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Successful minority pedagogy in mathematics: US and Japanese case studies

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Abstract

Case studies were conducted at two high-minority junior high schools in the U.S. and Japan, examining successful pedagogy in mathematics for minority students. Findings suggest that successful minority pedagogy includes the following characteristics: (1) Building upon students' prior experiences by using multisensory methods before teaching abstract concepts and rules; (2) Using familiar, every day words before introducing academic language; (3) Integrating literacy throughout instruction; (4) Guiding students to become critical thinkers through an inquiry process; and finally, (5) Developing trusting relationships with students and peers within a caring community

Introduction

One of the greatest mandates of pre-service teacher education in the United States and around the world today is preparing prospective teachers to effectively teach diverse populations, students from cultural, linguistic, racial, and ethnic backgrounds different than the dominant culture (Cochran-Smith & Zeichner, 2005; Ichise et al., 2008; OECD, 2012; Tsuneyoshi, 2008). Darling-Hammond (2006) further asserted that teachers who had more training in working with diverse student populations had more success empowering student achievement. For the U.S., the National Assessment Educational Progress (NAEP) results underscore the need for effectively teaching these populations: While 52% of White fourth-graders scored at or above the proficient level in mathematics, only 17% of African American, 24% of Hispanic/Latino, and 24% of Native-American students/Alaska Natives reached this level. Similarly, in eighth grade, while 43% of White students scored at or above the proficient level in mathematics, only 13% of African American, 20% of Hispanic/Latino, and 17% of Native-American students/Alaska Natives reached this level (NCES, 2011).

Japan, which is believed by many to be a homogeneous country with a single language and culture, in fact boasts almost three million minority individuals from various groups (Weiner, 1997), making it increasingly multicultural especially with the recent influx of "newcomers" (Okano & Tsuneyoshi, 2011; Shimizu & Shimizu, 2001). Among these minority

groups, people from the Buraku[1], an "invisible" minority due to their ethnic Japanese background, are considered one of the most historically stigmatized and marginalized groups in Japan (Hawkins, 1983; Ogbu, 1978; Shimahara, 1991). Similar to results in the U.S., a clear gap exists between achievement scores for students with a Buraku background and overall scores for Japanese students. For example, Shimahara (1991) showed that while the 4th and 8th grade Buraku students scored 76.4% and 63.4% respectively, the entire 4th and 8th grade students in Wakayama prefecture in Western Japan scored 81.6% and 72.5% respectively. Furthermore, according to unpublished statistics at the case study site in Osaka, Japan, a distinct gap between the 8th-grade Buraku and non-Buraku students in mathematics test scores was documented in 2008: The Buraku students scored 46.3% when compared to the non-Buraku students who scored 58.1%.

In light of these academic achievement disparities, using case studies, this paper examines successful pedagogical practice in mathematics instruction at high minority middle/junior high schools in the U.S. and Japan, in order to better understand how to improve learning experiences for minority students around the world. "Successful pedagogy" in this paper refers to teaching that is supported by both the quantitative improvement of students' test scores, as well as qualitative teaching behavior based on observations and interviews. The main research question addressed in this study is "How do teachers successfully teach mathematics to minority students?" Results from this case study may offer insights on teacher preparation and development on pedagogical principles of mathematics for diverse populations.

Literature Review

Pedagogy for Minority Students

Since the 1980s, an increasing number of qualitative studies have documented the importance of incorporating and affirming minority students' home culture in school. Terms such as "culturally relevant pedagogy," (Ladson-Billings,1994) "culturally responsive pedagogy," (Villegas & Lucas, 2002) and "culturally congruent instruction" (Au & Mason, 1981, 1983) all support the notion that teachers should connect the curriculum and their own interaction styles with the cultures of student groups that have been marginalized (Foster, 1989; Heath, 1983; Lipka,1991). In particular, culturally relevant pedagogy rests on underlying principles of caring and collaboration in the context of family and community, from which trusting relationships develop between teacher and student (Ladson-Billings, 1994). This safe environment enables students to make mistakes, explore ideas and think critically, allowing them to become responsible participants in their own, as well as others' learning.

More recently, culturally relevant pedagogy has been proposed as a viable framework for understanding minority students' learning in mathematics classrooms (Gutstein, Lipman, Hernandez, & Reyes, 1997; Leonard, 2008; Nasir, Hand, & Taylor, 2008; Nelson-Barber & Estrin, 1995; Villegas & Lucas, 2002). When examining successful teaching practices in mathematics for Mexican-American, American Indian, and African-American students, these authors found that successful pedagogy taps into students' cultural and informal math

experiences and understanding as a starting point from which to build new knowledge. If learning were to become meaningful for these students, then instruction must become equally meaningful, by connecting with students' home and community experiences. In other words, mathematics should not be isolated but instead embedded in cultural and social contexts of students' everyday lives.

