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Teacher Practices and Hybrid Space in a Fifth-grade Mathematics Classroom

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Providing students with a classroom environment that allows for meaningful learning experiences is important for students to develop deep and long lasting understanding about mathematics. This article adds to the literature on learning environments in mathematics by presenting a case study of one fifth-grade mathematics teacher and her classroom through the lens of a hybrid space. The framework developed in Barton and Tan's (2009) work is applied to a mathematics classroom to investigate the use of funds of knowledge and Discourses. The researchers conclude that this teacher's instructional practices allowed for the creation of a hybrid space in her classroom. Evidence from this case study found that two constructs were present in the classroom (a) family funds of knowledge and Discourse, and (b) peer funds of knowledge and Discourse. Results from this study could help teachers and researchers better understand how to create a meaningful learning environment for students in the context of a mathematics classroom.

Introduction

As educators come to better understand how students construct knowledge about mathematics, finding ways to provide an environment that is conducive to knowledge construction is vital. In this type of environment, teachers have the ability to provide meaningful learning experiences for students that can help them construct and retain knowledge for future use (Novak, 2002). Novak defines meaningful learning experiences as ones "where the learner chooses conscientiously to integrate new knowledge to knowledge that the learner already possesses" (p. 549). This

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concept is further supported by the National Council of Teachers of Mathematics (NCTM, 2000) who stressed the importance of learning that is based on students' prior knowledge and experiences as well as the idea of capturing and sustaining interest in order for teachers to build on students' mathematical understandings.

Though real world problems or contexts can be used as a way for building students mathematical understanding, real world contexts that are disconnected from students' interests or prior experiences might not be any more effective than non-contextual problems. According to Schoenfeld (1989), a problem is defined as a task that a student was inclined to solve because he/she found it interesting and engaging as well as one "which the student does not have a readily accessible mathematical means by which to achieve the resolution" (p. 88). Although many researchers and educators would likely agree on the importance of creating problems or mathematical tasks that students find interesting and engaging, there is a need to also consider how to create a classroom environment where students are engaged in the meaningful learning of mathematics. Boaler (1993) stated that "if the students' social and cultural values are encouraged and supported in the mathematics classroom, through the use of context or through an acknowledgement of personal routes and directions, then their learning will have more meaning for them" (p. 17). When students are able to engage in mathematics problems that are linked to their experiences, they are able to make meaning of mathematics in a way that is relevant to them. Ensign (2003) found that by using what she termed "culturally relevant problems" with fifth graders in an urban school, there were positive social/emotional effects for the students as well as increases in interest for the mathematics that students were doing. In light of these types of findings, it is important to consider how mathematics educators can create meaningful learning opportunities for students.

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The purpose of this study is to examine the instructional practices of one fifth-grade mathematics teacher and the interactions in her classroom through the lens of a hybrid space. This study is a follow-up of Linder, Smart, and Cribbs (2011) and was conducted in order to explore reasons why students in this classroom reported higher levels of motivation toward mathematics than students in other classrooms at the same school. In addition, this study begins to address other questions that have been presented by researchers including how a hybrid space develops in a mathematics classroom and the type of engagement available to students in this setting (Nasir, Hand, & Taylor, 2008). Specifically, this study examines the following research questions:

1. What instructional practices and interactions occurring in one fifth-grade classroom can account for students' higher levels of motivation?
2. How can the classroom interactions in one fifth-grade mathematics classroom contribute to creating a hybrid space?

Theoretical Lens and Framework

This study was approached through the lens of social constructivism which draws from the writings of Vygotsky. His foundational work stressed that learning was not only a social process but also a process where children learn about the culture in which they live (Vygotsky, 1978, 1981). In understanding students' learning, using a social constructivist perspective requires one to investigate the multiple components involved in that learning (Rogoff, 2008). This entails more than the space of a classroom and also extends to the students' community and family space. Specifically, this study takes the perspective that (a) students construct their own meanings based on their experiences with the world, (b) students are informed by social and historical perspectives (i.e., informed by their culture and the cultures in which they interact), and (c) meaning is derived through social interaction.

This study also adopts Lave and Wenger's (1991) theory of learning and applies it to the classroom context. Their work discusses how learning can occur through participation of students in a classroom community where the members of the community (students and teacher) co-construct knowledge. The components of the community consist of (a) students negotiating meaning through discourse with and about mathematics content, (b) participating as members of the classroom within the larger context of a mathematics community through doing and talking about mathematics, and (c) being involved in the process of reification by projecting their understanding of mathematics through interpretation and use (Wenger, 1998). Through these interwoven processes, students become members of a community as they share experiences to better understand mathematics and, in conjunction with their teacher, negotiate their place in the broader context of the mathematics community.

