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Church Carnival
Creamery
Las Socias
Lavanderia
Library Late Fee

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Overview of Community Mathematics Exploration Module

Summary of Module:

This module consists of three activities: A community walk, the development of a mathematics lesson, and a final write up and reflection. PSTs typically work in pairs or small groups on the activities in this module. There are different versions of activities and several additional options included in this module.

Goals for Pre-service teachers:

- PSTs will increase their knowledge of students' out of school activities and practices, including the activities students engage in after school, and students' perspectives on their own communities (what community locations are familiar to students, etc).
- PSTs will engage in students' communities by visiting community locations, and as much as possible, dialoguing with children, families and community members about their home and community-based activity.
- PSTs will increase their knowledge and familiarity with students' communities, particularly of activities and practices that might relate to mathematics instruction, and in doing so, challenge deficit-based or stereotypical assumptions about students' communities. PSTs will begin to see children as members of communities, and see communities as including home and family based activity, as well as broader community relationships, contexts and activities.
- PSTs will broaden their perspectives and understandings of students' competencies (and the competencies of family members and community members), by recognizing ways that students see and use mathematics in the home and outside of school.
- PSTs will plan a problem solving based mathematics lesson or activity that draws upon knowledge and understanding of the practices, activities and resources of students' communities.

Summary of Activities:

In Activity 1: Community Walks, PSTs conduct one or more visits (including virtual visits) to the community surrounding their field-placement school. There are various options for these visits, depending on the particular circumstances of each methods site. These visits may involve posing and investigating a problem related to the community setting.

In Activity 2: Mathematics Lesson Development, PSTs draw on what they learned from the community visits to inform their instruction. Again, there are several options for how PSTs might think about the implications for instruction, from planning (but not necessarily teaching) a problem solving oriented lesson related to the community visits, to planning a problem solving task (or set of tasks) that are related to the community visits and that might form the basis of a mathematics lesson.

In Activity 3: Final Write up and Reflection, PSTs engage in a group discussion/debriefing of the project (which may include presentations of their lesson plans and/or problem posing activities), followed by an individual written reflection (to be completed in class as a quick write or out of class as a homework assignment).

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Timing of Activities:

The tables below reflect several different options for implementing the activities across multiple class sessions.

Option A: Activities conducted over 3-week period, mostly during class sessions

Week 1: Launch	Week 2: Visits and lesson planning	Week 3: Lesson presentations
<ul style="list-style-type: none"> • PSTs form school-based groups (3-4 PSTs per group) • PSTs share information from students about communities activities, familiar settings • PSTs select two community locations for visits, conduct visits and reflect 	<ul style="list-style-type: none"> • PSTs talk with students about visits, learn more about students experiences and practices • PSTs select one location for follow up visit, as needed • PSTs brainstorm and plan a mathematics lesson based on visits 	<ul style="list-style-type: none"> • PSTs prepare PPT presentation that reports on community visits, and learning about mathematics in the community. Presentations highlight tasks and lessons. • Presentations and reflection session in class.

Option B: Activities conducted over a 6-week period, mostly outside of class sessions

Week 1: Launch	Week 5: Check In	Week 6: Lesson Presentations
<ul style="list-style-type: none"> • Instructor introduces assignment • Shows pictures and review assignment requirements including group and individual products. 	<ul style="list-style-type: none"> • Check in with PSTs about progress on community walk and lesson planning progress. • Show exemplar lesson “Las Socias” with specific attention to launch, use of L1, and rationale for number choice. 	<ul style="list-style-type: none"> • Groups make 7 minute presentation of CME Lesson with highlights from their walk and • Presentations are embedded in a session devoted to culturally responsive pedagogy

When time is limited (either in-class time, or out-of-class time), we have found that productive adaptations include:

- replacing the final reflection paper with an in-class quick write followed by a group discussion;
- encouraging students to visit community locations on their own, outside of class time (days when schools are closed and preservice teachers are not spending time in field work have worked well);
- replacing the full lesson plan development with an in-class work session in which preservice teachers brainstorm ways they might build on what they learned in their community walk in their math teaching;

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- combining the community mathematics walk with other community engagement experiences (in this instance, it is critical that preservice teachers focus specifically on *mathematical* practices in the community, as part of their broader community exploration)

Minimally, all teachers need to engage in some sort of community walk, reflect on what they learned in the walk and how they can draw on these new understandings and connections in their mathematics teaching.

Connections to other modules:

MC Module Connections:

This module can connect to an activity from another module, the “Getting to Know You” interview in the MC Module (Activity 1). In this activity, PSTs conduct an informal interview with a student or students in their field placement classroom to gather information about the children’s home and community experiences, the children’s knowledge of the community, and the children’s ideas about the use of / relevance of math in their community.

CMP Module Connections:

This module also connects to the analysis lenses used in the video lens activity in the Community Practices Module. More specifically, the instructor can use ideas and prompts from the various lenses to draw PSTs attention to particular aspects of sample CME lessons. For example, when PSTs review the Las Socias CME lesson, the *Power and Participation Lens* help PSTs to notice ways that teachers planned for various kinds of participation and included specific moves to address potential status issues.

Connections to other Big Ideas in mathematics methods courses:

The CME module connects to key concepts in mathematics methods courses, such as building on children’s thinking in instruction, and connecting to students’ experiences outside of school. As PSTs prepare a mathematics lesson plan based on what they learned from their community visits, they are explicitly probed to consider what they know about children’s mathematical thinking, AND what they know about children’s experiences in the community, including ways that children (or children’s family members or community members) might engage in mathematics outside of school.

Connections to Teaching Math for Social Justice:

PSTs are also encouraged to explore issues of fairness and social justice in the CME Module. For example, instructors might ask PSTs to talk with families, teachers, children and community members to identify important issues and challenges in the community, including issues of inequity or injustice. In our experience, PSTs have written lessons that explored issues such as a) the mathematics of a neighborhood payday loan establishment; b) the cost to replace a cement running track at a community park with a tartan (rubber) track that would be more supportive of runner’s joints; c) cost of prescriptions at a neighborhood pharmacy for families without insurance; d) excessive water use a construction site near the elementary school; e) equitable/inequitable placement of fire stations in the city; f) adding a safety fence around a community park that is surrounded by major roads with high levels of traffic; among others.

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These lessons have often focused on using mathematics as a tool to investigate, analyze, and better understand the issue, including important inequities or injustices. We have found that conversations with children and adults in the community have been essential to this process – particularly in the cases where PSTs are outsiders themselves to the school/neighborhood community, dialogues with community members have been critical to enhancing PSTs awareness of key issues and challenges.

Connections to EdTPA

The Education Teacher Performance Assessment (EdTPA) is a high stakes performance-based assessment used by several states to grant licensure (Pearson, 2014). An important component of the EdTPA requires PST to show evidence of how the mathematical focus of the lesson segment (a 3-5 lesson sequence) connects to “Personal/Cultural/Community assets.” A guiding question of the planning commentary specifically asks, “What do you know about your students’ everyday experiences, cultural backgrounds and interests?” (Pearson, 2014, p. 13). The community math exploration provides an explicit opportunity to create a mathematical lesson/task grounded in what the PSTs learn about their students and communities.

ACTIVITY 1: Community Walk

Goals for Community Walk Activity

- PSTs will engage in students' communities by visiting community locations, and as much as possible, dialoguing with children, families and community members about their home and community-based activity.
- PSTs will increase their knowledge and familiarity with students' communities, particularly of activities and practices that might relate to mathematics instruction, and in doing so, challenge deficit-based or stereotypical assumptions about students' communities. PSTs will begin to see children as members of communities, and see communities as including home and family based activity, as well as broader community relationships, contexts and activities.
- PSTs will increase their knowledge of students' out of school activities and practices, including the activities students engage in after school, and students' perspectives on their own communities (what community locations are familiar to students, etc).
- PSTs will broaden their perspectives and understandings of students' competencies (and the competencies of family members and community members), by recognizing ways that students see and use mathematics in the home and outside of school.

