Curriculum Materials Analysis as a Boundary Spanning Task: Bridging Science Methods and Field Placement Discourses

Abstract

Preservice teachers must often navigate the distance between science methods course and field placement classroom Discourses on their own. Discourses define the ways of talking about and enacting practices in different communities. In this project, we designed a curriculum materials analysis task to function as boundary spanning experience to bring the Discourses of the science methods course and field placement classroom closer together. We engaged preservice and mentor teachers in a co-learning event where they worked together on the curriculum materials analysis task. Using the ecological construct of an edge community as a framework for analysis, we examined the preservice-mentor teacher interactions during the curriculum materials analysis activity. Ecological edges occur when two different habitats come together, providing a rich diversity of resources and affording dynamic interactions that might not otherwise be possible. As an educational construct, edges occur when different Discourses are brought into interaction. During the curriculum materials analysis task, we observed four types of edge interactions: mentoring, connecting, navigating, and open. These interactions provided abundant opportunities for both preservice and mentor teachers to make sense of the connections between inquiry science teaching practices as portrayed in the science methods course and as enacted in the field placement classroom. Characteristics of boundary spanning tasks that facilitate dynamic, transitional edge interactions are discussed.

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Science teacher educators, preservice teachers, and inservice teachers frequently lament the differences and disconnects between university science methods courses and elementary classrooms. This disconnect is not unique to science teacher preparation and is reflective of a more general disconnect between universities and schools (Clift & Brady, 2005; Darling-Hammond, et al., 2005; Labaree, 2003; Smedley, 2001; Zeichner, 2010). One framing of this divide is that preservice teachers, mentor teachers, and university course instructors speak and act in the world from the perspective of different Discourses. Discourses define practices and identities within communities (Cobb & Hodge, 2003; Gee, 1991). However, they can also create boundaries that isolate people and practices with communities. For example, course instructors' ways of talking about and engaging in science teaching practices in the science methods course are often isolated from the contextual richness of the field placement classroom. At the same time, mentor teachers may not be familiar with the ways of talking about and engaging in practices introduced in the science methods course to be able to fully support preservice teachers in seeing how what they learn in university-based methods courses applies in their K-5 field placement (Gunckel, 2011). As a result, preservice teachers are often left on their own to

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negotiate differences between the Discourses of their science methods courses and field placements. As preservice teachers work to negotiate these differences, the sense they make of elementary science teaching may not match the constructs and practices offered in the science methods course and may also fall short of mentor teachers' expectations of the preservice teachers.

To address the general issues that result in this disconnect between universities and schools for teacher preparation, Zeichner (2010) recently called for the creation of hybrid spaces for preservice teacher preparation. Zeichner and others note the failures of past efforts that have sought to bring universities and schools together, observing that often old hierarchies are maintained and academic knowledge is privileged over practitioner and other knowledges (Bullough Jr, et al., 1999; Gorodetsky & Barak, 2008; Smedley, 2001; Zeichner, 2010). Zeichner proposed that a third space model could potentially bring Discourses together to provide new learning opportunities for preservice teachers. Gorodetsky & Barak (2008) have developed a third space model based on the ecological concept of edge communities. In this model, edges between interacting habitats (e.g., the edge between a meadow and a forest) are a metaphor for the communities created when differing Discourses, such as the Discourses of university-based teacher educators and school-based mentor teachers, are brought together. Ecological edge communities are dynamic zones where resources from both communities can be available for the benefit of all. Within educational edge communities, university and school-based Discourses could both become resources for preservice teachers learning new ways of talking, thinking, and practicing teaching.

In the Beyond Bridging Project, we have been creating co-learning spaces, where preservice and mentor teachers participate together in learning activities. These co-learning spaces are designed to be third spaces where university and school-based Discourses can interact and serve as resources for both preservice teachers and mentor teachers in building new teaching practices. In one of these spaces, preservice and mentor teachers engage together in a science curriculum materials analysis task designed to support preservice teachers in learning how to use curriculum materials to plan inquiry-based elementary science lessons. In this paper, I use an edge community framework to analyze preservice and mentor teacher participation and interaction in this co-learning space and consider the affordances and constraints of a curriculum materials analysis task for bridging university and school communities to enhance preservice elementary teacher preparation in science.

