Effects of a Culturally Responsive Project on Engaging Asian American Students in Mathematics Group Work

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by

Cilei Han

The Evergreen State College

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Sunshine Campbell, MEd, Member of the Faculty

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Abstract

How can educators engage Asian American students in mathematics group work even when many of them are successful in knowledge tests? Previous research found culturally responsive teaching can positively activate students' potential in academic and social abilities (Gay, 2002). In this study, an Asian culturally responsive mathematics curriculum project was designed and implemented with 33 Asian American and 23 non-Asian American high school students. The cultural responsiveness of five mathematics tasks used in the project was analyzed using qualitative methods. Data from a pre-survey, records of students' discourse and an exit survey were analyzed using quantitative methods to identify the effect of implementation of the five mathematics tasks. This study shows that: the teacher-designed mathematics project was a successful example of culturally responsive teaching content; and it can improve Asian American students' mathematics communication ability significantly. The strategies of using an Asian culturally responsive project to engage Asian American students in mathematics group work were further discussed, and recommended in this study. The proposal of "commence with communication quantity, and then develop communication quality" by this study can also be applied to education in other fields.

Keywords: Asian American students, culturally responsive teaching, mathematics communication, group work

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Effects of a Culturally Responsive Project on Engaging Asian American Students in Mathematics Group Work

Introduction

Since the liberalization of immigration policy in 1965, the number of first-generation immigrants living in the United States has quadrupled, from 9.6 million in 1970 to about 38 million in 2007 (Segal, Elliott, & Mayadas, 2010). The U.S. attracts more immigrants than any nation in the world. In 2009, 7.9% of K-12 Washington state students were categorized as Asian (OSPI data, May 2009) compared with 1.5% in 1977. There are 23 Asian American ethnic groups in the U.S. and more than 100 languages and dialects are used in daily life. For such a rising and complex population of students in our public school system, this is a group that is often marginalized in the research literature when paying attention to mathematics education due to their relatively high level of achievement in mathematics and science (Corbett, Hill, & Rose, 2008). However, this test performance is uneven by grade level, subject area, student subgroup and ethnic group (Hune & Takeuchi, 2008).

Another noticeable phenomenon which has been recently investigated by many researchers is the low engagement of many Asian American students in group work activities (Csete, Yan, & Kwan-Liddle, 1998; Saigo, 2008). Campbell and Li (2008) interviewed 22 Asian American business undergraduate students and found they held intensely negative views about group work. Similarly, a common opinion of "too much emphasis on group work" was held by 96% of Asian American participants in Huang and Brown's study (2009). Studies have shown that these negative attitudes come from various sources: students' unfamiliarity with the North American culture; inadequate

English proficiency; their cultural and educational background, a competition-oriented model of learning; and their underdeveloped interpersonal communication skills (shyness, low self-esteem, lack of confidence and face saving) (Berman & Cheng, 2001; Ferris & Tagg, 1996; Trice, 2001). Huang and Brown (2009) summarized some of the negative impacts reported by Asian American students:

- Lack of leadership skills to manage a group.
- Not involved with the community.
- Quiet, don't speak up.
- Reward individual for outstanding actions.
- Unwilling to take chances.

Johnson (2006), in *Privilege, Power and Difference*, even described that "Asian Americans, for example, are routinely treated like 'techno-coolies' to be managed for their talents but never allowed to manage themselves or other"(p.59).

In mathematics learning, the impairment of low engagement in group work is even stronger. The National Council of Teachers of Mathematics (NCTM, 2000) clearly expressed that "students should be good collaborators who work effectively with others", because "changes in the workplace increasingly demand teamwork, collaboration, and communication" (p.346). NCTM (2000) values communication as a fundamental element of mathematics learning and developed Communication Standards for Grades 9-12 as one of the ten standards. Certainly, Asian Americans' discomfort in group work can negatively affect their communicative ability in mathematics learning and lead to a lower cooperative level in the future.

