinez Elementary had also rarely experienced problem-solving based instruction. According to the teachers, these experiences were transformational for some students, for others it was a welcome relief from the sort of skills-based mathematics instruction that they had encountered for years.

Given that teachers at schools primarily attended by minoritized and economically underserved students such as MLs in the United States may not believe that their students can learn via problem-solving based instruction (Boaler, 2002), it is important to introduce instructional protocols such as the DMP to support teachers at these schools to improve their instruction. While examples exist in the research literature of teachers who induct their students into problem-solving based learning environments (See, for example, Lampert, 2001), research is needed that provides practical insights about how to implement and sustain problem-solving based instruction in schools such as Martinez Elementary attended largely by minoritized and economically underserved students (Kitchen, 2020; Kitchen et al., 2021). This study contributes to this research area (See Boaler, 2011; Kitchen et al., 2009) by providing insights about how

teachers who had limited experiences with problem-based instruction who teach diverse students responded to using a problem-solving based instructional protocol. The teachers' narratives also demonstrate that teachers who have had little experience implementing problem-solving based instruction can, in fact, learn how to do so when consistent supports are provided to them to do so. Lastly, this study contributes to the research literature by providing evidence that minoritized and economically underserved students benefit from their teachers having significant supports to implement problem-solving based instruction in their mathematics classes.

References

Baird, A. S., Garrett, R., & August, D. (2020). Math and English language development: MELDing content and academic language for English learners. NABE Journal of Research and Practice, 10(1), 1-12. https://doi.org/10.1080/26390043.2019.1653051

Battey, D. (2013). Access to mathematics: A possessive investment in whiteness. Curriculum Inquiry, 43, 332–359. https://doi.org/10.1111/curi.12015

Boaler, J. (2002). Learning from teaching: Exploring the relationship between reform curriculum and equity. Journal for Research in Mathematics Education, 33(4), 239-58.

Boaler, J. (2011). Changing students' lives through the de-tracking of urban mathematics classrooms. Journal of Urban Mathematics Education, 4(1), 7–14.

Chirinda, B., Kitchen, R., Castellón, L. B., & Matute, K. (2022). Teaching mathematics in post-apartheid South Africa: The perspectives of teachers of Black students. Research in Mathematics Education. https://doi.org/10.1080/14794802.2021.2024086

Cho, S., Yang, J., & Mandracchia, M. (2015). Effects of the M3 curriculum on mathematics and English proficiency achievement of mathematically promising English language learners. Journal of Advanced Academics, 26(2), 112-142. https://doi.org/10.1177/1932202X15577205

Davidson, A., Herbert, S., & Bragg, L. A. (2019). Supporting elementary teachers' planning and assessing of mathematical reasoning. International Journal of Science and Mathematics Education, 17(6), 1151–1171. https://doi.org/10.1007/s10763-018-9904-0

Davis, J. & Martin, D. B., (2008). Racism, assessment, and instructional practices: Implications for mathematics teachers of African American students. Journal of Urban Mathematics Education, 1(1), 10-34.

Echevarría, J., Richard-Tutor, C., Canges, R., & Francis, D. (2011). Using the SIOP model to promote the acquisition of language and science concepts with English learners. Bilingual Research Journal, 34(3), 334–351.

Gamoran, A., Anderson, C. W., Quiroz, P. A., Secada, W. G., Williams, T., & Ashman, S. (2003). Transforming teaching in math and science. New York: Teachers College Press.

Gutiérrez, R. (2013). The sociopolitical turn in mathematics education. Journal for Research in Mathematics Education, 44(1), 37-68.

Herbel-Eisenmann, B. A., & Cirillo, M. (Eds.). (2009). Promoting purposeful discourse: Teacher research in mathematics classrooms. Reston, VA: National Council of Teachers of Mathematics.

Jeannotte, D., & Kieran, C. (2017). A conceptual model of mathematical reasoning for school mathematics. Educational Studies in Mathematics, 96(1), 1–16. https://doi.org/10.1007/s10649-017-9761-8

Kitchen, R. S. (2003). Getting real about mathematics education reform in high poverty communities. For the Learning of Mathematics, 23(3), 16-22.