Theoretical Frameworks

Although Zeichner has only recently called for using third space as a framing for university and school-based partnerships for preservice teacher preparation, the construct of a third space has been used to support students in negotiating the divide between academic and home Discourses. In a review of the third space construct, Moje et al., (2004) outline three conceptualizations of third space in the education research literature. First, third space can function as a bridging space between students' everyday knowledge and academic Discourses. In this view, a third space is a meeting space, where participants make connections between their views of the world and the new, academic views that school is supposed to support. The work of Moll & Gonzalez (2002; 2005; 1992), Lee & Fradd (1996, 1998), Heath (1983), and Warren & Roseberry (2001; 2005; 1994) fit this approach. A second conceptualization of third space is as a navigational space that allows participants to move among various Discourses. As such, participants can be members of multiple communities and can draw on multiple Discourses as

necessary. The work of Lemke (1990) and Moje, et al. (2001) fit this perspective. The third conceptualization of third space is as a critical space, where competing Discourses interact together to challenge and reshape each other. The work of Calabrese Barton (2009; 2008) fits this perspective.

To these views of third space, Gorodetsky & Barak (2008) add the view of an ecological edge community. Edge communities are dynamic, transitional communities, composed of elements of the interacting core communities. In the same way that the edge community of a meadow and forest include elements of both the meadow community and forest community, educational edge communities are comprised of elements of the Discourses that participants bring from their core communities (e.g., university courses or field placement classrooms). Ecological edge communities provide resources that members of the community would not have available in their core community. For example, new trees in the edge zone have more sunlight for growth and may provide meadow rodents with more shelter from raptors flying overhead. Similarly, education edge communities offer resources for sense making that isolated communities do not have readily available. As a result, educational edge communities foster new growth that can lead the respective core communities in new directions.

The edge community framing of a third space encompasses all three of the perspectives on third space outlined by Moje. Edge communities function as bridges between different communities, allowing members of each core community to come together in joint activity, share resources, and develop new understandings and practices. Edge communities can also be navigational spaces, allowing members of the community to move among the Discourses present. As such, preservice teachers, for example, venture into the world of mentor teachers and mentor teachers navigate into the community of the university methods course. Finally, edge communities may become critical spaces where competing Discourses interact and potentially challenge status quo perspectives on learning and teaching. However, the construct of an edge community emphasizes, in ways that the other framing of third space may not as centrally highlight, the temporal, dynamic, and transitional nature of third spaces. Ecological edges are rich in resources, but also constantly changing and moving. A forest-meadow edge moves in location and changes in composition as the forest either expands or retreats. Furthermore, in ecology, few community members make the edge zone their permanent home. They garner what they can, but return to their more stable, and possibly safer, core communities. Similarly, educational edges are temporal, dynamic, and transitional. They exist for short periods of time, after which members may return to their core communities or move on to become members of new communities.

The construct of a boundary object is important within edge communities (Gorodetsky & Barak, 2008). Boundary objects function to coordinate differing Discourses and facilitate communication and meaning making among participants from different core communities (Gorodetsky & Barak, 2008; Star, 1989). Buxton, Carlone, & Carlone (2005) expanded the notion of a boundary object to boundary spanners, which can also include people and experience, in addition to objects, that facilitate communication and help make differences in Discourses explicit to all participants (Akkerman & Bakker, 2011; Anagnostopoulos, Smith, & Basmadjian, 2007). To be effective, boundary spanners must have meaning to participants from all Discourses represented, and must be flexible enough to facilitate interactions among participants (Akkerman & Bakker, 2011; Cobb, McClain, de Silva Lamberg, & Dean, 2003; Wenger, 1998). Within edge

communities, boundary spanners serve as focal points around which participants in the community interact and share resources.