Although the above studies have contributed to investigating the phenomena of and reasons for the low engagement of Asian American students in cooperative learning, substantial interventions are rarely explored and applied. Hence, this research aims to find a possible means to help Asian American students with positive engagement in group work. In the next section, I will first review the theory of culture and "Culturally Responsive Teaching" (CRT), especially on the construction of curricula. I will then review the current research literature on group work. It will help me answer three research questions in the study: (a) what is the experience of Asian American students in mathematics group work? (b) What are some features of an Asian culturally responsive mathematics task? (c)What is the relationship between my culturally responsive mathematics tasks and ability of Asian American students' communication in group work?

Given that much of the research has focused on African American and Mexican American students (Ladson-Billings, 1995; Gutstein, Lipman, Hernandez & Reyes, 1997), I wish to contribute to this much-needed area of research for underrepresented Asian-American students.

Literature Review

In reviewing the literature, I first explore the definition of culture and two culturally related reasons that influenced Asian American student engagement in mathematical group work. Due to Asian American students' comparatively higher mathematical academic achievement, their issue of low participation in group work had not been explored until 1998 (Csete, Yan, & Kwan-Liddle, 1998). The possible causes behind the issue are complex. One of the main reasons is the current mathematics curricula reflect the dominant-society-culture (Ladson-Billings, 1995) which might

marginalize Asian American students' participation in the classroom. One of the solutions might be using an Asian culturally responsive curriculum project to help these students with group work engagement (Gay, 2000). This is the second part of my literature review, which introduces the concept, elements of culturally responsive teaching, and the methodology of the curriculum construction.

Lastly, I summarize the background information and features of group work and focus on the importance of students' communication style and ability to work in groups. In all, use of a culturally responsive curriculum project to improve Asian American students' mathematical communication ability is one possible method to engage these students in mathematical group work.

Culture

The concept of culture has been studied extensively. Gutstein, Lipman, Hernandez & Reyes (1997) described culture as "the ways in which a group of people make meaning of their experiences through language, beliefs, social practices, and the uses and creation of material objects" (p.712). Hall and Trager (1953) defined culture as a set of patterns experienced by individuals as normal ways of acting, feeling, and being. For Spradley (1967), culture is "the acquired knowledge people use to interpret experience and generate behavior" (p.6). Culture is thus seen as involving not only everyday practices but also the way that people understand ideas and ascribe meaning to everyday life (Smith-Maddox, 1998). Asian or Eastern culture was initially constructed by Confucianism (Pye, 1985), which emphasized the importance of harmony and inner peace. In modern society, many Asian American students inherit these traditions such as respecting authorities, avoiding arguments and preferring refining themselves to earn

personal success (Darder, 1995). This differs greatly from the dominant U.S. culture. These differences in attitude might be one cultural reason that causes discomfort for Asian American students during group work activity.

The second cultural reason which influences Asian American students' performances in group work might be the curricula current American students are using. Culture plays such a significant role in teaching and learning that every curriculum and pedagogy is culturally responsive in some way. Even in mathematics, which is often viewed as culture-free, there is a place for cultural diversity in the math taught in school (Bishop, 1988). For example, according to various social and life practices, the units of length, weight, volume and currency vary from country to country. After people immigrate to other countries, they often feel that their culture is underrepresented and that the new curriculum and pedagogy reflect the culture of the dominant society. The notion of "cultural capital" (Bourdieu, 1977) has been used to study the complex ways in which schools perpetuate inequality. That is, although all ethnic groups have cultural resources that are valuable within their local community contexts, only certain resources are legitimate in American school settings (Lewis, 2003). Those certain resources "help students appear to be the correct kind of student, provide those who have it with multiple benefits, and support them with important knowledge" (p.171). For Asian American students who do not possess Western formal knowledge, they might have limited access to American-culture dominated classrooms and comparatively-weak common understandings. As a result, the culturally marginalized curriculum context can play an important role in disengaging Asian American students in group work activities. Culturally Responsive Teaching may be a possible way to support and engage Asian

American students in group work. In the next section, I will review this theory and adopt it as a standard in designing my culturally responsive mathematics tasks.