Description of Community Walk

In Activity 1: Community Walk, PSTs conduct one or more visits (including virtual visits) to the community surrounding their field-placement school. There are various options for these visits, depending on the particular circumstances of each methods site. These visits may involve posing and investigating a problem related to the community setting.

Version A. Community Walk Guided by Child and/or Family Member. In this version of the activity, PSTs accompany a child (or a member of a student's family) on a real or "virtual" walk of the child's community. This might involve walking with the child home from school, or riding the bus with the child to or from school. During the walk/ride, the PST dialogues with the child about locations and/or activities in the community. In instances when accompanying a child on a walk through his/her community is not possible, PSTs can conduct a virtual, child-guided community walk. One option for a virtual community walk is that the PST can ask the child to take photographs of his/her community and bring them to school. The PST can then discuss the photographs with the student. The goal of the community walk is to learn what the student/s know (or what a member of a student's family knows) of their neighborhood so that PSTs are able to incorporate this knowledge into a lesson they will develop. It is an opportunity for the elementary school student to show the PSTs interesting things in the neighborhood that can serve as resources for their lesson planning.

Version B. Community Visit(s) in small groups with other Pre-Service Teachers. In this version of the activity, PSTs (often working in small groups) conduct one or more visits to various locations in the community surrounding the school. Choice of location may be informed by the "Getting to Know You" Interviews that PSTs have conducted with students in their field-placement classrooms during the Math Learning Case Study Module, and/or by the "Focus

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Group” Interviews that are an option in the launch portion of this activity (see below for more info about the Focus Group Interview). Locations might include: parks, stores, businesses, cultural centers, community health centers, banks, professional offices, construction sites, police or fire stations, factories or processing plants, corner stores, restaurants, bakeries, etc. Each group should visit at least two locations, and if possible, should conduct multiple visits.

Lesson Outline for Community Walk

LAUNCH

Preparation may vary according to the version of the activity (see Version A and Version B above). What follows are general notes that apply to both versions. Additional specific preparation may be needed for some versions (i.e., if PSTs are going to give cameras to students and ask them to take pictures of their community, guidelines for distributing cameras, talking with children about the kind of pictures they should take and not take, for example, should be discussed.)

Engage the PSTs in a discussion about their current knowledge of the community (and the community’s practices that are mathematical) in which they are conducting their field observation / student teaching and about their thoughts about how the community might be a resource for students’ mathematics learning. A list of sample questions follow.

- What do you know about the everyday experiences of the students with whom you work?
- Do you know of *specific* resources in your students’ communities that you could use as resources in your teaching? If so, what are they?
- How might teachers find out about these resources in students’ everyday lives?
- What activities in the community of your students could you imagine being the basis for a mathematical project?
- What do you know about the resources in students’ communities?
- What businesses, parks, community centers, and other locations seem to be important and central to the life of the community? What kinds of things do students, family members, and community members do in these places? What kind of mathematical activity occurs in these places?
- What are your ideas about other mathematical knowledge, practices or activities that you might find in students’ homes and communities?

Instruct PSTs that they should refrain from making judgments about the neighborhood. The goal of the community walk/community visits is to learn from the community itself. It is an opportunity for PSTs to identify mathematical resources for lesson planning and for building relationships with students. Let PSTs know that the community walk is also a time for them to confront stereotypes or assumptions they may have had.

There are two optional activities that could occur during the LAUNCH portion of the Community Walk activity.

Optional Launch Activity: Focus Group Interview

In this optional activity, PSTs gather a small group of students from their field experience classroom (or a classmate’s classroom) to interview. This small group may include the PST’s

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case study student, from the MC Module. The questions posed to the group should be the same questions used in the MC “Getting to Know You” interview. (See interview protocol.) The goal is to learn more about the students’ experiences in the community as well as the community locations and activities that are familiar to students and their families. The interview also explores students’ views on the mathematical activity that goes on in their homes and communities. The purpose of this optional focus group is to inform PSTs choice of a community location (i.e., the interview may help them to chose a location that is familiar to their students), and to provide PSTs’ with insights about students’ experiences in that location. (For additional details about this option, refer to the Focus Group Handout in the Tools and Handouts section of the module.)

Optional Launch Activity: Involve Students and/or Families in the Planning of the Walk

In this optional activity, PSTs gather a small group of students (and/or family members/ or community members) and invite students’ help to plan the walk. Students can suggest places that the PSTs should visit, routes that they should take, and people that they should talk to during the visits. PST might have a large map of the neighborhood available to help students identify locations and suggest routes.

Optional Launch Activity: Practice Community Walk with Course Instructor

When mathematics methods courses are taught on university campuses (as opposed to on-site in elementary schools) instructors might conduct a practice community walk with PSTs, making observations about activities and practices, including mathematical practices, and talking with PSTs about what they notice and how they are interpreting what they notice. This “practice” community might may support PSTs in the kind of noticing and interpreting that they are expected to do when they visit sites in the community surrounding their field placement school.

EXPLORE

During the visits, PSTs should LOOK for and DOCUMENT evidence of mathematics. This could include: people using mathematics, mathematical concepts or principles “in action”, mathematical relationships, quantities, figures, etc. In addition, PSTs should, talk to individuals who work/play/shop in the setting about how they use mathematics, and when possible, take pictures and/or collect artifacts to document evidence of mathematical activity. We have identified the conversations with community members who work, play, visit, and/or make use of these community locations to be a key part of this activity. PSTs should be discouraged from simply mathematizing something they see on a sign or in a store without also dialoguing with someone in the community about the math that they use, the problems that come up as part of their daily work/activity, etc. The goal here is for PSTs to recognize mathematical practices in children’s communities – this includes mathematical practices of *adults* in the setting (e.g., store owners, employees, parents who frequent the location) and mathematical practices of *children* in the setting (e.g., the children themselves, siblings, cousins, etc.). If possible, PSTs can also take pictures and note how each picture evidences mathematics. Finally, PSTs should take note of things in the neighborhood or school that they hadn’t noticed before or that surprised them.

There are several optional activities that could occur during the EXPLORE portion of the Community Walk activity.

Optional Explore Activity: Follow-up Focus Group Interview

Following the PSTs community walk/visits, PSTs gather students from their focus group a second time. During this conversation, PSTs show students photographs and artifacts from their community visits and have students tell them more about what they see and do at these places, including any potential mathematical activity. The goal is to use the collected artifacts to elicit students' ideas, knowledge and perspectives on particular places and activities in their community. (For additional details about this option, refer to the Focus Group Handout in the Tools and Handouts section of the module)

Optional Explore Activity: In-depth interview with Community Member.

In this optional activity, PSTs conduct in-depth interviews with one or more members of the communities of their students to find out more about community assets, resources, and funds of knowledge. This community member could, but does not have to be a parent, or another member of a student's family. During the interview, PSTs inquire about community leaders, community organizations, important community activities, community resources and assets (libraries, health centers, churches, etc.), forms of communication in the community (newspaper, radio, etc.), community events and traditions, and important community businesses. PSTs then consider how they might draw on what they have learned about the community to inform their mathematics instruction.

Optional Explore Activity: Additional Visits and Extended Problem Posing

After the initial visit, each group might generate one or more questions that their visit to the community location raised (stated as a question, not as a topic to investigate), and the mathematical ideas/concepts that would help them to answer the question(s). PST should try and generate questions that “matter” – in other words, these should be questions that they or someone else in the school or community would actually want answered. They might consider questions that involve comparisons of some kind, or questions that relate to issues of equity and/or fairness. Also, PSTs should make sure that their questions are ones that could be answered using mathematics. The purpose of this extended problem posing activity is two-fold. First, it provides PSTs will additional opportunities to investigate and learn about a specific location in the community. Second, it allows PSTs to experience first-hand what it means to pose a problem and to use mathematics to investigate that problem. One goal is that PSTs might engage their own students in similar community-based problem posing activities, and the opportunity to pose and investigate problems themselves might support their ability to enact a similar activity in their own classrooms.