The edge community described in this paper is comprised of preservice teachers, who bring their Discourses as students in the science methods course, and mentor teachers, who bring their Discourses for teaching science in their respective classrooms. The curriculum materials analysis tasks are designed to function as a boundary spanning experiences, serving as a focal points for preservice and mentor teachers to interact and share resources. The intent is that by engaging together in the analysis task, mentor teachers will access the Discourses of the science methods course and preservice teachers with access to the perspectives, knowledges, and practices of the mentor teachers in the field placement classrooms. It is hoped that while participating in the analysis tasks together, each participant develops new understandings and practices that develop their views of learning and teaching and provide new avenues for professional growth.

This paper explores if and how the curriculum materials analysis tasks functioned as boundary spanning experiences and facilitated edge interactions between preservice and mentor teachers. The research questions are:

1. Did the curriculum materials analysis task function as a boundary spanning experience to facilitate edge interactions for preservice and mentor teachers?
2. If so, what are the characteristic of the preservice-mentor teacher interactions (the edges) that result?

Methods

Context

The preservice elementary teachers in this project were enrolled in a four-year elementary teacher preparation program at a large university in a diverse Southwestern city. Enrolled in the first semester of their senior year, undergraduate preservice elementary teachers took five educational methods and education foundations courses together as a cohort. One of these courses was a science methods course that emphasized inquiry-based science teaching for diverse students. The course was taught by a university science education faculty member, but was conducted at a local Title I elementary school. In addition, the preservice teachers were placed with mentor teachers in the elementary school and spent ten hours per week in the field placement classroom. Instructors for all of the university courses assigned planning and teaching projects that the preservice teachers completed in their field placements classrooms under the supervision of their mentor teacher.

The Beyond Bridging project was designed to support preservice teachers in recognizing connections between what they learn in their university science methods course and the ways teaching is enacted in schools. One approach to enhancing this support was to provide opportunities for the mentor teachers to learn more about the conceptual frameworks that the preservice teachers would be using in their science methods course to complete their assignments. The mentor teachers participated in a 16-hour summer professional development workshop in which they prepared to mentor the preservice teachers in teaching science. The course instructor introduced the mentors to the conceptual frameworks of the science methods course and provided opportunities for the mentor teachers to map how they would integrate the preservice teachers into their classrooms during the semester. The mentor teachers brainstormed

additional activities in their classrooms in which they could engage the preservice teachers, such as observing or co-teaching additional science lessons with the mentors.

During the semester, a special 2.5 hour session of the science methods course was planned which the preservice teachers attended along with their mentor teacher. In this joint class session, the preservice teachers and mentor teachers participated together a curriculum materials analysis activity, described below. The analysis activity was designed to support both the preservice and mentor teachers in taking an analytical and critical approach to using curriculum materials in their science planning and teaching. Because one challenge that the mentors and preservice teachers often experience is finding adequate time to meet together without also being responsible for supervising student, the joint session also provided dedicated time for the preservice and mentor teachers to co-plan when and how the preservice teachers would teach their lesson. During the joint session in this meeting, 11 preservice and 10 mentor teachers were able to attend.

Conceptual Frameworks for the Science Methods Course

Two conceptual frameworks were used in the science methods course to organize instruction and scaffold the preservice teachers into planning and teaching inquiry-based science to elementary students.

Inquiry-Application Instructional Model (I-AIM). The I-AIM is an instructional model designed to support preservice teachers in organizing instruction that engages students in the science inquiry practices of inquiry and application, elicits and builds on student thinking, and offers opportunities for cognitive apprenticeship (Gunckel, 2011). The I-AIM supports sequencing instructional activities to engage students in driving questions that meet established learning goals, provide experiences with phenomena, support students in finding patterns in experiences, and introduce scientific explanations to account for those patterns. Throughout the instructional sequence, the I-AIM prompts teachers to elicit student ideas and build on student thinking to develop scientific understandings. The I-AIM also encourages teachers to plan instructional activities that provide opportunities for students to practice using new understandings in both familiar and novel contexts. In the science methods course, the preservice teachers were expected to use the I-AIM to plan and teach their science lessons in their field placement classrooms.