In order to help build bridges to learning, Villegas and Lucas (2002) stress the importance of learning about students and their communities. By making an effort to understand students' lives outside of school, teachers can establish meaningful relationships that help students feel connected to school and promote their desire to learn. Treating students' distinct cultural and social contexts as an asset, culturally relevant mathematics pedagogy thus embraces the view that students come to the classroom with rich "funds of knowledge" (Garcia, 2004; Moll, Velez-Ibanez, & Greenberg, 1989). This perspective makes the approach a logical extension of the more broadly applied general culturally relevant pedagogy (Gutstein, Lipman, Hernandez, & Reyes, 1997; Nelson-Barber & Estrin, 1995; Tate, 1995).

Moses' Five-Step Approach as a Framework

In this paper, Moses' Five-Step Approach was used as a framework for understanding mathematics teaching among minority students (Moses & Cobb, 2001). Originally a freedom rider from the North during the Civil Rights Movement of the 1960s in the U.S., Moses proposed the Algebra Project in 1982 in order to provide equal access to college preparatory algebra for all students, especially African-American and other minority students who were excluded from participating in college-bound courses. Moses' framework identifies five steps in teaching algebra: 1) experiencing a familiar physical event; 2) drawing a pictorial representation to reflect on that experience; 3) describing the event using every day language (intuitive language or people talk); 4) describing the experience using academic language (structured language or feature talk); and 5) constructing symbols (abstract representation). Simply put, students first enter learning through a particular experience related to a given concept and go through each step of scaffolding to ultimately learn academic terms and abstract symbols.

Method

Setting

In the U.S., after receiving a small grant to conduct a project preparing pre-service teachers to instruct English language learners (ELLs), the first author approached a low-performing middle school near Los Angeles where, according to the School Accountability Report Card, 85% of the students were Hispanic/Latino, 47% were ELLs, and 79% were socio-economically disadvantaged. Only 9% of ELLs here scored at the proficient level on the California State Mathematics assessment as compared with 19% of Hispanic/Latino students statewide. With the principal's approval, this site was identified to participate in the summer and after-school intervention program. The first author worked with a mathematics specialist (fourth author) to conceptualize the project based on Moses' framework and other various frameworks

and articles for understanding and teaching minority populations (Echevarria, Vogt, & Short, 2008; Hollins, 2008; Moses & Cobb, 2001; Ortiz-Franco, N. Hernandez, & Y. De La Cruz, 2005).

The participating junior high school in Japan is located in Osaka, where 30-40% (the percentage fluctuates every year) of the school population is identified as being of Buraku origin and 55- 60% as socio-economically disadvantaged. In addition, more than 10% of the students have recently arrived from a foreign country such as China or have Korean heritage. The school site was selected because of its high minority student population, its willingness to accept outside observers, and the long-working relationship the first author has established with the school. The author's role on site, however, was minimal: She was an observer who neither participated in creating the curriculum nor teaching students. In short, she was a non-participant observer.

Participants

In the U.S., 15 pre-service teachers - ten female and five male – were identified by the first author from prerequisite teacher education courses. In order to teach in the summer intervention program and later after-school program, the participants had to demonstrate a willingness to learn different teaching methods with their peers. They received a modest stipend for their participation because the project was funded research. Of the participants, eight were Latino, four were Asian, two were White and one was Mixed Race (White and Latina). Three of these U.S. project's participants as well as the mathematics specialist and project collaborator were later invited as co-authors to describe the case in sufficient narrative for this manuscript.

In Japan, a male 8th grade mathematics teacher with less than five years of teaching experience was recommended by a school administrator. Author observation and interviews confirmed that the teacher appeared confident and showed a strong rapport with his students, unlike other teachers observed during the same visit. The teacher himself was from a non-Buraku background but mentioned that he had always had classmates and friends from a Buraku background when he was growing up. The teacher's drawing forward of this narrative strand from his personal biography suggested that he had developed a stance toward Buraku, one that resulted from his past positive experiences with Buraku peers. His unique style of teaching spurred the author to examine his instructional approach as a case study.

Design

Case study method has been widely used when examining successful pedagogical practices in schools in depth (Lipka, 1991; Ladson-Billings, 1994; Shulman, 1992). For the purposes of this study, the same case study method was used in order to examine teaching that had high outcomes among minority students in the U.S. and in Japan. As Stake (2005) stated, the aim of using case study is to "encapsulate complex meanings into a finite report but to describe the case in sufficient descriptive narrative so that reader scan experience these happenings vicariously and draw their own conclusions" (p.450). As such, the focus is on "process," whereby comprehensive, systematic, and in-depth information about each case is gathered

(Patton, 2002). As the first author visited the school site in Japan, distinctive teaching patterns emerged that struck a chord with the mathematics instruction the author was studying among minority students in the U.S. While these two cases were situated in entirely different context and languages, there were striking pedagogical similarities. In order to compare these cases on the central question of effective minority pedagogy, case study method was selected.