Culturally Responsive Teaching

Culturally Responsive Teaching (CRT) explores bringing multiculturalism to the educational mainstream. Gay (2010) defined CRT as "using the cultural knowledge, prior experiences, and performance styles of diverse students to make learning more appropriate and effective" (p.106). There is evidence that teachers who build on children's informal knowledge in mathematics classrooms help students use their knowledge effectively, make meaning out of mathematical situations, learn mathematics with understanding, and connect their informal knowledge to school mathematics (Carpenter, Franke, Jacobs, Fennema, & Empson, 1998)

Five essential elements of culturally responsive teaching are identified by Gay (2002) as:

- Developing a knowledge base about cultural diversity
- Including ethnic and cultural diversity content in the curriculum
- Demonstrating caring and building learning communities
- Communicating with ethnically diverse students
- Responding to ethnic diversity in the delivery of instruction.

The curriculum design is a key function in the process of incorporating cultural pluralism (Smith-Maddox, 1998). Three kinds of curricula: formal plans, symbolic curriculum, and societal curriculum are routinely present in the classroom, each of which offers different opportunities for teaching cultural diversity (Gay, 2002). The first curriculum, formal plans, is one of my two important working targets. It focuses on

instruction approved by the policy and governing bodies of educational systems. This type of curriculum is usually anchored in and complemented by adopted textbooks. Even though these curricula have improved over time in their treatment of ethnic and cultural diversity, they are still not as good as they need to be (Wade, 1993). Over the past 30 years, culturally relevant curricula have been explored in the following cultures: native Hawaiian (Boggs, Watson-Gegeo, & McMillen, 1985), Mexican American (Gutstein, Lipman, Hernandez, & de los Reyes 1997), African American (Foster, 1989 and Lee, 1993), Latino and limited-English speakers (Garcia, 1999) and native Alaskan (Lipka and Mohatt, 1998). This research indicates that culturally relevant curricula have positive effects on the academic achievement of ethnically-diverse students and can reflect ways of communicating and learning that are familiar to the students (Gay, 2000). However, there are still not enough teachers who know and understand what culturally responsive teaching is, especially Asian culturally responsive teaching, and how it might be enacted in the mathematics classroom to support students engagement.

Finding appropriate examples of culturally relevant teaching in practice has been described as “capturing lightning in a bottle” (Ladson-Billings, 1997,p.725). By anchoring in *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989), this research study aims to construct an Asian culturally responsive curriculum project for better representations of Asian cultures engaging Asian American students in an environment that utilizes group work. Before describing the methodology of my research, I will review the theory of group work to uncover the necessity of using a culturally responsive curriculum project to help Asian American students close their communication gap among diverse ethnic groups.

Group Work

Constructivism fosters collaboration over competition, active learning over passive learning and community over isolation (Gross, 1993; Cross, 1998). As a core of constructivism and "a fundamental revolution in epistemology" (Cross, 1998, p.7), group work, which is often used interchangeably with collaborative learning, constructive learning, peer learning, group learning, and learning community, has become a more common practice in schools in the last twenty years. In a group work learning structure, students are divided into small groups to answer a few challenging questions, to learn content knowledge, to exchange ideas or to complete cases, projects and group assignments (Cohen, 1994). Group work learning is believed to foster critical thinking, conceptual learning, develop individual accountabilities, improve problem-solving strategies, second language acquisition and provide a comfortable and supportive learning environment (Cohen, 1994; Holter, 1994 ; Porter, 2006). Besides these academic goals, cooperative learning also develops conflict-management skills, positive intergroup relations and socializing students for adult roles (Cohen, 1994; Porter, 2006). Research has compared students who came from classes using cooperative learning and from classrooms where only whole class instruction was in use. These studies showed the former learned much more and had far more helpful and cooperative behavior than the latter (Merriam, 1984). The NCTM (1989) advocates group work learning because "small groups provide a forum in which students ask questions, discuss ideas, make mistakes, learn to listen to others' ideas, offer constructive criticism, and summarize their discoveries in writing" (p.79). Therefore, the group work learning approach can be

viewed as an effective means for students to learn and practice communication in school life, which could be utilized in their future careers.

