Integrating Community Connections: The Development of a Teacher Candidate's Skills

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The Association of Mathematics Teachers Educators' (AMTE) *Standards for Preparing Teachers of Mathematics* (2017) states that well-prepared beginning teachers integrate "family/ community funds of knowledge into lesson design and implementation" (p. 24). Additionally, according to the National Council of Teachers of Mathematics (NCTM), responsiveness to students' backgrounds, experiences, cultural perspectives, and traditions helps to foster, support, and sustain a culture of access and equity (NCTM, 2014). In this article, I describe and reflect upon an example of how I supported an undergraduate secondary mathematics teacher candidate's (TC) planning and implementation of lessons that personally connected to her students. The example illustrates how, in general, mathematics teacher educators (MTEs) can support TCs in transforming naked (i.e., decontextualized) mathematics tasks into real-world mathematics tasks and real-world mathematics tasks into tasks with which their unique students feel *personally* connected. Francis Su writes that we can "[humanize] mathematics and math education… by shifting away from contextless portrayals of mathematics to reveal its social and cultural dimensions" (Su 2021, p. 11). Some instructional materials relegate real-world mathematics tasks to the end of the lesson. This may cause TCs to think real-world mathematics tasks are not a priority and can be excluded. If TCs are using naked mathematics tasks, MTEs can show them how, where, and why to find real-world mathematics tasks. After finding real-world mathematics tasks, MTEs can further support TCs in learning about their students and adapting real-world mathematics tasks to *personally* connect to their unique students.

Internship Expectations

During their final semester, TCs at my small, rural, public university in Mississippi enroll in a full-time *Directed Teaching* internship under the supervision and guidance of a 7-12 cooperating teacher and a university MTE supervisor. During their internship, TCs are responsible for planning and teaching lessons that address mathematics content and practice standards and are personally connected to their students (e.g., their communities, cultures, backgrounds, and/or interests). TCs have online and physical access to all state adopted high quality instructional materials (HQIM) (Mississippi Department of Education, 2021). The Mississippi Department of Education provides the Instructional Resources Center (IRC), located in our university library, with a copy of all current state-adopted textbooks. TCs also have access to a cloud-based shared drive with exemplar lesson plans written by prior TCs. Despite having access to these resources, TCs often require significant support in planning and teaching lessons that are personally connected to their students. Not all lessons in HQIMs include real-world connections, and when a lesson does not include real-world connections, TCs need to know how, where, and why to locate real-world connections. When the HQIM does include real-world connections, TCs may require support in modifying them so they specifically connect to their students.

Part 1: Learning About Students and Building Community

Emma, a white, cisgender, middle class, female TC completed her directed internship in an Algebra I classroom at a rural public high school. At the beginning of the school year, Emma established positive connections with her students' families by attending Back to School night and sending a letter home. In her letter, she presented an overview of the topics she would be teaching and asked if parents or guardians were interested in joining the class as a guest speaker to share how they use mathematics in their everyday lives or careers. Although no parents volunteered this semester, in previous semesters a pilot shared how he uses trigonometry, a real estate agent explained geometry applications, and a farmer, baseball coach, and medical equipment manufacturer each shared how they use statistics. In addition, Emma set out to create a classroom community where her students felt respected and safe. The students, Emma, and her cooperating teacher co-constructed norms for classroom participation. Emma asked her students to share information about their background experiences in mathematics, hobbies, and interests in an electronic survey. Emma saved this information in a spreadsheet, enabling her to reference it when making personal connections to her students while writing her lesson plans.

Part 2: Personally Connecting the Mathematics to Students

Over the course of the semester, Emma gradually began making personal connections to her students in her lessons. For my first formal observation, Emma wrote "None" in the Connections section of her lesson plan. The student learning outcomes for this lesson were to: (1) Identify even and odd functions; and (2) Justify orally and in writing why the function is even, odd, or neither (HSF-BF.B.3 & HSF-IF.C.8, National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). In our post-observation conference, I asked Emma why her lesson had no real-world or personal connections to her students. Emma responded that her lesson was based on a HQIM, specifically Illustrative Mathematics (IM), Algebra 2, Unit 5, Lesson 6, entitled *Symmetry in Equations* (IM, 2019). Emma pointed out that the HQIM had only naked mathematics tasks. I replied that although the specific lesson she referenced did not contain any real-world connections, the unit assessment, practice problems, and the modeling prompts in the IM HQIMs contained functions and graphs modeling many real-world situations, such as the symmetries in capital letters on a sign as well as changes over time in the height of a Ferris wheel, water in a tank and fountain, a student's heart rate, and the temperature. I asked Emma how she could have personally connected these to her students. Excitingly, she shared she could have had students track their own heart rates before, during, and after doing jumping jacks, graph the results, and justify if the graph was odd, even, or neither. I asked Emma if she thought her students would find the heart rate activity that she proposed engaging. She enthusiastically exclaimed, "Yes, and it would be a lot more fun for me too!"