Observations, interviews, and multiple formal and informal conversations with the teachers in the U.S. and Japan focused on the research question: How do teachers engage academically and behaviorally disengaged minority students in learning abstract concepts? Additionally, informal conversations with students, administrators, community members, and other teachers, and document analysis of newspaper articles, books, field notes, city and school demographic data, and other related documents were all used in the data analysis process to confirm or disconfirm findings.

While these case studies did not take place under the same conditions, using the same researcher's lens to investigate successful, effective mathematics pedagogy for minority students across the international contexts potentially adds value and insights they afford. The knowledge grows across the studies, not as a result of accumulation as traditionally conceived, but through a common researcher expressing similarities and differences arising from conducting the case study method.

U.S. Case Study

The case studies will begin with the background context in which teaching-learning took place, followed by pedagogy, which was the meeting place of the learners, curriculum, and teaching. Finally, student performance, the outcome of the pedagogy, will be discussed.

Background Context

The junior high school is situated in a large Los Angeles metropolitan area. It has struggled academically and was designated a Program Improvement school under the No Child Left Behind Act. Nearly 100% of the students are ethnic minorities, of which half are English language learners of Hispanic/Latino descent. Not only were the students in need of basic mathematics assistance, but also in need of the confidence to believe they had the ability to succeed academically. The students were selected to participate in the program based on their CST mathematics scores, grades, and teachers' recommendations. The students scored "below" or "far below" on statewide testing.

In preparation for summer instruction, the teachers reviewed pedagogy for teaching second language learners, created and collaborated on lessons plans that incorporated multisensory approaches in order for students to comprehend sixth grade mathematical concepts. During the summer program, the teachers taught four and half hours a day, four days a week over eight weeks. The principal chose the 20 lowest performing sixth graders, allowing for a 1:2 teacher-student ratio. This group of students increasingly became engaged in math and literacy lessons daily, discussing challenges they encountered, and completing several projects by the end

of the program. Although fewer in number, once the school year began, students voluntarily decided to continue to meet after school, three days per week, for one and half hours at a time.