However, group work learning could be problematic in a cross-cultural classroom because communication styles can vary among diverse ethnic groups. In traditional schooling, students are expected to listen quietly while the teacher talks and to speak only when granted permission by the teacher. But for African American and native Hawaiian students, they are used to providing prompts, feedback and commentary when someone is speaking, which were summarized as "Call-Response" by Baber (1987) and "Talk-Story" by Au & Kawakami (1994). Tannen (1990) named "Rapport Talk" for some European American females because they prefer showing involvement, support and confirmation by actively talking together. In contrast, most Asian American students would keep quiet or simply answer "Yes" to show respect to the speaker and save honor whether they understand or not (Liu, 1994).

Gay (2002) stated that the specific cultures of different ethnic groups must affect learning and working behaviors. It is the teachers' responsibility to not force or expect students to "divorce themselves from their cultures and learn according to European American cultural norms" (p.114). Instead, teachers can be encouraged to adopt culturally responsive teaching for ethnically diverse students to improve their academic and social achievement (Au & Kawakami, 1994; Gay, 2000; Ladson-Billings, 1995, 1997). The purpose of this research is to help Asian American students improve their engagement in group work by providing an Asian culturally responsive curriculum project, not forcing students to employ a certain communicative style. Hence, I designed an Asian culturally responsive project, investigated the current situation of Asian

American students on mathematics group work, and examined the impact of the culturally responsive mathematics project on Asian American students' communication.

Methods

I first introduce how I selected my study participants and I provide a flow chart to illustrate how my different participants "worked" in this research study. Then I introduce three sets of assessment tools and analysis methods respectively according to my three research questions. The first set of assessment tools include: a document analysis of Chinese culture and school mathematics, and an exit survey to score the culture responsiveness of my curriculum project. The former tool employs a qualitative method, which explains the procedure of designing these Asian culturally responsive math tasks and the main reference. The latter tool is a quantitative method which assesses the culture responsiveness of five mathematics tasks. By using these two methods, I could answer my first research question: what are the features of an Asian culturally responsive mathematics project?

The second set of assessment tools was used to answer my second research question: What is the current situation for Asian American students in mathematics group work? I used a pre-survey to help me understand students' perceptions regarding mathematics as a subject, group work and their self-evaluations on communication ability.

The third set of assessment tools was used to answer my third research question: What is the impact of my culturally responsive mathematics project on Asian American students' communication? This tool quantitatively focused on student interactions and discussions in group work by a standard measurement system. It included the quantity of students' communication and an analysis of the quality of communication. Mean, standard deviation and t-test were calculated to investigate the communication change that occurred through the five math tasks. Correlation coefficients were used to describe

the relationship between the change and the responsiveness of the tasks. From the pre-survey to the post-research analysis, these research methods provided contrasting pictures of Asian American students' attitudes, self-evaluations and changing performances through the five math tasks.

Study Participant Selection

This research study was conducted at Lakeview High School[1] where I work as a part time Chinese language teacher. It is ranked outstanding by the state Department of Education and more than 95% of students graduated on time. The demographic breakdown is: around 90% of students are white; less than 10% of students are enrolled in state free/price reduced lunch program. My Chinese classes have a total of 65 students in grades 9-12 in the Chinese Level 1-5 classes. Among them, 17 students have two Asian parents, 19 of them have one Asian parent, and one Asian girl is adopted by a white family. These 37 students are the Asian American students considered in this research study, and they consist of about half (56.9%) of all my students. See the corresponding Table 3.1 for details of democracies of all participants. The main body of the research study was designed to include three steps: (a) a pre-survey in which participants answer a questionnaire regarding attitudes towards math learning and group work. (b) Implementation of five math tasks in group work. (c) An exit survey in which participants answer two questions regarding the cultural responsiveness of the mathematics tasks.

I was required by the school district to conduct this study using after-school time since this project is for mathematics education, not for Chinese language education. This

[1] Names are changed to protect participants' identities.

made it difficult to find participants since the group work required participants to stay after school. After the first round of enrollment, only 19 students (13 Asian Americans and 6 non-Asian Americans) agreed to take part in all three steps, which I called "full time" participants. To obtain a larger data base to evaluate my teacher-designed curriculum project, I decided to maximize the number of research volunteers by enrolling "part time" participants. This group didn't take the pre-survey but completed the five math tasks at home independently since they could not stay after school. They then took the exit survey together with the first group. There are 37 "part-time" participants (20 Asian Americans and 17 non-Asian Americans) in the second group. This second group of participants provided useful data to evaluate the cultural responsiveness of the five math tasks. Figure 2.1 illustrates how participants were selected and the activities in which they participated.