To support this extended problem posing, PSTs should conduct additional visits to their community location(s) so that they can collect relevant data to help them answer the question(s) they posed. This might be data that is immediately evident (the price of an item; the cost of gasoline, the number of tickets required to earn certain prizes), or data that they need to generate (they can measure distances, take temperatures, keep track of time, look at menus, record examples of shapes, keep track of people who visit an establishment or cars that drive by, or the items that people order, etc.). At this point, PST are highly encouraged to talk to people at the site to assist them in generating the data that they need. They can also gather data from other sources (e.g. the internet, phone calls).

SUMMARIZE

Following the community visits, conduct whole or small group discussions to support PSTs in reflecting on their experiences.

For example, PSTs might meet in small groups to debrief the community walk /community visit experiences. Group might be formed according to field placement school, according to the version of the activity that PSTs selected (did they conduct an actual walk with a child or a virtual walk) or groups might be constituted to reflect a range of school/community contexts and/or activity options (i.e., the PSTs that conducted virtual walks might benefit from talking with peers who conducted actual walks guided by students or family members).

Sample questions for small or whole group discussions follow.

- What did you learn about the community that you didn't already know? What did you learn about the community that surprised you?
- What did you learn about the knowledge, expertise, practices and/or resources of the particular community that you visited?
- What examples of *mathematical* knowledge and practices did you identify during your community visit? Who was involved in these mathematical practices? (Children? Adults? Employees? Families?) If you conducted your community walk with your student, were these practices apparent to your student?
- What did you learn about the student's knowledge of the community? What aspects of the community seemed most relevant or salient to your student? What aspects of the community did your student not mention?
- What did you learn from your conversations with community members (including parents and/or other family members) about their work and practices? How do community members frame the role of mathematics in their work and daily activity?

As a bridge to Activity 2: Math Lesson Design, you might also conduct a discussion in which PSTs brainstorm how they might draw upon what they learned in their community walk in their mathematics teaching. Sample whole group discussion prompts follow.

- How might you use the knowledge and understandings that you gained from the community walk / community visits to inform your mathematics instruction?
- Brainstorm ways that you could build upon / draw upon your knowledge about the mathematical funds of knowledge of students communities in a math lesson. Try to generate specific lesson ideas. As you are brainstorming ideas, consider the math content of the lesson, how the lesson builds on what you know about children's mathematical thinking, and the connections to community knowledge and practices.

There is an optional activity that could occur during the SUMMARY portion of the Community Walk activity.

Optional Summarize Activity: Sharing with Peers about Visits

After the community visits, each group of PSTs might prepare a series of power point slides that showcase some of the photos that they took at their community location. Each slide could

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contain 1 photo (or 2 related photos), and the mathematical ideas or principals that are evident in the photo. Additionally, another way that PSTs might share what they learned about community mathematics is by creating visual representations. PSTs might use graphs, tables, charts, or diagrams to communicate what they learned about a particular community location to others.

INSTRUCTOR REFLECTION QUESTIONS:

- What do PSTs notice / focus on in students' communities? What seems to be most salient to them?
- What aspect of this assignment seemed most useful – in other words, what was it that really helped PSTs to start to recognize and highlight the mathematical knowledge and practices of students' communities/?
- What are PSTs ideas for designing or adapting their math lessons based on their enhanced knowledge of students' communities? What kinds of connections (connections between home and community mathematical funds of knowledge and school math lessons) seem most obvious or reasonable to PSTs?
- What resistance do PSTs exhibit, if any, towards connecting to students' home and community-based mathematical funds of knowledge in their instruction?
- How did you, as the instructor, respond to that resistance?

Ideas from Teach Math on Community Walk

Choice of Location

It is not essential that PSTs visit locations that were mentioned by children and/or are familiar to children. While we have found visits to familiar places to be fruitful, we also want to push PSTs to go beyond making connections to children's interests (i.e., writing a lesson about buying ice cream because PSTs know that students like going to the local creamery) and to instead start to notice how different people in the community use/do mathematics as part of their daily activity.

Ways to Support PSTs in Gaining Access

We have found that connections with families and community members, and school-community liaisons have played an important role in helping PSTs to gain access to community sites. When community insiders are able to accompany PSTs on the community visits, they are able to provide PSTs not only with entrance to community settings, but to a deeper understanding of the practices and activities. In addition, in instances when successive groups of PSTs conduct their field experience in the same school(s)/communities, we have found that we develop relationships with community businesses and centers, and that they come to anticipate (and welcome) the arrival of our PSTs. When PSTs are visiting a community site for the first time, we have sent them with letters from the course instructor that explain the purpose of the community visits, and the broader goals and context of the Community Mathematics Exploration Module.

Importance of Walking during Community Visits

We have found that when PSTs are able to walk during the community visits, the slowed pace of walking (as compared to driving) helps them to attend to aspects of the community that they had not previously noticed. When possible, we have organized PSTs to walk down streets, to walk to community hubs, to walk from one location to the next, and to reflect on what they notice during these visits.

Importance of Moving Beyond School and into Community

In some instances, PSTs have been reluctant to conduct community visits and have instead opted to conduct walks around the school grounds, talking with students, staff and visitors about activities and identifying mathematical practices. They sometimes justify this decision with pragmatic reasons such as the fact that time is limited and that travelling beyond the school grounds is not a viable option, or that school walks, as compared to community walks, are an activity that they could easily conduct with their own students (i.e., no transportation required). While we see learning about the school community as valuable and supportive of PSTs' practice, we do not view school explorations as a substitute for experiences in the community outside of the school. In the instances when PSTs have expressed a reluctance to leave the school grounds, we have tried to scaffold the community walk in numerous ways (e.g., pairing the PST with a peer who is an insider to the community; asking parents or school-community liaisons to accompany the PSTs, etc).

Importance of Talking to Families and Community Members Before and During Walks

We have also found that it is essential for PSTs to interact with families and community members during the visits. This requires some preparation, as PSTs need to think about the kinds of questions that they may want to ask people that they meet during their visits, as well as how they will talk about/explain the purpose of their visits to business owners, patrons, families and others. We have found that interactions with community members are critical to PSTs' understandings about the community, and that they help to challenge PSTs' assumptions.

In addition, schools may serve more than one specialized demographic group or community (e.g. military; new immigrant community). The community walk can be a vehicle to better understand a specific cultural/demographic community served by the school. The point is that PSTs should not feel limited to a location(s) visited by a majority of students (e.g. the mall; movie theatre). PSTs can also focus on a specific community and engage in discussions with families/community members in those specific communities.

Supporting/Scaffolding PSTs Work and Providing Examples

With respect to the choice of location and the development of a lesson, one tension we have experienced was how much to support students and provide ideas, versus letting them come up with the ideas, and when to provide those ideas (e.g., before or after visits, before or after they brainstorm lesson plan ideas).

While sharing ideas for possible visits/lessons at the beginning of the activity provides PSTs with examples of what they might explore, we have found that this sometimes lead to PSTs who start to plan their lessons BEFORE going into the community and observing, interacting and talking with community members. As a result, some of us have decided to wait to share examples until AFTER the initial community visit. Others share examples of places in the community that other PSTs have visited in the past, with photos from those locations, just to give PSTs an idea of the range of locations that might be possible.

Time for Sharing/Reflecting on Experiences

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While whole group sharing sessions take time, we have found them to be quite useful. For example, several of us have found that asking PSTs to make a short power-point that showcases what they have learned from their community visits helps broaden all PSTs understandings and awareness about the community. Others have noticed that asking PSTs to select photos to share deepened the whole group conversations, as PSTs thought carefully about what they wanted to share with their classmates, and about the specifics of the community location that they wanted to highlight.