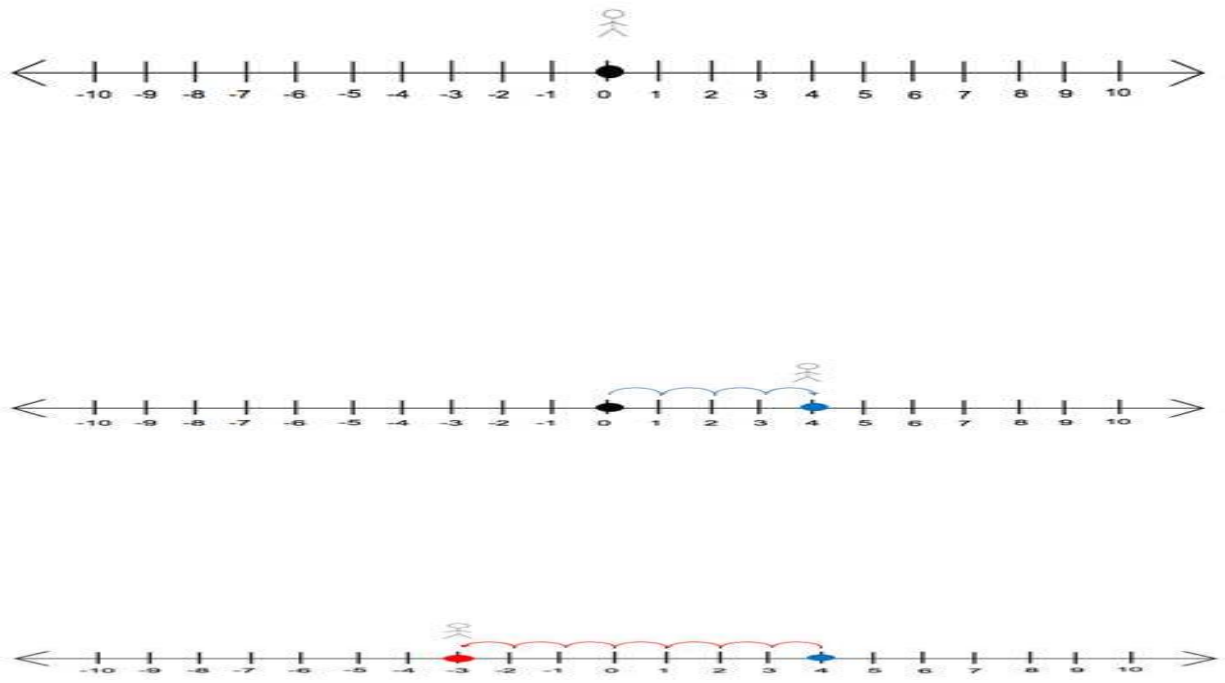
Pedagogy

The pre-service teachers in their learning community created innovative daily activities with their peers based on essential mathematical concepts identified by the National Council of Teachers of Mathematics Standards and the California Mathematics Standards. At least half of their teaching took place outside the classroom to provide kinesthetic learning opportunities. Activities took place on the basketball courts and fields, and the open space next to the classroom filled with chalk marks. The other half took place inside the classroom with visual and tactile activities, deliberately avoiding a traditional linear "lecture" style in order to address students' different learning styles. Hands-on, multisensory approaches can reduce linguistic demand on ELLs, thereby making content more comprehensible (Echevarria, Vogt, & Short, 2008; Peregoy & Boyle, 2005) and improves student learning and retention (Sousa, 2011). Students often worked with manipulatives and in groups to solve problems and questions. Teachers stood nearby or moved around the classroom to see who needed help. The teachers created a comfortable learning environment in which the students could voice their anxieties and frustrations. Furthermore, all of these activities took place in a rotating station format in order to meet students' short attention span.

At the Visual Auditory Kinesthetic Tactile (VAKT) station, students were taught through a multisensory approach, enabling them to retain and have a deeper understanding of the mathematic concepts. One such activity involved a number line drawn on the ground, where students physically moved their bodies along the line to learn about positive and negative integers (See Figure 1). "Okay, so we need everyone to place themselves at the starting point. What number do you think it is and why?" asked Ms. Patty[2]. The students excitedly raised their hands happy to be outside and yelled, "Zero because that's where you start counting!" After the teacher gave them a problem such as "4-7" (equivalent to 4+(-7)), students moved either right or left along the number line, depending on the number signs and operation symbols. Having gone through this common experience (Moses' Step One), students then drew what they had just experienced, to reflect non-verbally on what they had done during the physical activity (Step Two). In Step Three, students discussed what they did or thought they learned from the activity using every day language such as, "We moved left and right on the chalk. Sometimes we landed on the left of zero, and sometimes we landed on the right." Students were guided to Step Four, as the teacher restated students' everyday language into academic language. For example, Ms. Patty asked, "Does anyone know what we call numbers to the right of zero?" A few students answered, "They're positive numbers because they have plus signs in front of them on the number line." The teacher then scaffolded the students into naming the negative numbers. "What do you call the numbers to the left of zero?" asked Ms. Patty. "Minus numbers," answered the students hesitantly. "You're almost there," said the teacher. "Think opposites. The opposite of right is left. The opposite of positive is…?" "Bad…no, wait negative!" exclaimed the students. Ms. Patty

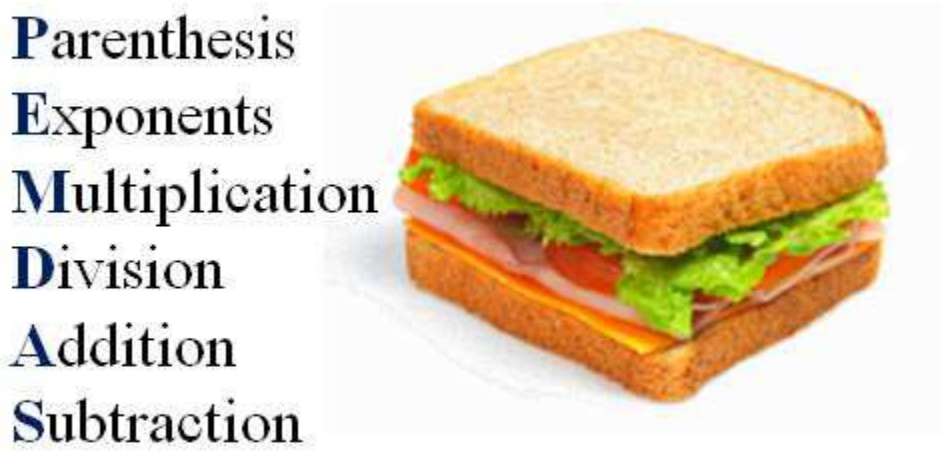
also added that positive and negative numbers are called positive and negative integers. In the final step, Step Five, teachers used mathematical symbols to express the previous step. Positive 4 minus positive 7 was expressed as “4-7 (or (+4) – (+7)).” To help connect it to students’ lives, Ms. Patty discussed how this concept was similar to borrowing money from a friend. “If you only have $4 and owe your friend $7, how much money do you still need to give him?”

Figure 1. Number Line Activity



At another station, Mr. Mark created a tactile activity to teach the order of operations (PEMDAS) by using student’s everyday experience of making a sandwich (See Figure 2). Mr. Mark first asked his students, “How do you make a sandwich?” The students responded, “First, we get the bread, then mayonnaise and mustard, then meat and cheese, and finally lettuce!” The teachers then connected the sandwich activity with the order of operations: starting with parenthesis, exponents, multiplication/ division, and ending with addition/subtraction. As a culminating activity, students created their own sandwiches while reciting the order of operations. This connection between math concepts and everyday application is something the teachers presented consistently: Math is fun, useful, and needed for students’ everyday life.