Although the classroom is a community comprised of students and teacher, a hybrid space is a particular type of environment where teachers attempt to engage students in learning by building bridges between the content and the knowledge and backgrounds of their students (Moje et al., 2004). Specifically, a hybrid space allows for students to use their funds of knowledge and participate in Discourses to engage more fully in the classroom community.

Funds of Knowledge and Discourse

NCTM (1991, 2000) acknowledged the importance of discourse in teaching mathematics through principles and standards that call for teachers to build on discourse in the classroom. Specifically, discourse as advocated by NCTM would include meaningful interactions between students and the teacher. For example, these interactions could include the questions that a teacher asks in the classroom, the conversations that occur between the teacher and students, and the conversations relating to mathematics that occur between students. Cobb and his colleagues (1997) also discuss the concept of discourse and theorize that it can provide support to students' mathematical development that is consistent with reform shifts which call for students to engage in verbalizing their mathematical reasoning.

Discourse is also an important construct in Gee's (2000) work on identity. However, he expands on the concept by making a distinction between discourses (with a lower case d) and Discourses (with an upper case D). Gee stated that discourse is defined as "connected stretches of talk or writing" while Discourse can be thought of as a "way of being 'certain kinds of people'" (p.110). This "way of being" might entail things such as accepted ways of acting and forms of communication associated with being a mathematics person in a certain classroom or being a member of a particular sports team. Building from work on discursive identity (Brown, 2004; Brown, Reveles, & Kelly, 2005), Barton and Tan (2009) stated that "a focus on Discourse…calls into question the cultural knowledge and experiences that shape who students are and why" (p. 52). Therefore, the ways in which students choose to interact and engage with mathematics, or the Discourses they draw upon while engaging with school mathematics, relates to their identification with mathematics and their sense of membership in related communities. Unfortunately, students frequently engage in classroom Discourses where mathematics is used as a tool that is separated from their everyday Discourses. However, given the right opportunities, the everyday Discourses that students bring to the classroom could be valued in ways such that students are able to cross the boundaries between their everyday Discourses and the academic or classroom Discourses.

Funds of knowledge are also important when considering how students construct knowledge in mathematics. Moll and his colleagues (1992) define funds of knowledge as "historically accumulated and culturally developed bodies of knowledge and skills essential for household or individual functioning and well-being" (p.133). This definition, which we adopted for this study, stresses the importance of students' cultural and historical backgrounds in shaping how they perceive themselves and the world around them. As Boaler (1993) stated, these types of culturally relevant experiences have the potential to create meaningful learning experiences for students. This level of relevance moves beyond real world problems, which may not build on students prior experiences. Students may enter a classroom with minimal knowledge of how to add fractions, but they may have used fractions in cooking with parents or dividing candy among siblings. It is possible that a teacher's instructional practices could provide opportunities for students to share and draw upon their funds of knowledge in the classroom as they relate to mathematics.

Gonzalez, Andrade, Civil, and Moll (2001) presented an in-depth theoretical framework which provides an example for how the funds of knowledge concept can be applied in the context of mathematics teaching. The framework entailed teachers becoming ethnographic researchers so that they could learn about their students and their households and communities. In turn, the teachers could then apply the understanding they gained about their students' funds of knowledge to the classroom in an effort to bridge the gap between academic mathematics and the community. This work emphasizes how teachers could use students' prior experiences and established "ways of being" to provide a more meaningful learning environment in the classroom.

Hybrid Space

Moje and her colleagues (2004) discuss three different views for third space (also referred to as hybrid space) based on previous work, but put forth a definition that draws on these three views. This definition stated that a third space

> focused on cultural, social, and epistemological change…is one in which everyday resources are integrated with

> disciplinary learning to construct new texts and new literacy practices, ones that merge the different aspects of knowledge and ways of knowing offered in a variety of different spaces. (p. 44)

This definition and, in particular, the third view discussed by these authors which highlights linking students' everyday and academic funds of knowledge and Discourses in order to create new knowledge and ways of knowing, informed the present study. In this study, academic funds refer to mathematical content. It is the use of funds of knowledge and Discourses that are integral in creating a hybrid space.

When teachers encourage students' use of their funds of knowledge when engaging with academic content, they allow for students to engage in making meaning of mathematics in ways that are relevant to them. This can be done through students' use of Discourse as they talk, write, and act out what it means to be a member of the mathematics community in the classroom. By recognizing students' funds of knowledge and Discourses as important resources in the classroom, teachers are in position to help students cross the boundaries between their lives outside of school and the mathematics classroom. It is important for research to investigate how a learning environment which enables students to cross these boundaries can be created as well as the influence it can have on student learning and mathematics identity. Boaler and Greeno (2000) have found that teachers' instructional practices are important in influencing students' perceptions, participation, agency, and identity in relation to mathematics. By creating a hybrid space in the classroom, teachers may influence students' identification with mathematics which could have a broader influence on their participation with mathematics.