For my second formal observation, Emma wrote "Students will explore the relationship between the gallons of water in a tank and the time in minutes as well as the relationship between the pounds of almonds and figs purchased and the dollar

amount spent" in the Connections section of her lesson plan. The student learning outcomes for the lesson were to: (1) Determine the slope and vertical intercept of the graphs of linear equations by making use of structure or by rearranging the equations; and (2) Convert equations from standard form, $Ax + By = C$, into slope-intercept form, $y = mx + b$ (HSA-CED.A.4 & HSA-REI.D.10, National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). Although these real-world tasks were in her lesson plan, Emma did not include them in her instruction. In our post-observation conference, Emma explained that she did not include the real-world tasks because she ran out of time. Emma's statement suggested that she still considered the real-world connections to be an optional add on and that she did not understand how or why to customize these real-world examples to personally connect to her students. I realized this was an opportunity for me to demonstrate the importance of making personal connections to students. I asked Emma to recall a time when one of her mathematics teachers personally connected the subject to her interests. Emma shared that her middle school mathematics teacher simulated a school store in her lesson on percentages. Then, I asked Emma to reflect on a time her teacher connected the mathematics to a real-world situation that she did personally find interesting. Emma described a Calculus lesson where she calculated the voltage and current through a capacitor. Finally, I asked her to recall a mathematics class that had no real-world connections. Emma exclaimed, "Most lessons!" I asked Emma how her engagement compared in these three scenarios. I believe that this discussion helped Emma realize the importance of including connections that her students personally relate to in her lessons. We ended our debrief session with some brainstorming of how she could modify the examples in the IM, Algebra 1, Unit 2, Lesson 11, entitled *Connecting Equations to Graphs* (IM, 2019) to specifically connect to her students. Emma decided that she could reference the local community pool instead of a water tank and locally produced snacks of pecans and cheese straws instead of almonds and figs.

I met with Emma the week before my third observation to assist her in brainstorming connections specific to her students. The student learning outcome for her lesson were to: (1) Create two-way tables based on information given in everyday language; (2) Calculate the total number of individuals in a group given a two-way table; and (3) Interpret values (orally and in writing) in two-way tables (HSS-ID.B.5, National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). Emma referenced IM, Algebra 1, Unit 3, Lesson 1, entitled *Two-way Tables* (IM, 2019), which involved students making two-way tables based on the following real-world data: (1) Whether students preferred writing with pens or pencils and on lined or unlined paper; (2) The wing and eye colors of fruit fly mutations; (3) The running times with or without music; (4) Whether students used floss or not and mouthwash or not; and (5) The age and existence of antlers on deer. Emma shared that based on her beginning of the year survey and conversations she had with students, examples 1, 3, 4, and 5 from the lesson directly connected to her students' interests. Therefore, only the fruit fly example needed to be replaced. I helped Emma write an additional survey on whether Emma's students attended the homecoming football game or not and whether they attended the homecoming dance or not. Emma facilitated each of these five tasks connected to her students' interests and the local community during

the lesson I observed. In her lesson reflection form, Emma commented that she noticed a dramatic improvement in her students' engagement and participation, which she attributed to the personalized connections she made to their interests.

Conclusion

For the remainder of the semester, I was pleased to see Emma continue to make personalized connections to her students' interests in each lesson she designed and implemented. In my 10 years of experience supervising TCs, I have found that without guidance and support TCs are unlikely to consistently connect the mathematics to their students' communities, cultures, backgrounds, and/or interests. To the TCs' credit, some lessons, even in HQIM, may only include naked mathematics tasks. In this situation, the MTE can demonstrate how, where, and why to find real-world connections. As MTEs, we can, and I argue should inspire our TCs to learn about their students and prioritize making personal connections to them in their mathematics lessons.

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