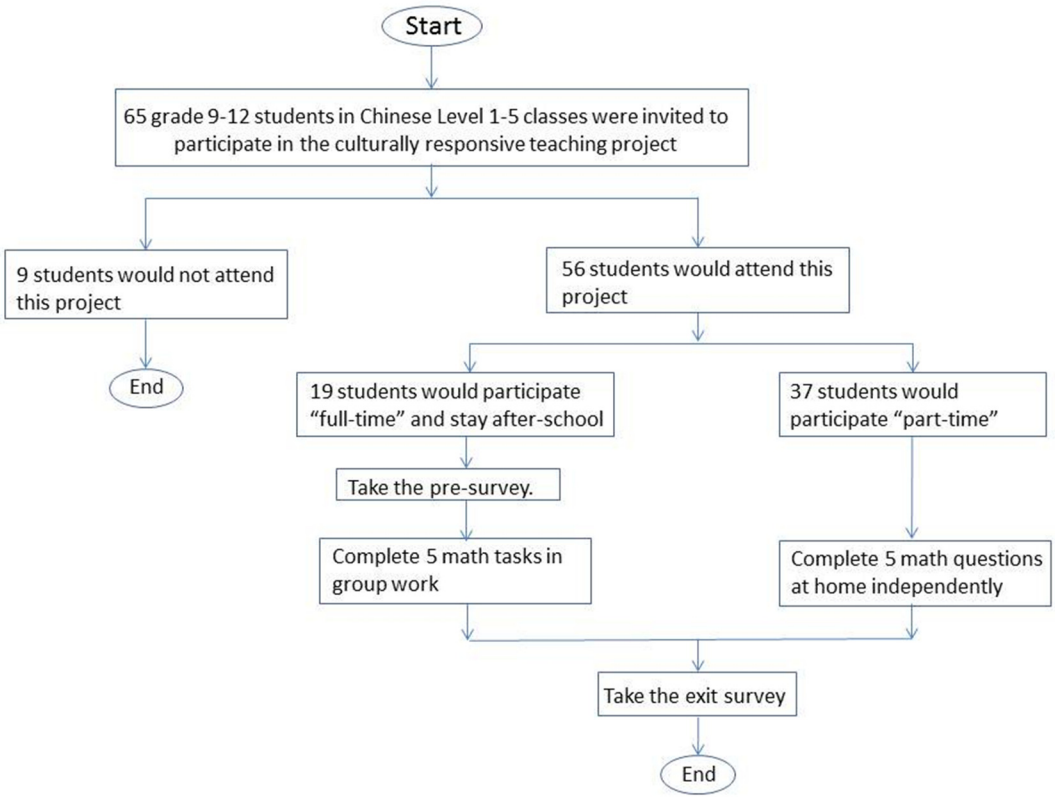

Figure 2.1 Participants Selection and Activities They Attended

Assessment Tools and Analysis Methods

The three research questions in this study were: (a) what is the experience of Asian American students in mathematics group work? (b) What are some features of an Asian culturally responsive mathematics task? (c)What is the relationship between my culturally responsive mathematics tasks and ability of Asian American students' communication in group work? Thus, I have three sets of assessment tools and analysis methods respectively. For the research question (a), a pre-survey and a quantitative method were employed. For the research question (b), both qualitative and quantitative methods were used. I qualitatively analyzed Chinese culture and school mathematics documents and designed an exit survey to quantitatively score the culture responsiveness

of the curriculum project. For the research question (c), great amount of quantitative methods were employed which included word counting and discourses classification by the NCTM standards.