Nasir, Hand, and Taylor (2008) called for research to look at how third space (hybrid space) can be created in a classroom setting. Flessner (2009) began to address this call for research in his study that stressed the importance of creating an environment that was conducive for the construction of a hybrid space. His classroom allowed students to feel "safe, respected, and confident" in addition to being "contributing members of the classroom community" (p.432). From this perspective, it is important that a teacher allow students to contribute their own knowledge about content. A teacher need not be the sole supplier of expertise.

One way that teachers can provide opportunities for students to engage with mathematics content is through contextual problems. For example, a teacher can present problems that relate to real life situations such as games the students play or provide materials that the students have experience with such as measuring cups or scales. Although NCTM does not directly discuss hybrid spaces, they do discuss incorporating reform practices that could support the creation of a hybrid space in the classroom. For instance, their calls for the use of contextual methods of instruction so that students learn mathematics in relation to real world scenarios align well with the goal of creating a hybrid space in the mathematics classroom (NCTM, 2000).

Hybrid Space Framework

Barton and Tan (2009) created a framework for viewing a hybrid space in the context of a science classroom. That framework discussed two types of funds of knowledge and Discourse that were authored by students in a science classroom which are relevant for the present study: (a) family funds of knowledge and Discourse; and (b) peer funds of knowledge and Discourse. Students' family and peer funds of knowledge are the knowledge that students have related to family and peer experiences, respectively. Likewise, the related family and peer Discourse refer to how students talk, write, act, or otherwise engage with those funds of knowledge. For example, family funds of knowledge and Discourse refers to how students draw on their experiences of family life, such as shopping trips or playing with siblings, to participate in classroom mathematics. Similarly, peer funds of knowledge and Discourse refers to how students draw upon their experiences with peers to help and support each other in learning mathematics. For instance, validating each others' responses in class or showing concern for peer understanding would be examples of students engaging in peer Discourse.

The framework of family and peer funds of knowledge and Discourses is used to investigate the instructional practices of one mathematics teacher and the resulting interactions in a fifth-grade classroom. It was chosen after multiple visits to the fifth-grade classroom during which two significant practices of the teacher were observed. The first was the use of discourse in the classroom.

Class discussions and students working in groups were everyday occurrences. Further these discussions helped to establish a community environment where students became important contributors of mathematical knowledge in the classroom. The second important practice was the focus of lessons and discussions on real-life contexts with an emphasis on how these contexts related to students' lives. Providing opportunities for students to discuss mathematics as it relates to their lives in this way could act as a bridge between students' home and community and the classroom. Both of these practices can be linked to Discourse and funds of knowledge, which are important aspects in constructing a hybrid space. Once these practices became apparent in observations, it was hypothesized that the teacher was creating a hybrid space for students in the mathematics classroom. Barton and Tan's (2009) framework allowed for specific types of funds of knowledge and Discourse to be investigated in relation to the development of the hybrid space.

Method

This study originated from a larger study on student motivation in elementary mathematics (Linder, Smart, & Cribbs, 2011). Based on the findings from the original study, it was determined that one teacher in an elementary setting in the southeastern United States had students who displayed significantly higher levels of motivation when compared with other teachers who participated in the study. than all other students in the school. In that study, motivation towards mathematics was determined by students' self-reporting on items related to anxiety, interest, task value, self-efficacy, and goal orientation. This fifth-grade teacher became the focus of the current study to determine what teacher practices might account for these results.

The teacher taught four different math classes throughout the course of the day with a total of approximately sixty students. She had 20 years of experience teaching students in 5th and 6th grades and, although she had taught multiple content areas throughout her career, she had been teaching solely mathematics for two years. The teacher had been nominated and selected as co-chair of the mathematics professional learning committee at the school where she taught. She was not only committed to professional growth

(having completed a masters and working on a doctorate degree), but she was also committed to inquiry practices and had recently begun using a curriculum which promoted inquiry methods in the classroom. The school where this study took place was being departmentalized as part of restructuring efforts to meet annual yearly progress goals and was a Title I school where 81% of the school population received free or reduced lunch.