Another option is using small groups for discussion and debriefing. One option is to form groups of PSTs who are participated in different community walks – so that they could hear about other places and experiences. We have found that these discussions go quite well, and that they provide a space for PSTs to share with others outside their group about their experiences, emotions and learning during the community walk. For example, PSTs have shared about how they felt uncomfortable as a “minority” (both language and cultural) in specific community locations – and how they were amazed by the different practices they observed that involved mathematics. PSTs have also commented on how beneficial it was to have fellow PSTs who were familiar with the community in their group (e.g., PSTs who were bilingual and could interact with community members in Spanish or English).

Ways to challenge stereotypes or deficit-based ideas about communities

The CME gives PSTs an opportunity to explore mathematical activities and practices of the communities in which their students and families live. This can be both exciting and disorienting for PSTs. We have found different opportunities during the CME activities to challenge stereotypes or deficit-based ideas about communities, families, and students. Depending on your implementation, opportunities to challenge deficit-based views arise during in-class debriefing activities as well as giving feedback on written submissions such as group commentaries or individual reflections. For example, in an in-class activity when PSTs discuss the data (e.g. pictures, images, fieldnotes) taken of their visit to generate task/lesson ideas, PSTs may voice stereotypes about the community (e.g. trash in yards; safety issues) or “surprises” that suggest deficit views such as “I was surprised at how clean the business was”; “there were so many of our families at the library, this surprised me given the test scores; or “I was surprised that the owner/family member could speak English so well.” The MTE can listen and strategically interject ideas that focus on the strengths of the community embedded in the such comments as well as ask for more elaboration on such comments to help PST be more aware of deficit views being expressed. If the PSTs have an opportunity to share their interpretations as well as ideas for math tasks to the whole class, other students and MTEs can challenge deficit views if they arise. In addition, the MTE can provide explicit feedback on group commentaries and individual reflections by asking specific questions “why does this surprise you?” or “What stereotype does your comment connect to or challenge about this community?”

Involving Families or Community Members in Community Walk Debriefs

Related to the point above, one way to support PSTs in thoughtful reflection on their experiences in the community is to invite families and community members to participate not only in the community walks, but in the debrief discussions. PSTs are often unclear about how to interpret or make sense of the activities that they observe (or don’t observe) during their community visits, and opportunities to dialogue with community insiders can enhance their understandings.

Handout CME 1
ACTIVITY 1: COMMUNITY MATHEMATICS VISITS
[PST handout]

PURPOSE: To deepen your knowledge about math teaching, your students, and the local community (ies) that your school serves by closely examining and documenting mathematical resources that can be used for math lesson planning purposes.

PRIMARY GOALS:

- 1) To increase your knowledge of students' communities, including the knowledge and expertise of community members.
- 2) Reflect on what you learned about the community as a mathematical resource and how it might support your mathematics instruction.

GROUPS: PSTs complete this assignment in groups of 2-4.

ASSIGNMENT:

A. Visit one or more locations in the community. You might visit locations in the community surrounding your field experience school. Or, if the students attending the school live in a different community, you might visit a location in the children's community. Whenever possible, walk (versus drive) around the community. Also, we recommend selecting locations that are familiar to students (i.e., locations you learned about from your case study student, places that you know are familiar to children in your field experience classroom, places that draw many families in the community, social hubs). Finally, consider inviting a parent or community member to serve as a "guide" for your community walk.

During your visits, **Look For And Document Evidence of Mathematics.** This could include: people using mathematics, mathematical concepts or principles "in action," mathematical relationships, quantities, figures, etc. **Talk to individuals** who work/play/shop in the setting about how they use mathematics. Take/draw pictures and field notes. Identify how each picture or experience you document provides evidence of mathematics. Pay attention to any mathematical practices you notice - this includes mathematical practices of *adults* in the setting (e.g., store owners, employees, parents who frequent the location) and mathematical practices of *children* in the setting (e.g., students, siblings, cousins, etc). Finally, take note of things in the neighborhood that you hadn't noticed before or that surprise you.

During your visit, refrain from making judgments about the neighborhood. The goal of the community visits is to learn from the community itself. It is an opportunity for you to identify resources for your lesson planning and for building relationships with community members. It is also a time for you to confront stereotypes or assumptions you may have had.

B. Formulate A Series of Questions And Data Sources about the context that could be *mathematized*. Start by reviewing the pictures and notes that you took, and brainstorming a list of possible questions and data sources. Try to generate questions that "matter" – in other words,

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these should be questions that you, students, or someone else in the school or community would actually want answered. You might consider questions that involve comparisons of some kind, or questions that relate to issues of equity and/or fairness. Also, make sure that your questions can be answered using mathematics.

Consider the data, as evidenced in your photos and/or fieldnotes that could be gathered to answer your questions. This might be data that is immediately evident in the context (the price of an item; the cost of gasoline, the number of tickets required to earn certain prizes), or data that you need to generate (you can measure distances, take temperatures, keep track of time, look at menus, record examples of shapes, keep track of people who visit an establishment or cars that drive by, or the items that people order, etc.). Data collection may also involve talking to people at the site (interviewing employees, etc.) and/or gathering data from other sources (e.g., the internet, phone calls).

C is an additional option, if PSTs are talking about community visits with children in their field experience classroom after the visits.

C. Talk With Students In Your Field Experience Class About Your Community Visits.

Show your students your photographs and artifacts from your community visits and have them tell you what they know about these places, and if relevant what they (or their family members) do at these places (including what they or their families might be do that involves mathematics). You will be amazed at how much more they will share with your photos in hand! If possible, have your group member(s) present when you share to help take notes on students' comments, reactions, ideas, etc.

D is another additional option, if PSTs are preparing a group presentation about their community walk.

D. Organize Your Information To Share With Others. Gather all the information and/or artifacts that you gathered during your "visit" and any other relevant data that might help you answer your question. Meet in your groups to discuss how you can represent your information (stories, pictures, graph, table, chart, diagram, photos, etc) to communicate what you learned to others. You might use Microsoft EXCEL (or another similar program) to represent the data. You might consider what each representation shows and what additional questions it raises. In a powerpoint (or other presentation), present the mathematics question(s) and summarize data collected (including example photos, photos of artifacts that you collected, etc) that document the mathematics practices evidenced in your community walk.

ACTIVITY 1 ADDITIONAL OPTIONS
Focus Group Interview And Follow Up Discussions
[Instructor Guidelines]

Part 1: Focus Group Interview

LAUNCH

Introduction to / Preparation for the Focus Group Interview:

Before PSTs conduct the interview, discuss the choice of children to interview, and the affordances / constraints of interviewing children individually or in pairs/small groups. Interviewing children individually allows the PSTs to probe more about each child's perspectives and experiences, and individual interviews may work particularly well for students who participate less and/or are reluctant to share in group settings. Small group interviews on the other hand can generate more ideas, as children build off of one another's comments. When possible, encourage PSTs to audiotape the interviews (with appropriate permissions). When audiotaping is not possible, PSTs should be instructed to take detailed notes during the interview, and to expand those notes as soon as possible after the interview.

Finally, review the interview prompts with PSTs (prompts are the same prompts used for the "Getting to Know You" interview in the Math Learning Case Study Module). Discuss how to probe for specific examples, and how to follow up with additional questions. (i.e., "can you think of how your mom uses math? When do you see her doing math? ... "Can you think of anywhere else that you go with your family? What else do you do there? What kinds of things do other people do there?")

In Class Discussion of the Focus Group Interview:

Small group discussion:

Have PSTs meet in small groups to discuss what they learned from their interview. PSTs might be grouped according to school (all the PSTs that are working in classrooms at the same or neighboring elementary schools form a group). Alternatively, each group could include PSTs that are placed at a broad range of schools (suburban schools, urban schools, schools with high numbers of English learners, etc.). Prompts for small group discussion follow.