Kitchen, R. (2020). The power of their ideas: Leveraging teachers' mathematical ideas in professional development. International Journal of Mathematical Education in Science and Technology. https://doi.org/10.1080/0020739X.2020.1847337

Kitchen, R., Castellón, L. B., Matute, K., & Mosqueda, E. (in review). Advancing an instructional framework for Emergent Bilinguals targeting mathematical reasoning and the language of mathematics. Mathematical Thinking and Learning.

Kitchen, R. S., DePree, J., Celedón-Pattichis, S. & Brinkerhoff, J. (2007). Mathematics education at highly effective schools that serve the poor: Strategies for change. Mahwah, NJ: Lawrence Erlbaum Associates.

Kitchen, R., Martinez-Archuleta, M., Gonzales, L., & Bicer, A. (2021). Actualizing change after experiencing significant mathematics PD: Hearing from teachers of colour about their practice and mathematical identities. Education Sciences, 11(11), 710. https://doi.org/10.3390/educsci11110710

Kitchen, R. S., Roy, F. C., Lee, O., & Secada, W. (2009). Comparing teachers' conceptions of mathematics education and student diversity at highly effective and typical elementary schools. Journal of Urban Mathematics Education, 2(1), 52-80.
Kong, J. E., & Swanson, H. L. (2019). The effects of a paraphrasing intervention on word problem-solving accuracy of English Learners at risk of mathematics disabilities. Learning Disability Quarterly, 42(2), 92-104. https://doi.org/10.1177/0731948718806659
Kooloos, C., Oolbekkink-Marchand, H., Kaenders, R., & Heckman, G. (2020). Orchestrating mathematical classroom discourse about various solution methods: Case study of a teacher's development. Journal für Mathematik-Didaktik, 41, 357-389. https://doi.org/10.1007/s13138-019-00150-2
Lampert, M. (2001). Teaching problems and the problems of teaching. Yale University Press.
Lee, O., Quinn, H., & Valdés, G. (2013). Science and language for English language learners in relation to next generation science standards and with implications for Common Core State Standards for English Language Arts and Mathematics. Educational Researcher, 42(4), 223-233. https://doi.org/10.3102/0013189X13480524
Luevano, C. & Collins, T. A. (2020) Culturally appropriate math problem-solving instruction with English language learners. School Psychology Review, 49(2), 144-160. https://doi.org/10.1080/2372966X.2020.1717243
Moschkovich, J. (2015). Academic literacy in mathematics for English learners. Journal of Mathematical Behavior, 40, 43-62. https://doi.org/10.1016/j.jmathb.2015.01.005
National Council of Teachers of Mathematics. (2014). Principles to actions: Ensuring mathematical success for all. Author.
Orosco, M. J., Swanson, H. L., O'Connor, R., & Lussier, C. (2011). The effects of dynamic strategic math on English language learners' word problem solving. The Journal of Special Education, 47(2), 96-107. https://doi.org/10.1177/0022466911416248
Pinnegar, S., & Daynes, J. (2007). Locating narrative inquiry historically. In D. J. Clandinin (Ed.), Handbook of narrative inquiry: Mapping a methodology (pp. 1–34). Thousand Oaks, CA: Sage.
Pólya, G. (1986). How to solve it: A new aspect of mathematical method. Princeton University Press. (Original work published in 1945)
Riessman, C. K. (1993). Narrative analysis. Newbury Park, CA: Sage Publications, Inc.
Schmidt, W. H., & McKnight, C. C. (2012). Inequality for all: The challenge of unequal opportunity in American schools. New York: Teachers College.
Short, D. J. (2017). How to integrate content and languge learning effectively for English language learners. Eurasia Journal of Mathematics Science and Technology Education, 13(7b), 4237-4260. https://doi.org/10.12973/eurasia.2017.00806a