Pre-survey. A Likert scale survey was employed to investigate students' attitudes towards mathematics learning and their self-perception on mathematics communication. There are a total of 20 questions under three categories: attitude towards mathematics (8 questions), attitude towards group work (5 questions), and self-perception of communication ability (7 questions). Participants were asked to choose from 1 ("strongly disagree") to 5 ("strongly agree") on the basis of a description of the practices associated with students school life. The completed surveys were divided into two groups: an Asian American group and a non-Asian American group. For scores collected from each group, an Excel spreadsheet was used to calculate the means of scores received by each survey question. Then t-tests were applied to each question for both Asian American and non-Asian American groups to determine whether there was a significant difference between each statement. Finally, the data for all 20 questions was classified under the three categories described above, so that the data could be compared in each category. Three tables of pre-survey data were created before the first group work activity so that I could have a clear picture of students' viewpoints and find the important indicators to measure the impact of my research study.

Chinese culture and school mathematics documents analysis. To prepare for an effective Asian culturally responsive project, document studies were necessary. Stage 1: I read two ancient Chinese mathematics books 《九章算术》 (Nine Chapters of Arithmetic) and 《孙子算经》 (Arithmetic Theory of Sunzi) to gain ideas for designing

with math tasks. 《九章算术》 is a Chinese mathematics book, composed by several generations of scholars from the 10th–2nd century BCE, its latest stage being from the 1st century CE. It lays out an approach to mathematics that centers on finding the most general methods of solving problems. Entries in the book usually take the form of a statement of a problem, followed by the statement of the solution, and an explanation of the procedure that led to the solution. 孙子 (Sunzi) was a Chinese mathematician, flourishing between the 3rd and the 5th century AD. He is known for authoring 《孙子算经》 (pinyin: *Sun Zi Suan Jing*; literally：Arithmetic Theory of Sunzi), which contains the Chinese remainder theorem. By reading these two books, I understood the influence from ancient Chinese history better and obtained the great enlightenment to design my mathematics tasks.

In stage 2, I read 《中国文化概论》(An Introduction to Chinese Culture) and 《美国华人社会的变迁》(The Changes of Chinese community in America) to connect Chinese cultures with current Asian American students' life styles. These two books uncovered many cultural phenomena in current China and some inherited cultural elements in Asian American families. All these readings helped me refine the designing of my mathematics tasks so that they reflected accurate, modern Chinese cultures in Asian American communities. In Chapter 3, I will use one of the five math tasks to illustrate how it represents Chinese cultures.

In stage 3, I assessed the tasks using the Levels of Cognitive Demand (Smith, M. & Stein, M., 1998) to make sure that the math tasks I designed were ranked as either Level 3: "Procedures with connection" or Level 4: "doing math". Further document studies included Principles and Standards for School Mathematics (NCTM 2002). The

Problem Solving Standard for Grades 9-12 provided me with important measurement standards to refine the mathematics tasks. In addition, the Communication Standard for Grade 9-12 provided objective indicators for measuring students' communication abilities. Referring to these standards, I carefully considered the mathematics knowledge embedded in the tasks to make sure it was understandable yet challenging enough for all high school-age students. In Chapter 3, I will use these standards to analyze the math tasks to demonstrate they are valuable math problems.

Exit survey. After implementing the culturally responsive mathematics tasks, I used the exit survey to collect evaluation data from my "full time" and "part time" participants.

Stage 1: The exit survey listed all five math tasks to help students recall the content they worked on in group work or at home. There were two of the same questions for each mathematics task. It was designed to measure the cultural responsiveness of these tasks (statement 1) and its popularity among students (statement 2). The first question is: "This task reflected Asian culture: strongly /moderately /weakly /I don't know." Students were asked to choose only one best answer based on their experience. Because filling names on the exit cards was optional for students, I had to classify all students into two big groups: anonymous group and real name group. In the real name group, I could divide students into Asian American group and non-Asian American group according to the names they provided. The purpose of classifying participants was to compare whether the three groups of students had significantly different perceptions of Asian cultures. In other words, I was trying to understand whether Asian American and non-Asian American participants evaluated the tasks in significantly different ways.

In stage 2, I assigned three categories and scored them as “strongly” (3), “moderately” (2) and “weakly” (1). I separated and discarded the “I don’t know” answer from all four choices, because when students could not identify the task’s culture responsiveness, his/her data should not be counted as an evaluation or equivalent to “moderately”.