- Describe what you learned from your interview(s) with students.
- What surprised you? How did what you learned from your student about his/her home and community experiences compared with your previous ideas about your student and/or his or her community?
- How did the interview inform your understanding of the mathematical, social, cultural, or linguistic knowledge and resources in students' homes and communities?
- Share specific examples of knowledge, practices, or activities that occur in students' homes or communities that you think (and/or that your student thinks) involves mathematics.
- How did your own perceptions of the mathematics involved in community activities and locations compare do your student's perceptions? Did you see mathematical connections that were not apparent to your student? Why do you think that might be?
- How might you be able to draw on or connect to some of what you learned from your interview in your mathematics instruction? Generate several specific examples.

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- What might be the purpose of drawing on students' home and community-based funds of mathematical knowledge in your mathematics instruction?
- What might be the impact?

Whole group discussion:

Follow the small group discussions with a whole group discussion. Ask each group to be ready to share 1-2 key insights that they gained from their interviews and their ideas about how they might use those key insights to inform their math instruction. Encourage PSTs to be as specific as possible during the whole group discussion (i.e., specific examples of what they learned and how they might use it). Any of the prompts listed as small group discussion prompts could also be used to guide the whole group discussion.

Part II: Follow Up Discussion With Focus Group (Explore)

Following the PSTs community walk/visits, PSTs gather the students in their focus group a second time. During this conversation, they show students photographs and artifacts from their community visits and have students tell them more about what they see and do at these places, including any potential mathematical activity. The purpose of this follow up conversation is for PSTs to enhance their knowledge of the children and their competencies, by providing children the opportunity to share knowledge of their communities and of the activity that occurs in their communities.

Part III: PST written report on Group Interview and Follow-up Discussions (Summary)

[based on activity developed by Amy Roth McDuffie]

PSTs might complete an individual written summary of what they learned during the focus group interview and discussions and how they might use what they learned to inform their mathematics instruction.

ACTIVITY #2: Mathematics Lesson/Tasks Development

Goals for Pre-service Teachers

- PSTs will plan a problem solving based mathematics lesson or activity that draws upon knowledge and understanding of the practices, activities and resources of students' communities.

Description of Mathematics Lesson/Tasks Development

The purpose of this activity is to support PSTs to design a problem-based task or lesson that connects to the Community Math Exploration (Activity 1). This activity is done once as part of the CME module. However, it can also be an additional context to practice lesson planning/task design. The lesson/task design is an important product of this module. It is also used as part of the final reflection commentary and optional presentations (Activity 3).

In groups in the methods class, PSTs will develop a lesson (or a set of mathematical tasks) incorporating knowledge they have gained about students' communities from community visits (Activity 1). The lesson (or tasks) should be problem solving based, and should include opportunities for students to investigate/solve problems that are related to a particular community context. It is critical that the lesson (or set of tasks) draw on community contexts, practices, issues or activities to help students to deepen their understanding of a specific math concept. In other words, the lesson must have a specific and significant math focus AND be connected to authentic practices/contexts observed and discussed in the community math exploration. The lesson (or set of tasks) should indicate that PSTs are drawing on what they know about children's mathematical thinking in a particular domain. Additionally, the lesson (or set of tasks) might include opportunities for students to use mathematics to investigate an issue of equity or justice in the community, and/or the lesson might include having students do a similar activity (e.g. conducting their own community walk).

Lesson Outline for Mathematics Lesson/Task Design

Version A: Mathematics Lesson Plan Development

PSTs create a standards-based lesson based on what they learned (e.g. photographs; interviews with families/workers; observations of math practices) from their community math exploration (activity #1).

The lesson design can be done outside of class or included as part of in-class activity work time. In-class time can be devoted to analyzing exemplar CME Lessons and/or brainstorming mathematical questions and possible problem-based tasks to include in the lesson. PSTs should use a common lesson plan template for this activity. A lesson plan template is provided to guide this process (see Aguirre et al, 2012). But, use of program lesson template is encouraged.

Some major components of the lesson plan should include:

- High cognitive demand tasks (Stein et al, 1998)

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- Attention to student mathematical thinking (strategies; possible confusions; number justifications; task structures)
- Differentiation (task extensions for students who struggle or need extra challenge)
- Connections to contexts, practices, activities observed in CME
- Links to CCSS-M and/or state math standards

LAUNCH

To support PSTs in generating ideas for lesson plans, instructors might lead a whole group brainstorming session. Suggested discussion prompts follow.

- Brainstorm ways that you could build upon / draw upon your knowledge about the mathematical funds of knowledge of students' communities in a math lesson. Try to generate specific lesson ideas. As you are brainstorming ideas, consider both the math content of the lesson, and the connections to community knowledge and practices.
- What mathematical activities did you observe in students' communities? Is there a way you could design a lesson that highlights these particular mathematical activities, and that provides students opportunities to deepen their understanding of the related math concepts/skills as they are engaging in these authentic and relevant activities?
- What kinds of problems arose in the daily practices of employees, business owners, customers, community members, etc. that you talked with during your community visits? (For example, problems related to how to maximize profits, how to make a product, how to determine prices, how to budget, how to arrange a space, how to make consumer decisions, how to organize events, how to create work/event schedules etc.). Is there a way that you could adapt these problems to make them appropriate for elementary students?
- What kinds of problems did you pose during/after your community visits? How might you adapt those problems to make them more appropriate for elementary students?

Another way to support PSTs as they brainstorm lesson ideas is to share a sample lesson plan created by previous groups of PSTs (Lavandaria; Las Socias; Pizza Parlour). For example, instructors might share the "Lavandería Lesson" with PSTs, and ask the PSTs to think about the cognitive demand of the lesson, the important mathematical idea and the connections to an important context (the Lavandería) and practices (making decisions about best purchases) in the community.

This launch can be a stand-alone component in which the math teacher educator reviews major points of lesson plan development using CME sample lessons to help guide the lesson design outside of class. Specifically, the presentation can highlight variations of CMEs lesson that show case strong connections to both children's mathematical thinking and cultural funds of knowledge (e.g. Las Socias) as well as lessons that gave strong attention to one construct but limited attention to the other (Dollar Store for strong attention to students mathematical thinking; Military time to strong attention to Community based funds of knowledge). By presenting these examples, PSTs have models to strive for that attend to both students mathematical thinking and cultural funds of knowledge.

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Alternatively, this can also launch an in-class activity in which PSTs engage in a lesson analysis that can also serve as a guide to their own CME lesson development. Below continues this in-class activity of analyzing CME lessons.

EXPLORE

As a small-group activity have PSTs explore key components of exemplar CME lesson plans such as cognitive demand; task structures and extensions; connections to funds of knowledge; student thinking strategies; teacher questions; participation structures; addressing status issues; attention to language (math; L1). Have PSTs summarize insights about the lesson on poster paper and prepare to share out with the whole class. If time allows, PSTs might review multiple example lesson plans that represent different ways of making meaningful or less meaningful connections to children's/community members community-based mathematical funds of knowledge.

SUMMARIZE

Have PSTs share out major points of small group discussion. Then use these insights as points for consideration in the final CME lesson plan design that occurs inside or outside of class.

Version B: Mathematics Task Development

PSTs participate in an in-class group activity in which they generate problem-based tasks that connect to what was learned in the Community Math Exploration (Activity 1). The task can be included as part of a lesson plan and/or part of the final presentation about the community math exploration.