Figure 2. PEMDAS Activity



Since many students had difficulty converting word problems into equations or deciphering directions (e.g. “evaluate”), literacy stations were created. The Matching Star center introduced and helped students analyze key math terms such as “division” and “percent,” as well as phrases like “more than” through the use of games where terms were matched with the relevant symbols (e.g. ÷, %, >). Later, teachers helped students break down key terms by associating them with familiar words. For example, when Ms. Kathy covered basic geometry terms, she knew she had to break down this new terminology so as not to intimidate her students. For a term such as “equilateral,” Ms. Kathy wrote it on a whiteboard and asked students, “What does ‘equilateral’ remind you of?” “What could this word mean, do you think?” The students first looked at one another’s faces for a clue before Josie finally yelled, “Equal!” Soon enough, all the students were discussing what “equal” meant, where they had seen it before, and how these meanings were related to this new word. Ms. Kathy continued to break the words into smaller parts, such as prefixes, suffixes, and core words. She explained that the prefix “tri-” in triangle, for example, was associated with other familiar words with similar prefixes such as “tricycle” or “tripod,” guiding her students to discover that “tri” meant “three.” In this fashion, Ms. Kathy demystified mathematical vocabulary so students would not see them as a world apart from themselves, but instead part of the world and language they already owned and valued.

During recess and before and after the program, many teachers also spent time with their students in order to find out more about their favorite food, sports, movies, skills, and concerns. On one occasion, during a break, Ms. Patty saw her student Natalie making lanyards by weaving colored strings. Ms. Patty commented, “I remember making those when I was in school. I love

the colors. You weave so quickly and you are really talented!" Being encouraged by her teacher's positive comment, after making her lanyard, Natalie gave it to Ms. Patty. Feeling badly that she had taken her student's only lanyard, Ms. Patty returned it to Natalie saying, "Thank you, Natalie. It was very sweet of you to offer." Ms. Patty knew that Natalie had no other strings to make another. Shortly after that, being touched by the student's kind gesture, Ms. Patty bought her some strings. The teacher's gesture reciprocally touched Natalie who returned the next day with a new lanyard she had begun making. "I started making you one out of your favorite colors," Natalie told Ms. Patty. In this fashion, by the end of the summer program, many teachers built a close caring relationship with students after earning their respect and trust.

Finally, at the end of each day, the teachers met with their peers in their learning community through face-to-face debriefings and an on-line discussion forum to discuss, suggest, and make sense of what happened in their teaching. They discussed student behavior and pedagogical questions that had arisen during instruction and planned for the next lessons.

Student Performance

Based on the consistent participation of students, pre-and post-assessments conducted at the beginning and end of summer were used to gauge learning. There were marked gains on the fundamental concepts of basic operations, negative numbers, rate, and equations: 57% to 77%, 36% to 70%, 57% to 84%, and 55% to 97% respectively (Author, 2011). The most significant improvement occurred in fractions, which is considered the greatest obstacle to learning algebra in the U.S. (National Mathematics Advisory Panel, 2008): the average score rose from 24% to 69%, a gain of 45 percentage points. Finally, in the area of questions that required reading skills such as word problems, there were significant gains from 27% to 41%. This increase is noteworthy considering that the students were ELLs, as they tend to have a weaker mathematized-situation language even when they may not have difficulty communicating in ordinary life (Ron, 2005).

Japanese Case Study

Background Context

The junior high school where this case study took place is known for its high Buraku student population, human rights focus, and dedicated instructors. Teachers, administrators, and staff here openly classify their experience as *"shindoi,"* the closest translation for which is "struggling" or "challenging," due to multiple obstacles faced within the school, starting with students' lack of attendance, disruptive behavior during instruction, low academic performance and motivation, and family and financial issues. In order to address these *"shindoi"* phenomena, the staff puts extra effort into connecting to and motivating students. For example, teachers regularly conduct "lesson study" professional development examining their pedagogy well into after-school hours and place *"kahai"* ("additional") teachers, sent by the city, to support instruction.

One of the most unique programs the school offers is a special overnight fieldtrip for the entire 8th grade to visit Nara, where the Buraku liberation movement started. While there, students visit the museum, listen to the rich oral history given by the Buraku activists and residents, and conduct fieldwork such as interviews and observations. Prior to visiting the site, teachers help students prepare for the event by learning about the Zenkoku Suiheisha (formerly Buraku Liberation League), its people and historical milestones. At night, students discuss what they learned from their fieldwork and share their experiences and feelings regarding discrimination. According to an accompanying teacher, in this intimate and powerful setting, many students open up their hearts, Buraku and non-Buraku students alike, to support each other in sharing their deep feelings. This conversation often lasts deep into the night, as they listen to testimony after testimony about each other's trials and develop empathy for and rapport with each other. As a follow-up activity, once back at school, students publish a journal about what they learned from their experience (Author, 2009).