A qualitative analysis of this fifth-grade teacher's instructional practices in mathematics was conducted in the spring of 2010. Data was collected through classroom observations, paired student interviews, and a teacher interview. Nine classroom observations, including at least one observation in each of the classes taught by the teacher throughout the day, focused on teacher practices, student and teacher interactions, and classroom norms were conducted and recorded in April and May of 2010. Video recording the observations allowed for the activities of the classroom to be more easily documented for later transcription. Interviews were also conducted in pairs with 20 students at the end of May 2010 using a semi-structured protocol to get a better idea of how they perceived mathematics and their teacher in relation to mathematics. The teacher interview was conducted in July of 2010 using a semi-structured protocol to better understand the teacher beliefs about mathematics and teaching. These three data sources were chosen to provide a detailed picture of the teacher's instructional practices and to allow for exploration of how these practices influenced the students. A member of the research team later transcribed the classroom observations and interviews. Using these data sources, we were able to investigate reasons why students in this teacher's classroom had higher levels of motivation toward mathematics. It was after an initial analysis of the data that it became apparent a hybrid space framework could provide insight into the instructional practices and interactions that were present in the classroom.

Because a lived experience was being examined during the course of this study, phenomenological methods were employed during data analysis (Moustakas, 1994). Drawing from the transcendental branch of phenomenology, which posits that researcher subjectivity can be accounted for through bracketing, this study explored the lived experiences of participants through classroom observations. Interviews of participants allowed for a

better understanding of these lived experiences, giving an opportunity to further explore the emerging themes from classroom observations. Due to the fact that the framework of a hybrid space examines how students position themselves in the classroom and the type of Discourses that are present, a phenomenological approach is appropriate and allows for an iterative process to be used in interpreting these experiences.

The analysis of data occurred at each stage of data collection beginning with repetitive readings of all transcriptions and viewings of videos to determine an initial overall understanding of the data. From there, meaning units were identified and extracted from the data and then clustered in a secondary analysis to form themes. Emerging themes, based on a triangulation across all three data sources, were used to develop individual and composite descriptions of the data (Moustakas, 1994). Once these descriptions were created, the results were compared to Barton and Tan's (2009) framework to determine if the constructs identified in a science classroom were similar to those identified in this mathematics classroom. Because the research team hypothesized that certain aspects of a hybrid space were being utilized in this fifth grade classroom, it was difficult to bracket out subjectivities on the part of the researchers. An attempt was made during data analysis to reduce subjectivity by having multiple people involved in the data analysis process. Thematic analyses were conducted individually by two members of the research team who then met and compared findings. Findings were identical across analyses. What follows in the results are the composite descriptions with support from the data.

Results

The teacher participating in this study had already been shown to successfully motivate her students in a previous study (Linder, Smart, & Cribbs, 2011). When asked what her goal was for her students she stated, "That they succeed." Expanding on this, she stated that "because a lot of times you'll say 'math is my worst subject. I don't like it.' And then when you have attitude like that, you know, that kind of hinders you from being successful... more like believing in yourself." She believed that helping students to see mathematics as relevant to themselves and important to real

life situations would help them to be successful in the future.

The focus for this study was to determine what practices were occurring in the classroom that contributed to the development of a hybrid space by studying the classroom interactions. Analysis of classroom Discourses along with supporting evidence from teacher and student interviews resulted in two themes emerging that relate directly to Barton and Tan's (2009) hybrid space framework: The presence and incorporation of (a) family funds of knowledge and Discourses; and (b) peer funds of knowledge and Discourses. These themes emerged by examining the types of Discourse being enacted in the classroom as students engaged with mathematics (e.g. how students talked about mathematics, the types of discourse the teacher supported and encouraged, and the ways in which students used tools and materials to better understand mathematics). Before discussing these themes, it is important to first discuss the particular instructional practices used by the teacher, which have been detailed under four sub-themes (a) discourse, (b) real life objects and tools, (c) relevant mathematics, and (d) differentiated instruction.

Instructional Practice

The participating teacher exhibited strong classroom management skills as evident though her ability to readily command the attention of the students in her class. On occasion, the teacher reminded students to "raise your hand please" or that "somebody's talking, let's be respectful." The word respectful was used frequently by the teacher to define the way students should interact with each other. The teacher was also firm and purposeful with her students and their activities, while still presenting a friendly and open demeanor. This was seen through established procedures for how the class functioned on a daily basis and the way the teacher supported student participation. In student interviews, the teacher was described as being "smart", "funny", "helpful", and "a good teacher" among many other similar comments. Even in the midst of noisy and mobile activities, the teacher maintained control and kept students on task. The classroom layout was such that students were sitting in groups facing each other. There were approximately four groups of desks where students would work together as a whole, be split into two

groups, or occasionally work individually. This classroom layout promoted student discourse, which seemed to be the intent of the teacher.

Although this general description of the teacher and her classroom helps to establish a picture of her classroom including the established practices and procedures, greater detail will be provided through the four sub-themes discussed below. By investigating this teacher's instructional practices, what is valued as it pertains to students funds of knowledge and Discourse can be seen. This pertains to the research questions in that these practices provide insight into how this teacher was able to support a hybrid space in her classroom.