Student Science Toolkits. The second conceptual framework used in the science methods course emphasized that children come to learning science with rich intellectual and cultural resources for making sense of the world. Student science toolkits include students ideas and understandings about the world as well as their funds of knowledge (Moll, et al., 1992) for participating in school science. In the science methods course, the preservice teachers were expected to interview students to learn more about their science toolkits and then plan and teach science lessons that built on student ideas and leveraged their funds of knowledge.

Curriculum Materials Analysis Task

The curriculum materials analysis task used in the joint preservice-mentor teacher science methods session included two parts. In the first part, the preservice and mentor teachers worked together in groups of four or five people to analyze a commonly-used third grade lesson on seed parts and functions. These curriculum materials were specifically chosen to represent typical elementary science curriculum materials that often show weaknesses in supporting student learning and engaging students in inquiry practices (Kesidou & Roseman, 2002). Preservice and

mentor teachers in the groups were provided with copies from a popular published set of the student and teacher materials for the lesson. As represented in the curriculum materials, the seeds lesson begins with developing a KWL (What do you Know, What do you Want to know, and What do you want to Learn?) chart about seeds, then engages students in making observations of a dry lima bean. At the conclusion of the seeds lesson, students are directed to place their dry lima bean in water overnight so that they can observe differences between the dry bean and the wet bean the next day. In addition, the preservice-mentor teacher groups received a guiding resource sheet which provided specific analysis questions that aligned with the I-AIM and prompted consideration of student science toolkits. The guiding resource sheet included a description of a hypothetical class of third grade students and their community. Analysis questions included, for example, questions about whether an interesting and student-relevant driving question was provided, whether and how the driving question was presented to students, and if there were opportunities for students to share their initial ideas about the driving question. Other analysis questions focused on what type of experiences with phenomena were provided, what patterns in these phenomena students would notice, if these experiences would be interesting and relevant to students, what ideas about the experiences the students developed, and if and how scientific explanations for the patterns were introduced. The preservice teachers were expected to submit for course credit the answers to the analysis questions that their preservice-mentor teacher groups developed.

In the second part of the curriculum materials analysis task the preservice and mentor teachers were asked to use the same guiding questions used in the analysis of the seeds lesson to analyze the curriculum materials that the preservice teachers were using to plan and teach their science lesson in their field placement classrooms. In most classrooms, these curriculum materials were the school district-mandated curriculum materials from a popular kit-based science program. The preservice teachers were expected to submit for course credit their analyses and suggestions for modifications to the lesson that they would be teaching from these curriculum materials based on the analysis of how well the materials fit the I-AIM and leveraged student science toolkits.

Data and Analysis

Data included video recordings and transcriptions of four small groups of one to two preservice-mentor teacher pairs working on the curriculum materials analysis tasks. Follow-up whole group discussions were also video-recorded and transcribed. Preservice teacher analyses of the seeds lesson and the curriculum materials that they were using to plan their science lessons were also collected.

Analysis followed a grounded theory approach (Strauss & Corbin, 1990). Codes were generated from the data that characterized what preservice and mentor teachers each noticed during the task, whether and how they built on each others' contributions, and what connections or disconnections they made among the task, the analysis framework, and science teaching in an elementary classroom. These codes were used to characterize the types of interactions that the preservice and mentor teachers had while engaged in the curriculum materials analysis task (Esterberg, 2002). Codes were refined and patterns related to how the curriculum materials analysis task was functioning as a boundary spanner emerged. Emerging patterns were shared with the project research team and hypothesized explanations for the patterns were generated (Creswell & Miller, 2000). A return to the data tested the validity of the explanations for accounting for the patterns identified (Bogdan & Biklin, 2003).

Findings

In working together on the two parts of the curriculum materials analysis task, preservice and mentor teachers participated in the task in a variety of ways. These interactions provided multiple opportunities for sense making of the analysis task and the broader practices the analysis tasks were meant to scaffold. These different ways of interacting and opportunities for sense making characterize types of edge interactions present within the groups.

Mentoring Edge Interactions

In some groups, the preservice teachers and mentor teachers enacted a mentor-student relationship. The curriculum materials analysis task served as a focal point around which mentor teachers guided preservice teacher analysis and thinking to build new understandings of inquiry science teaching practices.