In stage 3 I calculated the average scores for all five math tasks in all three groups. I applied t-tests to each paired groups to see whether there was significant difference between the Asian American group and the non-Asian American group, the Asian American group and the anonymous group, and the non-Asian American group and the anonymous group. Results, discussed in Chapter 3, showed that I could adopt the average score of the three groups’ average scores as the final score to evaluate each task’s culture responsiveness. The score for each task was treated as an independent variable and were very important towards the future assessment of students’ group work engagement.

The second statement in the exit survey was: “I will suggest this task be adopted by my math curriculum, strongly /moderately /rarely /I don’t know”. It gives students an opportunity to express their feelings for the math tasks and also allowed me to think from the students’ perspective. I used this question to test whether there’s any relationship between the tasks’ culture responsiveness and its popularity among students. I repeated the same analysis procedures for statement 2, i.e. the three stages for Question 1, and got the final scores for the five math tasks. The finding and discussion for this exit survey were given in Chapter 3 and Chapter 4.

Analyses of Standard measured student interactions. All five classroom activities designed for this research study were performed in five school days during a two week period. The activities were completed for one hour each after the last period of the school day. The activities were audio-taped and then transcribed. To trace any change in engagement of Asian American students, I did two types of quantitative analyses: word counting and classifying and comparing the discourses.

First, I separated all the transcribed activity discourses into three groups according to the speakers: Asian American group, non-Asian American group and I as the teacher. Then I used the "Word count" function to get the amount of words spoken by all groups in each activity. I calculated the range, mean value, t-test and correlation coefficient statistics on the data from three groups to find a detailed comparison. Specifically, I calculated the correlation coefficient between the quantity of Asian American students' communication and the level of culture responsiveness which was calculated from the participants' exit survey. The result could partly reflect how effectively the research project had engaged Asian American students in group work. This analysis provided a general picture and surface impression of any change in Asian-American students' group work engagement. The next analysis may provide more details on the communication quality in group work.

In order to analyze the quality of students' discourses, I separated students' discourses into two main categories: "High Quality Communication" and "General Communication". The High Quality Communication category is composed of discourses which meet the Communication Standard for Grade 9-12 of Principals & Standards for School Mathematics (NCTM 2000). There are four standards as listed below;

- Organize and consolidate their mathematical thinking through communication;
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others;
- Analyze and evaluate the mathematical thinking and strategies of others;
- Use the language of mathematics to express mathematical ideas precisely.

A discourse belongs to the High Quality Communication category if it reflects one of the four standards above. Otherwise, a discourse is classified into the General Communication category. I read and classified all discourses created during the group work tasks into two main categories and then into four sub-categories if they belonged to High Quality Communication. A table of sample classified sentences is available in Chapter 3, see Table 3.14. After arduous classifying work, I calculated the total number of sentences in each sub category for the Asian American group, the non-Asian American group and the teacher group. This discourse data base provided me sufficient space to use statistical methods to analyze them. I used range, sum, mean value, standard deviation, improvement rate, t-test and correlation coefficient to compare Asian American and non-Asian American groups. Specifically, the correlation coefficient between the quality of Asian American students' communication quality and the level of cultural responsiveness of the tasks could more accurately reflect how effective the mathematics tasks engaged Asian American students in group work. Analysis of quality of communication provided a more detailed picture than the analysis of the quantity of communication. It indicated comparatively deeper connections between students' engagement and their communication ability. It also brought up a new discussion about how to improve the quality of Asian American students' communication in group work.

Limitations

There are many limitations in this research study. The size of the sample group is clearly not large enough to make a very broad statement. The participants were from grades 9-12 and had very different mathematical backgrounds. This could result in unconscious leadership during group work. I, as an Asian teacher, attended students' discussion and might influence Asian-American students' engagement in some degree. An additional limitation to the results was the novice stature of my implementing the culturally responsive project. Though I am quite familiar with Asian culture and have taught high school math for 7 years, my experience with culturally responsive teaching was far from an experienced level. Just as my Asian American students needed time and experience to engage in group work, I found that I also needed time to reflect and improve my implementation of such a complex teaching method particularly when trying to address the delicate issues of Asian culture responsiveness.