Discourse

One of the defining characteristics of the classroom was the teacher's focus on discourse. This discourse involved students answering the teacher's questions, presenting their work to their classmates, or discussing problems together in groups. The teacher rarely worked or discussed a problem or mathematics concept without asking students for their thoughts and explanations. These questions ranged from students being asked to explain their rationale, such as "How do you know that 43 over 100 is in its simplest form?" to the class being asked to help work through a problem that was presented, such as "What's half of 36?" This focus on soliciting students' thoughts and explanations helped to create an atmosphere where students felt as if their ideas and viewpoints were valued by the teacher. Through use of open discourse such as this, the teacher fostered an environment in which the teacher and students were continually negotiating what it meant to know and do mathematics in the classroom. This is important for creating a hybrid space as it opened the door to bridging academic funds of knowledge and Discourse with students' cultural and historical backgrounds. Though this is only a brief description of how the teacher promoted discourse in the class, evidence of the specific types of discourse in the class will be detailed through the lens of a hybrid space framework below.

Real Life Objects and Tools

Another classroom practice that the teacher implemented was the use of real life objects and measuring tools for students to interact with and use. The essential question for the first lesson observed was "What is capacity?" In order to address this question, the teacher brought various food and medicine products to class for students to sort. As a part of this lesson, the students were also given a measuring cup and asked to find the relationships between units. The lesson continued to the next day where students created their own measuring cups using plastic cups provided by the teacher. During another lesson observed, the students were presented with the essential question, "How are pounds and ounces used in the customary system?" In order to help the students answer this question, the teacher provided students with one pound bags of popcorn to hold and compare with other items the teacher had brought from home (canned food and a soda bottle). The lesson continued with students being given various scales where they would first estimate the weight of objects before measuring the actual weight. Students were encouraged to use items from their own book bags and from around the classroom. The inclusion of real life materials that students were likely to be familiar with as well as the opportunity for students to use their personal items allowed for students to make connections between their own lives and the mathematics content. This practice is closely linked to the next theme which is the use of relevant mathematics and encourages the creation of a hybrid space in the classroom.

Relevant Mathematics

Student interviews revealed that students felt their teacher believed mathematics was important and often discussed the relevance of mathematics to real life. In response to the question "Do you think [your teacher] thinks math is important?" two students stated the following:

> Student 1: She like applies it to real life things…like with geometry, like with like structures, how they need to be built, like construction. How they need to be built just to stand.

> Student 2: And sometimes in math like she compare, like when she doing geometry, she compare it to real things in life. Like a rectangular prism as a cereal box, a sphere as a ball. She can explain it as to real life things.

The teacher further supported this finding with her interview responses stating that "math is all around you" and "[math is] definitely relevant." She also gave a rationale for this belief as seen in the following statement:

> I don't want kids to think that, hey, I'm teaching this because it's a standard I need to teach, but how is this going to benefit you in real life? You know, so that they can make that, be able to make the connection. Because in kids, that's what kids will do. They'll think that, well that's not relevant and then they'll tune out… I think a lot of times, if you show them how it applies to real life situations, they're going to be more apt to remembering it and making those connections, understanding it.

This belief in the importance of mathematics and relating it to real life was present in the teacher's classroom practices and was a defining characteristic that students attributed to their teacher. Just as the other practices that were part of this classroom, the students were getting a clear message for what was valued as mathematics and were provided with opportunities to connect the content with their own lives. This goes beyond the inclusion of real life contexts as there is a focus on helping students make connections in ways that are relevant to their lives and ways of knowing.

Differentiated Instruction

The teacher also stressed her belief in the importance of getting to know her students. In her interview she stated that "you got to really know your students" and "know what this student needs and where I need to put this student." It was her belief that knowing her students allowed her to be a more effective teacher because she was able to adapt instruction based on their needs. She also stated that because students were different, it was important to use different strategies. She stated that mathematics content "may have to be presented in another way in order for me to get it. So

knowing that and knowing that all children are different, it just makes me want to accommodate for all those abilities.". One important strategy that the teacher discussed in her interview was having students explain mathematics to each other. She stated that "maybe they just can't understand my verbiage, so I will say 'why don't you try and explain that to that student.'" This was another practice that promoted open discourse in class, which included students sharing their explanations to the class as a whole and to each other. Students' thoughts and knowledge about mathematics were incorporated in the everyday practices of the classroom.

It was through these methods of instruction along with the comments made by students in interviews that the researchers began to see a pattern that allowed for students to bridge the gap between the mathematics content being taught and students' backgrounds. In the next section, this concept will be discussed further through the lens of a hybrid space framework.