In a group with three preservice teachers (Barbara, Edna, and Francis) and two mentor teachers (Jade and Anna), the preservice teachers were discussing, as directed by the analysis questions, whether the seeds lesson fit the stated learning goals and had a driving question. The preservice teachers felt the lesson was nothing more than a KWL chart and were frustrated because they were not finding features in the lesson that the task asked them to analyze. Barbara (PST) said, “I don’t think this activity really goes into anything enough to really establish a driving question.” Anna (MT) challenged Barbara to “…think of it [the seeds lesson] as sandwiched in between other activities that you might incorporate with this. So imagine for yourself what came before and what came after…. Because they [elementary students] really have to know what the purpose of this is.” Francis considered Anna’s (MT) suggestion and then asked, “So what is the driving question?” Anna (MT) pushed Francis’ thinking by turning the question back to her, stating, “I asked you that.” This support pushed Barbara, Edna, and Francis to persist in the task and they eventually developed a driving question for the lesson that they had earlier determined did not provide a driving question for students. Had they been doing this task alone in the science methods class, Francis (PST) and Barbara (PST) might have concluded that the lesson was too simplistic to accommodate a driving question. Anna (MT) and Jade (MT) modeled for the preservice teachers how classroom teachers must often work with insufficient curriculum materials and make modifications necessary to support student learning. They pushed the preservice teachers to persevere in the face of weak materials to develop a more inquiry-based lesson.

During part 2 of the curriculum materials analysis task, the preservice and mentor teachers analyzed the materials for the lesson that the preservice teachers would be enacting. These conversations often started with a focus on procedures for teaching. For example, Abby (PST) and Adele (MT) were analyzing a lesson designed to engage second-grade students in exploring whether or not toothpaste was a solid or a liquid. This lesson was new to Adele (MT) because she had not previously taught second grade. However, she was familiar with the general organization of the science kits of which this lesson was a part. Adele and Abby first read through the procedures together to understand how the activity was structured. Adele pointed out specific instructional moves that Abby should make, such as when she noted explicitly to Abby that Abby should make a T-chart on the white board. Neither the curriculum materials nor Adele explained the pedagogical purpose for the T-chart. However, when prompted by the curriculum materials analysis task to analyze whether the materials provided opportunities to elicit student thinking, Adele said to Abby, “I guess maybe at this point you are going to gather their ideas, you are going to make a T chart and they [the students] are going to identify solids or liquids.”

The curriculum materials analysis task enabled Adele to make her pedagogical reasoning more visible to Abby so that Abby could see connections between the I-AIM from the science methods course and the pedagogical reasoning and insights of practicing teachers.

In mentoring edge interactions, the curriculum materials analysis task spanned the boundary between the Discourses of the science methods and field placement contexts. The task focused preservice and mentor teacher participation and interactions in such a way that it transformed what might have seemed to be a frustrating and academic-oriented analysis for the preservice teachers into an opportunity for preservice teachers to observe how their mentor teachers engaged in the types of analysis and planning practices that the curriculum analysis task was meant to scaffold. The task provided a context in which the mentor teachers were able to make their thinking visible to preservice teachers and were able to interact with preservice teachers making sense of new science teaching frameworks and practices.

Connecting Edge Interactions

During the curriculum materials analysis task, the preservice and mentor teachers often drew from their own familiar Discourses to make sense of new ideas and practices. In these instances, the preservice and mentor teachers built on each other's contributions in ways that helped the other person make connections across experiences and constructs and to develop a richer understanding of the analysis framework and practices.