Major considerations for task design:

- High cognitive demand tasks (Stein et al, 1998)
- Attention to student mathematical thinking (strategies; possible confusions; number justifications; task structures)
- Differentiation (task extensions for students who struggle or need extra challenge)
- Connections to contexts, practices, activities observed in CME
- Links to CCSS-M and/or state math standards

LAUNCH

Provide overview of task design using a prompt such as, “What makes a good problem-based task?” Generate a list that considers math ideas, connection to standards, student math thinking, math discourse, engagement etc.). If connections to funds of knowledge/community do not arise add to list.

Share with PSTs sample lessons/tasks (e.g. Lavandaría; Las Socias; Pizza Parlour lessons are included in the Tools and Handouts section).

In small groups/pair shares, ask PSTs to analyze the tasks using the criteria developed from the above prompt(s). It is a good idea to guide the discussion to include attention to the following: cognitive demand, student mathematical thinking, connections to cultural funds of knowledge; differentiation; mathematical discourse and language use (math, L1).

EXPLORE

- As a small-group activity PSTs engage in task design. Provide specific guiding questions to support problem-based tasks design: How does this task...
 - promote problem solving
 - connect to cultural funds of knowledge/authentic practices found in CME
 - engage student mathematical thinking
 - reflect multiple entry points (e.g. number choices; multiple strategies)
 - foster math discourse including use of language (math, L1)

SUMMARIZE

- Share out progress on task design that will be incorporated in final presentation and/or lesson plan (via poster or ppt presentation).

Version C: Presentation of the Lesson Plans

Organize a whole class sharing session where each group of PSTs presents their lesson (task) to the class. These presentations could include the following components: a) PSTs explicitly state the central problems or task in the lesson (i.e., what is the mathematics problem that the lesson is built around), and explain why they chose that particular task, b) PSTs highlight the key mathematical ideas that the lesson address, and discuss how the lesson will support students' understanding of those key math ideas, and c) PSTs highlight how the lesson connects to and draws upon important settings, contexts, activities, issues and/or practices in students' communities. *In other words, PSTs' presentations should make it clear how they used what they learned in their community walks / community visits to inform the design of their lesson.*

Teach Math Ideas on Mathematics Lesson/Task Development

Selecting exemplar CME Lessons to launch activity

The module contains a selection of exemplar CME lessons produced by PSTs that highlight different robust lesson planning practices connecting to community math explorations. Each can be used to highlight different strengths related to cognitive demand, attention to language, participant structures, task selection (i.e. number choice) etc. Utilizing CME lesson exemplars can have a positive impact on features PSTs include in their lesson/task design.

Lesson vs. task design

Our experience has been that usually time is the biggest factor that determines whether activity 2 will include a lesson or task design component. If possible, full lesson design is preferable.

Challenge PSTs to find other mathematical contexts beyond consumerism or money to design tasks.

It is important to challenge PSTs to think beyond money or consumer practices as the only contexts for math explorations. This can be challenging when visits to community sites include local businesses, restaurants, stores etc. We suggest you challenge PSTs to observe other

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mathematical contexts in addition to consumer practices involving money (e.g. measurement/geometry; probability). Alternatively, if PSTs do use money as a context, push their thinking beyond tasks that find the “total cost” to explore the purpose and/or fairness of consumer practices involving money.

Challenge PSTs to make meaningful connections to both CMT and CFoK.

During the launch activities point out how sample lessons (e.g., Las Socias, Lavandería) pay close attention to both CMT and CFoK in the lesson. Challenge PSTs to think about the guiding prompts/criteria to develop a robust task/lesson that integrates both components. PSTs might share their proposed lesson tasks with one another, and provide construct feedback and how the tasks elicit and connect to both CMT and CFoK. The instructor might also refer to the Task Lens from the video and lesson analysis prompts used in the Classroom Practices module, and ask PSTs to use the guiding prompts in the Task Lens to analyze and potentially revise their proposed CME lesson tasks.

When PSTs generate more superficial connections to CFoK, we have found it helpful to provide specific feedback on lesson plans about the authenticity of practices reflected in the tasks. We might ask the to consider whether the community context or practice is “general” to all kids are special in some way? What makes the context special? Is the assumption all kids like pizza? Or because this pizza parlour is a business located in the community and frequented by students/families of the school? The idea is for the math tasks to be grounded in practices/activities observed in the setting or discussed with members of the community. We want them to move away from traditional textbook word problems that are “dressed up” by changing the names. Showing evidence to practices/activities observed or voiced during the community math exploration is key.

Explore ways lessons might connect to issues of equity or social justice

While not all community contexts leads to exploration of equity or social justice issues, show examples and challenge PSTs to find possible connections that might help students to solve/address an issue in their students’ community with mathematics. For example, we have found that it is helpful for PSTs to talk with families, teachers, children and community members to identify important issues and challenges in the community, including issues of inequity or injustice. In our experience, PSTs have written lessons that explored issues such as a) the mathematics of a neighborhood payday loan establishment; b) the cost to replace a cement running track at a community park with a tartan (rubber) track that would be more supportive of runner’s joints; c) cost of prescriptions at a neighborhood pharmacy for families without insurance; d) excessive water use a construction site near the elementary school; e) equitable/inequitable placement of fire stations in the city; f) adding a safety fence around a community park that is surrounded by major roads with high levels of traffic; among others. These lessons have often focused on using mathematics as a tool to investigate, analyze, and better understand the issue, including important inequities or injustices. We have found that conversations with children and adults in the community have been essential to this process – particularly in the cases where PSTs are outsiders themselves to the school/neighborhood community, dialogues with community members have been critical to enhancing PSTs awareness of key issues and challenges.

Moving towards sustainable practices

In some instance, we have asked PSTs to teach the CME lessons that they design, as a way of helping PSTs to consider how these kinds of experiences and lessons might be an integral part of their teaching. We also suggest inviting experienced teachers who have done this kind of work into the mathematics methods course to talk with PSTs about their practice, and to answer questions. Experienced teachers can share insights with PSTs about strategies that they use to get to know children, families and communities, and ways that they have used what they have learned in their mathematics teaching. That said, we also acknowledge that planning and implement mathematics lessons that connect to mathematical practices in children’s communities is a challenging practice, even for veteran teachers, and one that develops over time.

Handout CME 2
Activity 2: Mathematics Lesson/Task Development
Lesson Plan Template
[PST Handout]

NAME:

DATE:

GRADE LEVEL:

LESSON TITLE:

PURPOSE OF LESSON - Include unifying concept(s), if appropriate:

STANDARDS ALIGNMENT (common core, district if applicable, ELD/ESL if applicable):

MATHEMATICAL LEARNING GOALS/OBJECTIVES: (*Clearly state what you expect the students to know and be able to do as a result of this lesson.*)

- Math content objective
- Math practice objective
- Language objective

CONNECTIONS:

- Previous Math Knowledge: *What prior math knowledge and experiences does this lesson consider and/or build on?*
- Cultural/community context (*knowledge/experiences/mathematical practices*) (e.g. *historical/cultural events, family funds of knowledge, values of students*): Discuss how *your community visits and conversations with students and families* informed your planning of this lesson. How does your lesson connect to, or build on the specific *mathematical* knowledge and practices that you learned about via your community visits?
- Academic language: How does the lesson develop academic language and build upon student linguistic knowledge including attention to math/everyday language, discourse, vocabulary, and use of L1.

MAIN TASK (state exact task(s) here)

JUSTIFY TASK (WHY): (number choices, task structure, task wording, task context, etc.)

[OPTIONAL] TASK EXTENSIONS UP AND DOWN

Describe how you could adapt the task (i.e., task structure, context, and/or numbers) for students who struggle with the mathematics (extensions down) and for students who are ready for an additional challenge (extensions up).

ANTICIPATED STUDENT RESPONSES:

List different ideas for how students might respond to your task. Include specific strategies they might use, possible confusions or misconceptions that might arise, etc. For each idea explain why students might think that and how you might respond to challenge or extend their thinking.