Pedagogy

Dressed in casual athletic pants and shirt, Mr. Kato walks around the building talking to passing students. They approach him with ease and comfort. In addition to his role as an 8th grade mathematics teacher, Mr. Kato is a respected baseball coach whose long-time passion is to take his team to *koshien*, a prestigious annual high school baseball event held in Osaka, which attracts the strongest baseball teams from each of the 47 prefectures in Japan. In his classroom, Mr. Kato approaches the often complex subject of mathematics by using stories, games, and manipulatives to help his students become motivated to learn mathematics. While many of the students have given up hope of learning mathematics, Mr. Kato feels his primary responsibility lies in making it accessible to them. He openly admits to his students, "If you don't understand (mathematics), it's my fault!" His words seem to relieve some of the math anxiety that has accumulated in his students over time.

Throughout his lessons, whenever students utter "I don't understand!" or "I never learned this!" Mr. Kato tries to use familiar language instead of using mathematical jargon. For example, when teaching variables "a," and "b," Mr. Kato used his students' initials "Aoki," and "Baba" in order to connect with his students and make it more concrete. Likewise, he often uses baseball vocabulary such as "Suzuki, this is the 7th inning, concentrate!" in order to relate to many athletes in class. On one occasion, he shared his *koshien* story when he was in 9th grade himself and related his nervous and challenging experience with his students as they worked for the first time on the expansion of the formula $(2x + 1)(y-7) = 2xy -14x + y –7$. By providing step-by-step scaffolding, Mr. Kato acknowledges that some of his 8th graders are still having trouble with multiplication, which is normally covered in 2nd grade in Japan. This, according to Mr. Kato, negatively impacts their learning and understanding divisions and fractions.

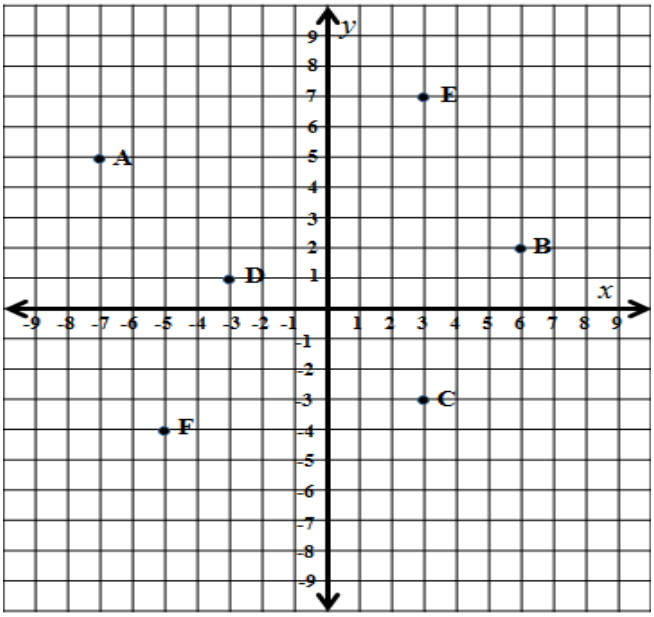
Examples of mathematics activities used in Mr. Kato's 8th grade classrooms include using snacks to teach linear equations with two variables and teaching X & Y coordinates through a treasure hunt. In the first example, the teacher initially provided two sets of real

objects: five chocolate bars and three cookies for 210 yen and five chocolate bars and eight cookies for 310 yen. The same number "five" for chocolate bars made an easy entry for students to find how much each cookie and chocolate is. In the next step, the teacher provided slightly harder challenges with different coefficients for each snack: five chocolate bars and four cookies for 120 yen and two chocolate bars and two cookies for 56 yen. Since this question is more strenuous, the teacher prepared hints such as "When you buy two of the second set, you will find a new way to solve the problem!" Eventually, students figured out that by buying four chocolate bars and four cookies for 112 yen, one chocolate bar was 8 yen. The key in this activity is for students to become increasingly independent as Mr. Kato guides them, rather than simply handing out the answer.

Mr. Kato also created a treasure hunt activity, in order to teach X and Y coordinates (See Figure 3). First, he posed a question: "This treasure map was found at Mr. Kato's residence. Along with the map came a sentence 'If you go to the right one step and up four steps, you will find the treasure.' Can you find the treasure on the map?" After students had the opportunity to explore the first question, the teacher then led them to the next question, "If the sentence said 'you will find the treasure if you go to the right one step and go down four steps from Point A,' let's think about where the treasure is." After going through this exercise, Mr. Kato gave another map with Points A through F for students to hide their own treasure on the map and had them explain to their classmates where they hid it. He finally concluded the activity with the question "Let's think about what is necessary in order to communicate to others where you hid treasure."