Family Funds of Knowledge and Discourse

Family funds of knowledge and Discourse is related to students' experiences outside of the classroom including family life and activities and emerged as a theme in this study when exploring the instructional practices and interactions that were present in the classroom. In particular, evidence of this theme was seen as students discussed mathematics in relation to how they used household items, measuring tools, and experiences with members of their family.

In the lesson on capacity, mentioned previously, students were asked to compare and contrast items the teacher brought to class. At this point in the class, the teacher left the concept of capacity open, allowing students to discuss the concept according to their current understanding. The teacher asked the students to decide as a class the order of items from least to greatest capacity without looking at any labels. The students were presented with the following items: soda bottle, stomach medicine bottle, marinating sauce, milk carton, throat spray, cooking oil, and olive oil. While ordering these items based on class consensus, the teacher asked a student why she had put one item before another.

Student: …because, like, when I take it, it's very thick.

Teacher: Ok, so you based it on the thickness of it?

Student: Yeah, I based by how it looks.

Teacher: You didn't feel it.

Student: Like, yesterday I had to get some.

Teacher: Oh, ok, ok, so you're using your knowledge that you might have used before by holding it…Ok, let me ask you this. You didn't hold any of these other ones.

Student: No.

Teacher: So how do you know that this (holding up stomach medicine) is heavier than this (holding up cough medicine)?

Student: I know that soda is heavier than all.

Teacher: So because it's thicker, you think it is heavier?

Other students interjected at this point with how they thought the items should be ordered leaving the student to think about the question the teacher had asked her.

The teacher used items that might be commonly used in students' households to allow for students to become engaged and feel as if they had the ability to contribute to the class discussion. For example, during the same capacity lesson, the teacher asked another student for his strategy in ordering the items. The student responded that "I know how they all, I've used them all before, so I know…" Students detailed how they had previous experiences using items and were able to explain their reasoning for how items were sorted according to capacity. One student detailed a story of how she had discussed the concept of capacity at home with her sisters.

Student: Um, in my house my sisters, they be trying to say that, well, they put two cups out. They put a big, it's small and all thin and stuff, and they have a little small one. And they say the ones that's small has more liquid inside it when it doesn't.

Teacher: Ok, um, because it's smaller, anyone have one of those, than something that's taller?

Student: It's wider.

Teacher: It's wider. It could have more liquid than something that's taller.

The teacher continued the discussion of wide versus tall with the rest of the class, giving validity to the student's thoughts about capacity. This interaction indicates that the teacher was open to the students sharing their experiences about capacity as well as

discussing how they related to the current lesson. Students felt comfortable sharing those experiences with the class and these experiences helped the students to connect new concepts to previously developed understandings of the content.

The teacher also presented students with opportunities to relate to previous experiences through her questioning. She asked students "When do you use measuring of capacity?" as a way to draw out their previous experiences. Students responded with comments such as "cooking," "experiments," and "how much you eat." When the teacher asked the students "Where have you seen pounds and ounces used?" students responded with "the store," "weighing vegetables," and "at the doctor." Two students commented about their experiences with capacity as detailed below.

Student 1: At home.
Teacher: At home, how'd you use it at home?
Student 1: Like when you want to know how much rice you want to use.
Teacher: Ok
Student 2: You can also use to how much milk you want to put in a cake.
Teacher: So you have to measure how much milk that you might have to put into a cake…

The teacher asked for a few more comments and then moved the discussion on to how to estimate weight by looking at an item. During these discussions, students are positioning themselves as being important contributors of mathematical knowledge in the classroom. Students are not only responding to questions presented by the teacher but are justifying their responses and debating with their peers. This highlights the types of Discourse that are present in the class which creates a space where students can discuss mathematics using their family funds of knowledge.

To further help students relate to the mathematics content, the teacher provided tools for the students to work with as part of the lessons she taught. An example of this can be seen from the lesson on pounds and ounces when the teacher brought bags of popcorn to help students to estimate weight. A brief example of the discussion that ensued after the students had an opportunity to hold the bag of popcorn is detailed below.

Teacher: What objects might weigh about the same? Thinking

of the weight of that popcorn, can you think of any other objects that might weigh about the same as that bag of popcorn?

Student 1: Soda.

Student 2: The manwich.

Student 3: A one pound bag.

Student 4: A banana.

Teacher: Ok, so he says the manwich.

The teacher continued this discussion by allowing students to share more of their thoughts before having them compare the weight of the bag of popcorn and a container of Kool-Aid. As part of the lesson, students were also asked to use various scales to weigh items in the classroom.