In working on the analysis of the seeds lesson, Penny (MT) and Gina (PST) worked closely together to determine if the seeds lesson fit the learning goals provided in the task. One of these learning goals was that students should know that plants come from seeds and be able to explain how seeds are part of the plant life cycle. During their analysis, Penny (MT) asked Gina (PST) how the learning goals related to the state standard about life cycles. Penny (MT) was unsure about the intended scope of the seeds lesson, but Gina drew from her familiarity with the way that sequences of activities had been previously discussed in the science methods course to explain that this lesson was only the first lesson in a unit that would address the learning goals. Immediately, Penny (MT) related the learning goals to the sequence of lessons that she taught in her first grade classroom, stating, "That's like in the *New Plants* kit where they grow *Brassica* seeds and see the whole life cycle." Gina (PST) was able to provide Penny (MT) with new resources for making sense of the task and the Discourse of the science methods course. At the same time, Penny (MT) was able to help Gina (PST) see a connection to the field placement classroom and to show her how the seed lesson that they were analyzing was representative of typical science curriculum materials, thus situating the lesson in an authentic teaching and learning context, and making the task of analyzing the lesson more realistic.

When Penny and Gina moved to part 2 of the curriculum materials analysis task, both still made connections between the science methods and field placement contexts and Discourses. Gina was analyzing a first grade unit on balls and ramps and was focused on completing the curriculum materials analysis questions that she would have to submit to the course instructor for a grade. As she read each analysis question out loud, Penny (MT) and another mentor teacher at the table, Delia (MT) used the analysis question as a springboard for sharing their previous experiences teaching the unit. Penny and Delia asked each other how they interpreted and implemented the materials in their own classrooms. Meanwhile, Gina stayed focus on writing answers to the analysis questions, seemingly only partially paying attention to Penny and Delia's conversation. Within this example, the mentor and preservice teacher participation initially appeared somewhat disconnected, with Gina focused on completing the

task for her course, while Penny and Delia were thinking about connecting students with experiences with phenomena. Nevertheless, the completed analysis that Gina submitted in the methods course included examples of modifications based on Penny's and Delia's conversation. Within this edge interaction, the questions that Gina was engaged in answering for her methods course assignment guided a professional sharing conversation that offered Penny and Delia new ideas for teaching the materials in their own classes. At the same time, Gina was able to leverage this conversation to provide authentic examples of modifications that she could incorporate in her own lesson plans.

Again, the curriculum materials analysis task focused the preservice and mentor teacher interactions in ways that enabled both parties to span the distance between their respective practices and Discourses. Both preservice and mentor teachers were able to draw on their own experiences to make connections across Discourses. Preservice teachers helped connect mentor teachers to the constructs and practices available in the science methods course and frameworks, and mentor teachers were able to help preservice teachers recognize authentic examples of these practices in the work of teachers in classrooms.

Navigational Edge Interactions

Another edge interaction that occurred was one in which preservice and mentor teachers moved back and forth between the Discourses and practices of the science methods and field placement classrooms, sometimes together, and sometimes individually. An example of this interaction occurred in a group with Edward (MT), Ilana (PST), and Felicity (PST) while analyzing how well the seeds lesson fit the stated learning goals. The second learning goal that the seeds lesson was supposed to address stated that students should be able to develop a question about seeds based on observations. Initially, Edward was unfamiliar with the nature of the task and the ways that learning goals were defined in the methods course. Ilana and Felicity led the activity while Edward hung back from the conversation. Then, when Ilana and Felicity decided that the lesson fit the second learning goal, Edward asked for evidence of their claim. Ilana restated her conclusion and extended it by saying, "They can make their questions from what they observed about the seeds, so that also goes into it." Edward then pointed to the student activity sheet and said, "Because they have an activity sheet that talks about that. One with the dry beans. And one with the soaked beans. And they have to observe what happened and make questions from it." In this example, Edward initially had to make sense of what Ilana and Felicity were doing. However, the practice of deciding if an activity meets the learning goals was not unfamiliar to Edward. The preservice teachers modeled for Edward the nature of the analysis task and helped him to understand how learning goals were defined in the methods course. Edward then moved ahead, pushing the preservice teachers to provide evidence for their claims and pointing to the specific evidence that would support the conclusions that they had drawn. In this way, he was moving back to the practices with which he was familiar and brought Felicity and Ilana along with him. In this navigational edge interaction, Edward was able to interpret a practice from both the methods course and field placement Discourses and then support the preservice teachers in moving from their space of comfort to a new space where evidence for claims is necessary.