As in the first activity, Mr. Kato carefully guided his students step by step to discover important principles such as having common rules and standards to communicate with each other. In this example, students first found that they needed a beginning point such as Point A to even begin describing where they want to go (i.e. direction). Then they were guided to hide their own treasure to apply what they had just learned. They eventually learned to express the location by calling the right/upper side as "+" and left/down side as "-" on the coordinate so that everyone is on the same page. In explaining these principles, the teacher stressed again the importance for students to discover these essential principles heuristically.

Figure 3. Treasure Hunt Activity



Mr. Kato's strong belief in his role as a facilitator in students' learning, rather than as a dispensary of knowledge, is evident throughout his instruction. This reflects a school-wide philosophy that teaching is all about supporting students' own learning. After writing the answers for the three expansion questions mentioned earlier, Mr. Kato encouraged his students to find patterns across the identified solutions (See Figure 4).

Figure 4. Expansion Examples.

$$(x + 5)(x - 7) = x^2 \overset{+}{- 2x} \overset{\times}{- 35}$$

$$(x + 2)(x + 4) = x^2 \overset{+}{+ 6x} \overset{\times}{+ 8}$$

$$(x - 9)(x - 3) = x^2 \overset{+}{- 12x} \overset{\times}{+ 27}$$

Rather than overtly presenting an alternative method for what is commonly called the FOIL (First, Outer, Inner, Last) method, Mr. Kato simply wrote a "+"sign on top of the -2x, +6x, and -12x in the examples, and an "x" sign on top of the -35, +8, and +27. He then encouraged the class, "I would be happy if you could notice the pattern here." Finally, the teacher invited those students who understood the hints or patterns to share with their classmates. In this way, Mr. Kato guided his students to discover a problem-solving strategy on their own. Namely, a fast method of expanding simple binomials when the variable(s) have a coefficient of 1: square the variable to create the first term of the polynomial, add the constants/numbers in the binomials to get the middle term, and multiply those same numbers to form the last term. Mr. Kato's

pedagogy is thus well thought out and moves from an easy entry point to increasingly challenging tasks, which is a characteristic trait of Moses' Five-Step Approach.

When he teaches, Mr. Kato provides a meaningful, hands-on experience to the students before introducing mathematical terms and abstract symbols (i.e. Step One in Moses' Five-Step Approach). During this process, the teacher's role is to guide students to discover patterns and rules on their own by posing questions that scaffolded step by step. Only after students are engaged in an activity based on the target concept and had time to make sense of the experience using their own words (i.e. Step Three) did the teacher explain the concept using mathematical language with abstract symbols (i.e. Step Four and Five).

What is particularly unique in Mr. Kato's teaching is that he believes that classroom management is directly connected to instruction, demonstrated by his excellent classroom management skills throughout his classes. On a number of occasions, the author observed the same students who were engaged in Mr. Kato's classes misbehaving in other teachers' classes. When asked how he handled student behavior problems, Mr. Kato responded that even if students were behaviorally disruptive, once they are engaged and interested in learning, they will show fewer behavioral problems.

Student Performance

The 2009 Academic Performance Report published by Osaka Prefecture reveals that while junior high schools in Osaka prefecture scored 45.9% on average, the case study junior high school's overall average was 39.9%. In contrast, the 8th graders taught by Mr. Kato score up to par with the Osaka prefecture average (45.9%) and in some questions, score much higher than the average. For example, on the following question, whereas the Osaka prefecture average was 82.8%, his students' average was 95.7%: $16ax^2 \div 4ax$. Likewise, in the question of $\frac{7a-3b}{8} - \frac{2a-b}{2}$ the Osaka prefecture average was 48.9% while his students' average was 56.5%. These scores indicate effectiveness in the teacher's pedagogy described previously.

Limitations

There are some limitations in this study. First, these case studies were conducted independently of each other, as the original intent was to examine them as separate studies. Only later did the idea to compare them occur, when unanticipated similarities were discovered. As such, a pure comparison between the U.S. and Japanese teachers in terms of the number of participants, background preparation, years of teaching experience, test results, and others was not feasible. In this sense, then, identifying patterns is "exploratory" in nature, begging for a more elaborate, robust study. Another limitation is researcher bias, especially in the U.S. case study. The researcher/first author along with the mathematics specialist created the project for the pre-service teachers based on Moses' framework among other frameworks. As a result, results of the study may have been influenced by their preconceived ideas and subjectivity.

Discussion

The two case studies from the U.S. and Japan revealed that despite many differences in their educational systems, distinct similarities existed in U.S. and Japanese pedagogy when teaching mathematics to minority students: 1) connecting mathematical concepts with students' prior experience and knowledge by providing hands-on, multisensory learning activities; 2) using familiar, every day words before introducing academic language of the mathematics discipline; 3) integrating literacy throughout instruction; 4) guiding students to become critical thinkers through an inquiry process; and finally, (5) developing trusting relationships with students and peers within a caring community, which fostered motivation and student learning.