Though conversations such as these can occur spontaneously in a classroom, these examples are meant to demonstrate ways in which the teacher fostered an environment where students could discuss mathematical concepts in relation to their own experiences. She also encouraged discussion and questions in the class through the use of household items. Students were eager to participate and seemed to be excited about sharing their experiences. The use of tools also allowed students to engage in new "ways of being" or Discourse and created opportunities for bridging between students' family funds of knowledge and academic funds of knowledge.

Peer Funds of Knowledge and Discourse

Peer funds of knowledge and Discourse are related to how students provide peer support or specifically help each other with mathematics and emerged as a theme in this study when exploring the instructional practices and interactions that were present in the classroom. In particular, evidence of this theme was seen in how the students supported each other in classroom activities and in developing understandings of mathematics in addition to how the teacher's instructional practices provided opportunities for students to support each other. The following discussion between two students occurred during the lesson on capacity that was described in detail in the previous section. The students were looking at a plastic measuring cup that the teacher had given them and the teacher asked the class to come up with inferences.

Student 1: Thirty-two equals is one quart and on this scale is always skipping fifty and one liter…
Student 2: No, it's skipping like a hundred and fifty, I mean a hundred. Look.
Student 1: Yeah, yeah.
Student 2: It's skipping a hundred.
Student 1: One liter equals one thousand milliliters.
Student 2: It's skipping one hundred.
Student 1: Oh, I see. I already got confused with it.

One student helped another to understand the intervals on the measuring cup. During another observation, this type of peer interaction was observed again as one student struggled to understand a warm-up problem that was posted on the board at the beginning of class. The students were trying to determine what a flat diagram on the board would look like if it was folded to make a 3D image.

Teacher: Ok, what shape does that make?
Student 1: A cylinder.
Student 2: The cylinder wouldn't look like that…one circle would be at the bottom. One circle is at the top.
Student 2: A cylinder would be like this. A circle would be here. The other circle would be right here, so when the wrap… (*The student indicated with his hand what he was doing with the figure on the board.*)
Teacher: Ok, what is it then?
Student 2: I thought it was a prism.
Student 1: No.
Student 3: Can I, can I… (*This student goes up to the board to help the other student.*)
Teacher: We have a debate going on here.

Two students continued to help one student who was struggling to understand the problem on the board. After further discussion, the student who was confused about how to figure out the problem states "Yeah, I see it." At this point, the teacher continued with the lesson.

In several of the interviews, students stated how they were concerned about their fellow peers' understanding. For instance, when asked during an interview if they ever got to ask for help from friends in class, one student responded with "Like some people like didn't know how to do it. 'Cause I got a 100. And we

had to help other people, so they could get a 100 too." Additionally, when asked if they got to work in groups, one student stated the following:

> [The teacher] placed us as in, like, she has like, I'm one of the high students. She has like certain high students with some people who don't learn as quickly and has some people who learns quickly. And then some people like for others to help.

It was clear from this comment that the students were engaged in helping each other through grouping. This pattern became even more apparent when the students were asked in an interview if their teacher would listen to them if they came up with a new strategy or idea in class.

> Student 1: Yes, she'll listen 'cause like we come up with new strategies to use in math. We come up with new strategies to see, try a strategy, um, like on a problem...
>
> Student 2: She'll like accept it 'cause it might help…
>
> Student 1: Other students.
>
> Student 2: Yeah, it might help other students. And like it might help her explain it better.

Not only were students supporting the idea of helping each other through sharing strategies, but they also felt what they had to say was significant to the class. Both classroom observations and interviews revealed that students were concerned with each others' understanding. The teacher's classroom practices and teaching strategies supported this practice as she often put the students in groups or pairs in an effort to facilitate their learning and also encouraged them to explain their reasoning about mathematics to each other.

Discussion and Implications

The results section presented evidence of teacher practices that provided opportunities for a hybrid space to exist in a fifth-grade mathematics classroom. Specifically, the teacher exhibited instructional practices related to four themes: (a) discourse, (b) real life objects and tools, (c) relevant mathematics, and (d) differentiated instruction. These practices promoted discourse about mathematics through the use of real life applications and tools and allowed students to use their funds of knowledge to

better understand the mathematics content being discussed. The discourse that students participated in can be related to the framework that Barton and Tan (2009) presented in their work on hybrid space as evident in the teacher's recognition, and incorporation, of students' family funds of knowledge and Discourse and peer funds of knowledge and Discourse during classroom observations.

Since a hybrid space is a classroom setting that is co-constructed between the teacher and students, a teacher's instructional practices are integral for the creation of a hybrid space. This study found evidence that the teacher was providing opportunities for a hybrid space to exist in her classroom, which included a pattern of questioning where students were expected to share strategies and explanations of their thinking. This expectation encouraged students to share their knowledge about mathematics, which is an indication that they were co-constructors of knowledge in the classroom. The teacher also used real life objects and tools to promote meaningful discourse in the classroom and to help students to make meaningful connections to the mathematics being discussed. Whereas these practices are important for helping students make connections that can increase their use of the content in new situations, it is the combination of these practices with the teacher's focus on promoting relevant mathematics in the classroom that supports the creation of a hybrid space. The teacher provided opportunities for students to connect their historical and cultural backgrounds with the mathematics being discussed in the classroom. Lastly, the teacher's use of differentiated instruction promoted an atmosphere where students were invested in each other's learning.