LESSON FLOW

Launch: Introduction Phase – *How will you launch the lesson? What will hook students into this lesson and/or connect to prior knowledge? (Consider questions that will elicit students' prior knowledge needed for this activity, get students curious about the task, and/or relate to their personal backgrounds or interests. You may also include a statement of the objective and a check that students can state the objective, or a review and assessment of pre-skills).*

Explore: Exploring the Task Phase. Consider and State **how you will:** *Find out about students' thinking; Support students' thinking; Support diverse groups of learners. **Include SPECIFIC QUESTIONS that you will ask students.***

Summarize: Summarizing Phase. Consider how you will: *Facilitate a class discussion and a sharing of students' strategies; Encourage dialogue and debate among students; Summarize the important mathematical ideas; Include SPECIFIC QUESTIONS that you will ask students.*

[OPTIONAL] ASSESSMENT: How will you assess student learning?

[OPTIONAL] ACCOMODATIONS:

Select TWO groups of students (e.g., English Language Learners, inclusion students, gifted students) and describe how you will adapt the lesson, as appropriate, to meet their needs.

ACTIVITY 3: Final Write Up and Reflection

Goals for Pre-service Teachers:

- PSTs will broaden their perspectives and understandings of students' competencies (and the competencies of family members and community members), by recognizing ways that students see and use mathematics in the home and outside of school, both as reflected in their own CME projects and those of their peers.
- PSTs will reflect on and synthesize their knowledge and familiarity with students' communities, particularly of activities and practices that might relate to mathematics instruction, and in doing so, challenge deficit-based or stereotypical assumptions about students' communities.

Description of Final Write up and Reflection

The final portion of this module involves a whole class debriefing discussion about the community exploration module. During this discussion, PSTs might a) present and elicit feedback on the lessons that they planned, b) describe and provide specific examples of the mathematical activity that they observed in the community and/or that they learned about during their interview(s) with students, c) discuss how they might involve their own K-8 students in community mathematics explorations, and d) more generally, discuss what key insights they gained from this module that they think will impact their teaching. Following a group discussion, presentation, and/or debriefing session, PSTs will complete an individual or small group written reflection. This reflection will be in response to key prompts (see related PST handout), and can occur either as an in class quick write activity or an out of class homework assignment. The individual and small group versions of this final write up are described in greater detail in the Summary portion of the lesson outline.

Lesson Outline for Final Write up and Reflection

LAUNCH

You might begin the discussion by posting a set of prompts, and providing time for PSTs to reflect individually, in writing. PSTs might first share their written reflections with a partner or in small groups, before the whole group discussion begins.

Another option is to share by posting discussion prompts on chart paper around the room, and conducting a gallery walk where PSTs circulate among the posters and jot down ideas related to each question. Like the individual reflection time described above, this activity provides time for PSTs to consider the questions before the discussion begins.

EXPLORE

What follows is a list of possible questions for whole group discussion.

- What was it like to think about the community in mathematical terms?
- What did you learn?
- about the community / the neighborhood?

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- about using mathematics to investigate community contexts?
- about using math as a tool to investigate issues of equity or social justice?
- As you participated in this project, what surprised you?
- As you were planning your mathematics lesson, what kinds of things did you think about and consider? What did you find to be useful connections to the community? How did you use knowledge gained from your community walk, interviews or visits to inform your lesson?
- As you were planning your lesson, what challenges did you face? How did you respond to those challenges (focus here on challenges specific to making connections between particular math content/concepts and community knowledge, practices, activities or settings)?
- Would you like to do a similar community math exploration with your own students? Why or why not? What would students gain from a project like this? What adaptations would you need to make? What challenges do you think you might face, and how might you respond to those challenges?

SUMMARIZE

The summarize portion of this activity involves a final written reflection. There are two options for this reflection. In Version A, PSTs complete the write up individually, either during the methods course (following the whole group discussion), or outside of class as a homework assignment. In Version B, PSTs work with other members of their small group to reflect on and summarize their experiences in the Community Mathematics Exploration Module.

In both versions of this write up, PSTs are asked to reflect on their experiences interviewing a child about their community(ies), conducting a community walk and/or visiting specific community locations and dialoguing with community members about their practices, and designing a math lesson plan that draws upon what they learned about students' community(ies). Specific prompts are included in the PST handout for this activity.

We generally suggest that when PSTs complete an individual reflection (Version A), it should be approximately 2 pages, and that PSTs should be as specific as possible in their responses. When PSTs complete a small group reflection (Version B), we generally suggest that it should be between 3-4 pages.

In some instances, we have had PSTs complete both Version A and Version B of this assignment. Version A is typically an individual homework assignment completed at the end of the module, outside of class, and Version B is conducted at least partially in-class, with time for PSTs to meet and discuss in their small groups.

Handout CME 6
Activity 3: Final Write up and Reflection
[PST Handout]

Version A: Final Individual Reflection

Version B: Final Group Commentary

Version A: Individual Reflection

Please reflect, individually, on your experiences in Community Mathematics Exploration Activities. This includes your experiences interviewing a child about their community(ies), conducting a community walk and/or visiting specific community locations and dialoguing with community members about their practices, and designing a math lesson plan that draws upon what you learned about students' community(ies). Your reflection should be approximately 2 pages, and should include responses to each of the questions listed below. (You can use question numbers to organize your response.) Please be as thoughtful and specific as possible in your responses.

Prompts for Individual Reflection:

- Related to community visits: Write about your experiences going on the community walk or conducting the community visits. What did you learn about the community, including the mathematical activity occurring in the community? Did anything surprise you? What did you learn about your students and their families? What did you learn about yourself?
- Related to lesson planning / math teaching: Write about your experiences drawing on what you learned during your community visits to design a problem solving based mathematics lesson. What were your goals in designing the lesson? What connections did you try to make?
 1. What do you think might be the *benefits* of this kind of math teaching (teaching that draws on and connects to the mathematical funds of knowledge in students' communities) for your students?
 2. What do you see as the *challenges* related to this kind of mathematics teaching (teaching that draws on and connects to the mathematical funds of knowledge in students' communities)? How might you respond to those challenges?

Additional Optional Prompts:

- Why did you choose to go to the places you visited and/or the means of visiting them (e.g., riding the bus, walking, viewing from outside, going inside, etc.)? Include details about your conversation(s) with student(s) and how the conversations informed your experience.
- As you participated in the different parts of this project, what surprised you? What did you expect before engaging in this activity? Did your expectations/preconceptions change because of this experience? In what ways?
- What was it like to think about the community in mathematical terms?

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- **If** your community walk was guided by a student, what did you learn about the student's knowledge of the community?
- **If** you conducted a problem posing investigation based in a specific community location (or around a specific community activity or issue) what did you learn about using mathematics to investigate issues/places in the community?
- **If** your investigation linked to issues of equity or social justice, what did you learn about using mathematics as a tool to investigate issues of equity or social justice?
- How might you incorporate what you learned in a mathematics lesson?

Version B: Group Commentary

Work with the members of your group to prepare a group commentary about your community math exploration experience. Your group commentary should be approximately 3-4 pages, and should:

- DESCRIBE how you selected the places that you visited and/or the means of visiting them (e.g., walking, guided by a parent, riding the bus, etc). Include details about your conversations(s) with students and/or people in the community and how those conversations informed your choice of places to visit. If you explored locations not mentioned by your student(s), explain how/why you decided to visit those places.
- DESCRIBE in detail (with photographs if possible) your activities and interactions in the places you visited. Where did you go? Who did you talk to? Demonstrate clear evidence of time and effort to learn about the community/neighborhood/culture of your student(s). If you shared photos and artifacts from your visits with your students, describe any additional information you gained. (e.g., What did students say? What more did they tell you? How did they relate to what you showed them?)
- DESCRIBE how the math lesson explicitly connects to your team's community math walk experience. How did the community math walk inform your mathematics lesson? How does your lesson connect to or build on the specific mathematical knowledge and practices that you learned about during your community visits?