Open Edge Interactions

While often in the edge interactions facilitated by the curriculum materials analysis task the mentor teachers were guiding and pushing the preservice teachers, there were also instances in which the preservice teachers challenged the ideas of the mentor teachers. These situations

opened the conversations to new possibilities for both preservice and mentor teachers. For example, the curriculum materials analysis task included a question that asked if there was an initial experience for students with a phenomenon. The first activity in the seeds lesson was creation of a KWL chart. A group of two mentor teachers (Oscar and Adele) and two preservice teachers (Monica and Abby) discussed whether a KWL chart counted as an experience with a phenomenon. Oscar, the mentor teacher, claimed that the KWL chart was an initial experience. However, Monica, a preservice teacher, disagreed. She said, "Well I think it goes under the knowing my students." Adele, the second mentor teacher then agreed with Monica, saying, "Yeah it's building their background." Monica clarified her position, stating, "[The KWL] addresses that issue but it doesn't necessarily give them the phenomenon. It asks them, have you had it?" Oscar may have been expecting that since the seeds lesson was used as an example for the analysis it would model the features of the I-AIM and thus should include an initial experience with a phenomenon. However, Monica, the preservice teacher, felt comfortable challenging a mentor teacher's analysis and offering another interpretation. In this situation, both the mentor teachers and preservice teachers had equal standing to offer and evaluate ideas and push each other's thinking. Open edge interactions allow for mentors and preservice teachers to break out of their usual roles as teachers or students and engage in joint sense making.

Discussion

The curriculum materials analysis task functioned as a boundary spanner by serving as a focal point around which preservice and mentor teachers could interact in a co-learning space in ways that might not have been possible in either the science methods course or the field placement classroom. While working together to complete a common task, the preservice and mentor teachers brought forth the resources of their respective Discourses. Preservice teachers brought their understanding of the science methods constructs, sharing with the mentor teachers the ways of talking and thinking about learning goals, inquiry practices, and students that were common in the science methods course. Similarly, the mentor teachers brought their ways of talking about and thinking about planning and teaching science lessons that they used in their own elementary classrooms.

By accessing, using, and building upon the multiple Discourses present, the preservice and mentor teachers were able to each enact multiple roles. At times, the mentor teachers enacted teacher roles, drawing on their Discourses as classroom teachers to model their practices, make their pedagogical reasoning visible, and guide preservice teacher thinking. During these moments, the preservice teachers enacted their familiar roles as students, leveraging the guidance provided by their mentors to complete the assigned tasks. At other times, both the mentor teachers and preservice teachers sometimes traded roles, with the preservice teachers serving as guides to their mentor teachers, such as when they explained constructs used in the methods course or when they challenged their mentors' interpretations of ideas or materials. During these moments, the mentor teachers made connections between the constructs made available by the preservice teachers and their own practices as elementary teachers. These connections then allowed the mentor teachers to move back into their mentor teacher role, guiding the preservice teachers to see these connections between the science methods and field classroom Discourses. In other instances, the preservice and mentor teachers participated together as co-learners, co-constructing new understandings about inquiry, planning, teaching and students. While working together, the preservice teachers and mentor teachers leveraged the abundance of Discourse resources to move fluidly among student, co-learner, and teacher roles.

This fluidity of roles in interactions was most pronounced during the analysis of the seeds lesson. The seeds lesson was new to both the preservice and mentor teachers. As a result, neither could claim expertise on the materials. The mentor teachers were able to sometimes make connections between the materials and lessons they had previously taught in their own classrooms, which they shared with the preservice teachers. The preservice teachers were able to make connections to the I-AIM planning and teaching constructs and practices from the science methods course, which they shared with their mentor teachers. The mentor teachers were then able to make connections between their familiar practices and the practices highlighted by the analysis task, as when Edward pushed Ilana and Felicity to provide evidence for their claims, or when Jade and Anna guided Barbara, Edna, and Francis to consider the broader context of the seeds lesson. In the analysis of the curriculum materials that the preservice teachers were using to plan the lesson they would teach in their mentor teachers' classrooms, in most cases, the mentor teachers were already familiar with the curriculum materials. This situation pre-positioned them as experts on the materials and provided fewer opportunities for the preservice teachers to share their ideas or enact roles other than their familiar student roles. The exception to this situation seemed to be Adele and Abby. In this case, however, the materials they were analyzing were new to Adele (MT) as well as to Abby (PST). Although Adele was the expert on her own class and had familiarity with similar curriculum materials, she was exploring the specific lessons for the first time with Abby and thus seemed more able or willing to move between teacher and co-learner alongside Abby as they analyzed the lesson. Thus, in order to function as boundary spanners in edge communities, focal tasks that have some element of unfamiliarity to all participants may provide the most opportunity for facilitating edge interactions.