Although each of these practices on its own is important, it was the combination of these instructional practices that allowed for the supportive scaffold that Barton and Tan (2009) discussed in their work. The teacher supported student's funds of knowledge and Discourse as legitimate ways of knowing and learning mathematics in the classroom. As a result, students who might not otherwise have opportunities to actively participate were active participants in the classroom where their knowledge and experiences were valued by the teacher and their peers. These practices fostered an environment that allowed for the creation of a hybrid space.

The teacher's recognition and incorporation of family funds of knowledge and Discourse emerged as a theme as evident through the instructional practices the teacher incorporated to support discussions students had that related to activities and conversations with family members. Not only did the teacher provide an environment that promoted students to discuss the content in their own words, but she also asked students to reflect on their prior knowledge and experiences outside of the classroom in order to make meaning of the mathematics content. Students discussed shopping trips with family members, cooking at home, and conversations they had with siblings in relation to the content being covered in class. In addition to this theme, the incorporation of peer funds of knowledge and Discourse emerged as a theme in the classroom as seen through the teachers inclusion of practices that provided opportunities for students to support each other's learning of mathematics and students' discussions in the class as they helped each other make sense of mathematics. Interviews with the students also indicated that students had concern for their peers understanding of mathematics. The teacher created a classroom environment where students worked together to understand mathematics. In class discussions, students answered each other's questions and built on each other's answers to support their learning. Group work was also used frequently to provide students opportunities to reason about mathematics together. Though not all of the themes from Barton and Tan's (2009) framework were evident in the classroom, the results indicated a hybrid space was created.

Although this study contributes to the knowledge of hybrid spaces and their development, there are a few limitations which warrant consideration. First, it is important to remember that the teacher in this study was not intentionally creating a hybrid space, but rather that this space occurred spontaneously as a result of her teaching practices. Flessner (2009) discussed this idea by stating that it was only when he stopped trying to create a hybrid space that one occurred, and it may be best for teachers to focus on creating the conditions that are conducive for a hybrid space. Although the teacher in this study was using practices that supported the creation of a hybrid space, if she had been intentional in creating this type of classroom environment, she might have incorporated other practices to support students' funds

of knowledge and discourse. Data might have also provided more insight into how cultural or historical knowledge might have been present in the classroom. Thus, further research is necessary to determine if these types of funds of knowledge are critical in creating a hybrid space in a mathematics classroom, and if so, how this would influence students. Another potential limitation of the study was that classroom observations occurred over a short period of time. If observations were conducted over the course of the year, it is possible other funds of knowledge and Discourses would be seen in the data. It is also possible that different constructs are more readily seen in different content areas as Barton and Tan's (2009) framework was based in the context of a science classroom. Further research needs to be conducted to investigate the framework for mathematics classrooms in order to determine if the framework should be modified.

One possible implication from this study is that teachers' instructional practices can promote students' use of their non-academic funds of knowledge and Discourses in the classroom. When teachers provide opportunities for students to link their prior experiences to the mathematics content, a more meaningful learning environment can exist such as the type discussed by Boaler (1993) and Ensign (2003).This type of environment could potentially contribute to the high levels of motivation that were evident for students in this classroom as documented in a previous study (Linder, Smart, & Cribbs, 2011). The fact that students are active participants through discourse in the lessons observed could contribute to the higher levels of motivation that these students displayed compared to the other K-5 students at the same school. Sfard (2009) stated that:

> Learning to speak, to solve mathematical problem or to cook means individualization of these activities, that is, a gradual transition from being an only marginally involved follower to other people's implementation to acting as a competent participant, with full agency over the activity. (p. 56)

This statement may hint at the interplay that is occurring in the classroom. Students are given opportunities to relate mathematics to their prior funds of knowledge and experiences. These opportunities allow students to move from being passive learners to active participants in the learning process where they are treated as valid contributors of mathematical knowledge in the classroom.

The findings from this study suggest that the discourse present in this teacher's classroom shows a picture of how students are trying to make meaning of the mathematics content and add it into their funds of knowledge. Further research needs to be done to better understand the relationship of a hybrid space with student learning. It would also be useful to investigate these teaching practices in more depth and to examine the long-term impact to student learning and motivation when students are members of a classroom which allows for a hybrid space to exist.

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