Both international case studies support the assertion that successful pedagogy connects mathematical concepts with students' prior experience and knowledge through hands-on, multisensory activities. As illustrated by writing and moving along a number line on the playground, playing with chocolate bars and candies to figure out equations, working on a treasure hunt map to learn about X and Y coordinates, teachers provided concrete experiences using visual, auditory, kinesthetic, and/or tactile modalities of learning. This is equivalent to First Step in Moses' Five-Step Approach, in which teachers create a common physical experience for all students as a starting point to later connect back to mathematical discussions. Setting up a stage or background context at the beginning of instruction not only engages students but also creates multiple access points to develop their understanding of abstract concepts. This initial step provides students with the important "link" or foundation in learning mathematical concepts and vocabulary in later steps.

Another characteristic that existed in both case studies was the use of familiar, everyday language before introducing academic language. When teaching positive and negative numbers and X and Y coordinates, for instance, the teachers used "moving left and right on the chalk/tape" and "go to the right one step and go to the left four steps" to indicate "positive and negative" or "+, -." This depicts Step Three in Moses' framework, which encourages the use of every day, non-mathematized language. To help students articulate their experience using their own language in which they feel comfortable is critical, as this provides an easy or nonthreatening entry point for them to learn mathematics. Furthermore, it enables them to make a connection between ordinary language and mathematical language and concepts. Hearing students make sense of their experience in their own words also helps teachers assess students' understanding, which informs teachers to make better decisions about their pedagogy.

Related to the use of everyday language is the integration of literacy throughout instruction. Mathematics not only involves numbers but also specialized vocabulary. For many, it is similar to learning a foreign language (Cirillo, Bruna, & Herbal-Eisenmann, 2010). As Mr. Kato and the U.S. teachers demonstrated, in order to make learning meaningful, teaching literacy along with concepts must become the essential focus of instruction. Teachers need to be cognizant of breaking down difficult words, have students actively read and write mathematical vocabulary in context, or even generate problems on their own using newly acquired vocabulary. By so doing, students will be able to manipulate academic language that is often intimidating.

Moses' Step Four accurately describes this particular point: to guide students to gradually move from talking about the experience using ordinary discourse to talking about the experience using more regimented mathematical language.

The case studies also indicated that effective teaching pushes students to become critical thinkers through an inquiry process. Rather than focusing on the *product* or outcome by simply giving out answers, these teachers focused on the *process* by guiding students step by step with questions that stimulated their thinking. As evidenced in the Matching Star station where the teachers guided the students to apply problem-solving strategies in learning new vocabulary and Mr. Kato's treasure hunt activity that led his students to eventually hide their own treasure on the map, Moses' framework precisely provides such a scaffolded process, breaking down learning experiences in five steps from less challenging to more challenging tasks.

Finally, at the core of successful minority pedagogy lie trusting relationships between teachers and students within a caring community, which fostered student motivation and learning (Villegas & Lucas, 2002). Grounded in a pre-service teacher community, the U.S. teachers collaborated to create activity plans, taught rotating stations with their partner(s), and discussed academic and behavioral issues day and night. Additionally, they endeavored to create a learning environment where students felt connected and safe in their learning of mathematics as in the lanyard and sandwich examples. On the Japanese side, lesson study provided opportunities for teachers to share and discuss their teaching with their colleagues. Through an overnight fieldtrip, teachers also encouraged students to learn about Buraku history and discuss discrimination issues and personal experiences, which helped them build deeper relationships with one another. Finally, Mr. Kato built a caring community in his classroom where students were motivated to learn through his baseball stories and other encouraging remarks.

In summary, although limited in scope and size, these exploratory case studies found East met West with similar characteristics when comparing successful strategies in teaching mathematics to students of minority status. Furthermore, this international comparison study points to the importance of providing meaningful pedagogy for minority populations that experience a disconnect between home and school when faced with learning abstract mathematical concepts and academic language. As Darling-Hammond (2006) asserts, successful teachers must be able to link what students already know with what they need to know through a variety of activities based on their distinctive learning needs. Truly, providing effective instruction to minority students stands at the forefront of our mission and mandate in preparing teachers for the future.

Notes:

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1. Historically the Buraku were regarded as "untouchables" or "polluting" due to the influences of Buddhism and Shintoism, which views killing animals or handling their carcasses as "polluting." Their assigned roles as animal slaughterers, sewage removers, and prison guards in

earlier historical periods contributes to the stigmatized status of the Buraku today (Harada, 1996; Ogbu, 1978; Shimahara, 1991). The term "Buraku," which literally means "village" can be perceived as a discriminatory term in Japan. For further explanation, see author's previous work (2009).

2. All of the names of the schools, teachers, and students that appear in this manuscript are pseudonyms.

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