Another interesting feature of the interactions between the preservice and mentor teachers during the analysis of the curriculum materials that the preservice teachers were using to plan their lessons was the ways in which the preservice and mentor teachers' focus and activity were sometimes coordinated and sometimes seemingly disconnected. Some preservice mentor teacher pairs, such as Adele and Abby and Anna and Edna, worked together to use the task guidelines to analyze and understand the pedagogical aspects of the curriculum materials and co-plan the science lesson. In contrast, other pairs, such as Edward and Ilana, engaged in the procedural planning and pedagogical analysis of the curriculum materials as separate tasks. Penny and Gina both engaged in the analysis aspects of the task, but did so separately, with Penny using the analysis to further her own professional thinking about the curriculum materials while Gina focused on completing the assignment. While the intent of the design of the curriculum materials analysis task was to facilitate opportunities to connect science methods constructs to field classroom practices, these preservice and mentor teachers' participation in the task suggests that the task served multiple purposes for the various members of the edge community and not just the purposes of the designers. The task allowed mentor teachers to share their expectations for the preservice teachers' planning and teaching, allowed preservice teachers access to mentor teachers pedagogical thinking, allowed mentor teachers to share ideas and build understanding with colleagues and preservice teachers, and allowed preservice teachers to meet the expectations of their course instructor for completing the assignment. From a teacher education perspective not all of these purposes may be of equal value. That is, one might hope that the preservice teachers would engage more deeply with the activity than just as an assignment to be completed. However, while some preservice teachers may have engaged with the task at this level some of the time, as a boundary spanner, this analysis task provided multiple entry points

that allowed all participants to use the task to fulfill the purposes that their roles as students, teachers, and co-learners enabled.

Conclusion

As edge communities, co-learning spaces provide potential avenues to bridging the divide between university and school contexts for teacher preparation. The edge community, as an example of a third space, disrupts the common notion of boundaries between science methods courses and field placement classrooms, and between preservice teacher and mentor teacher roles. In the usual framing of the university and school divide, communities are bounded by their Discourse practices. The boundary between Discourses is a line of demarcation, with preservice and mentor teachers on one side of the boundary or the other. Edge communities, however, transform the line of demarcation into a space that can be occupied and moved within, allowing preservice and mentor teachers to leverage the opportunities not usually available in either the university or school communities. Edge communities acknowledge the dynamic gray areas between typically dichotomous spaces, celebrating the hybridity of roles and interactions rather than classifying people and practices as within either one or the other space. As a focal point for facilitating an edge community, the curriculum materials analysis task enabled preservice and mentor teachers to come together to share and leverage Discourse resources, construct new understandings, enact new or different roles, and fulfill the purposes that these roles enabled. This dynamic, transitional space provided new opportunities not otherwise available to either preservice or mentor teachers.

In ecology, edge communities provide abundant resources and nurture diversity of species and habitats. However, edge zones are not spaces to be permanently occupied in either time or space, nor are they spaces where all is good and safe. Ecological edges shift and change and while they offer many benefits not available in core communities (e.g., in either the forest or the meadow), they also have pitfalls and limitations. Within the edge community facilitated by the curriculum materials analysis task, pitfalls and limitations also lurked. While the curriculum materials analysis task provided access to new resources and roles, not all of the resources and roles are necessarily equally productive for preservice teachers learning. Other benefits and limitations are yet to be identified and much exploration of the benefits and constraints of edge communities for preservice teacher preparation remains.

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