Additional Resources and References

Related Readings for Instructors:

- Aguirre, J.M., Turner, E.E., Bartell, T., Kalinec-Craig, C., Foote, M.Q., Roth McDuffie, A., & Drake, C. (2012) Making connections in practice: How prospective elementary teachers connect children's mathematics thinking and community funds of knowledge in mathematics instruction. *Journal of Teacher Education*, 64(2), 178-192.
<http://jte.sagepub.com/content/early/2012/12/05/0022487112466900>.
- Aguirre, J.M., Zavala, M. & Katanyoutanant, T. (2012). Developing robust forms of pre-service teachers' pedagogical content knowledge through culturally responsive mathematics teaching analysis. *Mathematics Teacher Education and Development*, 14(2), 113-136.
http://www.merga.net.au/documents/MTED_14_2_Aguirre_et_al.pdf
- Bartell, T. G., Foote, M. Q., Drake, C., Roth McDuffie, A., Turner, E. E., & Aguirre, J. M. (2013). Developing teachers of Black children: (Re)orienting thinking in an elementary mathematics methods course. In J. Leonard & D. B. Martin (Eds.), *The brilliance of Black children in mathematics: Beyond the numbers and toward a new discourse* (pp. 343-367). Charlotte, NC: Information Age.
- Buck & Sylvester (2005). Pre-service teachers enter urban communities: Coupling funds of knowledge research and critical pedagogy in teacher education.
- Civil, M. (2006). Building on community knowledge: An avenue to equity in mathematics education. In N. Nasir and P. Cobb (Eds.), *Improving access to mathematics: Diversity and equity in the classroom* (pp. 105-117). New York: Teachers College Press.
- Civil, M. (2002). Culture and Mathematics: A community approach. *Journal of Intercultural Studies*, 23 (2), 133-148.
- de Abreu, G. (1995). Understanding how children experience the relationship between home and school mathematics. *Mind, Culture, and Activity*, 2(2), 119-142.
- Drake, C. & Norton-Meier, L. (2007). *Creating Third Spaces: Integrating Family and Community Resources into Elementary Mathematics Methods*. Paper presented at the annual meeting of the PME-NA, Oct 25, 2007.
- Ensign, J. (2005). Helping teachers use students' home cultures in mathematics lessons: Developmental stages of becoming effective teachers of diverse students. In A. Rodriguez & R. Kitchen (Eds.), *Preparing mathematics and science teachers for diverse classrooms: Promising strategies for transformative pedagogy* (pp. 225-242). Mahwah, NJ: Lawrence Erlbaum.
- Foote, M. Q., Roth McDuffie, A., Turner, E. E., Aguirre, J. M., Bartell, T. G., & Drake, C. (2013). Orientations of prospective teachers towards students' families and communities. *Teaching and Teacher Education*, 35, 126-136.
- Foote, M. Q., Roth McDuffie, A., Turner, E. E., Aguirre, J. M., Bartell, T. G., Drake, C. (2012, November). Prospective teachers' perceptions, beliefs, and dispositions toward students' family, community, and culture. In L. R. Van Zoest, J.-J. Lo, & J. L. Kratky (Eds.) *Proceedings of the 34th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. (pp. 605-612). Kalamazoo, MI: Western Michigan University.
- González, N., Moll, L. & Amanti, C. (2005). *Funds of knowledge: Theorizing practices in households, communities, and classrooms*. Mahwah, NJ: Lawrence Earlbaum.

Community Mathematics Exploration Module

- Ladson-Billings, G.J. (1999). Preparing Teachers for Diverse Student Populations: A Critical Race Theory Perspective. *Review of Research in Education*, 24, 211-247.
- Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Education Research Journal*, 32 (3), 465-491.
- Lipka, J. (2005). Math in a cultural context: Two case studies of a successful culturally based math project. *Anthropology and Education Quarterly*, 36(4), 367-385.
- Turner, E. E., Aguirre, J. M., Bartell, T. G., Drake, C., Foote, M. Q., Roth McDuffie, A. (2014). Making meaningful connections with mathematics and the community: Lessons from pre-service teachers. In T. B. Bartell & A. Flores (Eds.), *Embracing resources of children, families, communities, and cultures in mathematics learning* [A Research Monograph of TODOS: Mathematics for ALL], 3, 30-49. San Bernardino, CA: TODOS.

Related Readings for Preservice Teachers:

- Amanti, C. (2005) Beyond a beads and feathers approach. In N. González, L. C. Moll, & C. Amanti (Eds.), *Funds of knowledge: theorizing practices in households* (pp. 131-141). Mahwah, NJ: Lawrence Erlbaum Associates.
- Barta, J., Sanchez, L. & Barta, J. (2009, September). Math in the milpa. *Teaching Children Mathematics*, 90-97.
- Civil, M. & Kahn, L. H. (2001). Mathematics instruction developed from a garden theme. *Teaching Children Mathematics*, 7 (7), 400-405.
- Flores, A. (1997). Sí se puede. It can be done: Quality mathematics in more than one language. In J. Tentracosta (Ed.), *Multicultural and gender equity in the mathematics classroom* (p. 81-91). Reston, VA: National Council of Teachers of Mathematics.
- Gonzalez, N., Andrade, R., & Carson, C. (2001). Creating links between home and school mathematics practices. In E. McIntyre, A. Rosebery, & N. Gonzalez (Eds.), *Classroom diversity: Connecting curriculum to students' lives* (pp. 100-114). Portsmouth, NH: Heinemann.
- Gutstein E. & Peterson, B. (2005). *Rethinking Mathematics: Teaching Social Justice by the Numbers* (pp. 117-120). Milwaukee: Rethinking Schools Publications.
- Kahn, L. & Civil, M. (2001). Unearthing the mathematics of a classroom garden. In E. McIntyre, A. Rosebery, & N. González (Eds.), *Classroom diversity: Connecting school to students' lives* (pp. 37-50). Portsmouth, NH: Heinemann.
- Kalchman, M. (2009, May). Using the mathematics we do everyday: Preservice teachers gain a new perspective by recognizing the mathematics in everyday situations. *Teaching Children Mathematics*, 532-539.
- Kyle, D., McIntyre, E., & Moore, G. (2001). Connecting mathematics instruction with the families of young children. *Teaching Children Mathematics*, 80-86.
- Lo Cicero, Fuson, Allexsaht-Snider, *Mathematizing children's stories, helping children solve word problems, and supporting parental involvement*. In W. Secada (Ed.) *Changing the Faces of Mathematics: Perspectives on Latinos* (pp. 59-70). Reston, VA: NCTM.
- Milner, H. R. & Smithney, M. (2003). How teacher educators created a course curriculum to challenge and enhance preservice teachers' thinking and experience with diversity. *Teaching Education*, 14 (3), 293-305.
- Simic-Muller, K., Turner, E., Varley, M. (2009). Math Club problem posing: An afterschool mathematics program for Latino students focuses on field trips to explore mathematical practices of the community. *Teaching Children Mathematics*, 207-212.

Community Mathematics Exploration Module

- Torres-Velasquez, D. (2004). Culturally responsive mathematics teaching and English Language Learners. *Teaching Children Mathematics*, 249-255.
- Turner, E.E., & Strawhun, B.T.F. (2005). With Math, It's Like You Have More Defense. In E. Gutstein & B. Peterson (Eds.), *Rethinking Mathematics: Teaching Social Justice by the Numbers*, (pp. 81–87). Milwaukee, WI: Rethinking Schools.
- Turner, E., & Strawhun, B. T. F. (2007). Posing problems that matter: Investigating school overcrowding. *Teaching Children Mathematics*, 13, 457-463.
- Varley Gutierrez, M. (2009-2010, Winter). I thought this U.S. place was supposed to be about freedom. *Rethinking Schools*, 36-39.