Description of Participants and Research Findings

I will first give a brief introduction of my study participants, and then present three major findings according to the three research questions.

(a) What is the experience of Asian American students in mathematics group work?

(b) What are some features of an Asian culturally responsive mathematics task?

(c)What is the relationship between my culturally responsive mathematics tasks and ability of Asian American students' communication in group work?

Information about Study Participants

As a Chinese language teacher at Lakeview School, I selected my students as subjects for this research project. There are a total of 65 students in my Chinese language classes, and 56 of them participated in this project. Since this project is for mathematics education research, I received approval from the school district to conduct this study but was asked to conduct this study using after-school time.

To enroll as many student volunteers as possible for this research project, a copy of "Introduction of Ms. Han's Research Study" (see Appendix A) was sent to all 65 students in my Chinese language classes. Students were invited to participate in this research project using after-school time. They could choose to participate either through group work in classroom or through independent work at home ("full time" and "part time" participants described in Chapter 2). Fifty-six of the total 65 students volunteered to participate in this research project, with 19 students choosing group work and 37 students choosing independent work. Table 3.1 gives the demographics of participants.

Table 3.1
Demographics of Participants

	Female	Male	grade 9	grade 10	grade 11	grade 12	Asian American Students	Non-Asian American Students
"full time" participants	7	12	9	0	7	3	13	6
"part time" participants	19	18	13	15	6	3	20	17
Total	26	30	22	15	13	6	33	23

All "full time" participants completed a pre-survey, finished five math tasks in group work, and then completed an exit survey. All "part time" participants finished the same five math tasks independently at home rather than as group work, but then completed the exit survey together with all "full time" students. The "part time" participants did not take the pre-survey, since the survey was about participants' attitudes towards group work. To answer my two research questions in order, I first introduce the project, and then focus on the effectiveness of the project.

Findings of Pre-Survey

As stated in chapter 2, the pre-survey had a total of 20 questions under three categories: students' attitude towards mathematics learning, attitude towards group work, and students' self-evaluated qualities of communication. See Appendix B for a pre-survey working sheet. I first collected and classified survey data into two groups, Asian American students and non-Asian American students, and then input them into Excel spreadsheet. By using a statistic functions, this Likert scale-based survey showed various significant differences (see Table3.2-Table 3.4 and Figure 3.1-3.3 below) between Asian American and non-Asian American groups in each category.

Category 1: Attitudes towards Mathematics. There are eight survey questions in this category and are mixed randomly among the 20 survey questions. The following table 3.2 presented the average score for each survey question created by the two student groups. The last column presented the degree of significant difference between the two students groups.

Table 3.2
Comparison of Attitudes towards Mathematics between Two Groups

Question Number	Survey Question Content (1=Strongly Disagree, 2=Disagree, 3=undecided, 4=Agree, 5=Strongly Agree)	Average Score of Asian American Group	Average Score of non-Asian American Group	Degree of Significant Difference (df=5)
1	Mathematics is enjoyable and stimulating to me.	3.8	4.2	Slightly (t=0.795, P<0.25)
3	In mathematics I can be creative and discover things by myself.	3.8	3.6	None (t=0.328, P>0.5)
7	I try to learn mathematics because it helps develop my mind and helps me think more clearly in general.	4.2	4	None (t=0.554, P>0.5)
10	Mathematics makes me feel uneasy and confused.	2.5	2	Slightly (t=1.015, P<0.2)
12	Mathematics is a solitary activity, done by individuals in isolation.	2.4	2	Slightly (t=1.058, P<0.2)
14	Mathematics is important for my chosen profession.	3.5	3.3	None (t=0.419, P>0.5)
15	Mathematics is needed in designing practically everything.	4.1	4	None (t=0.152, P>0.5)
17	I am interested and willing to acquire further knowledge of mathematics.	3.8	3.6	None (t=0.537, P>0.5)

Figure 3.1 illustrates Table 3.2 and gives a visual impression on the survey data.

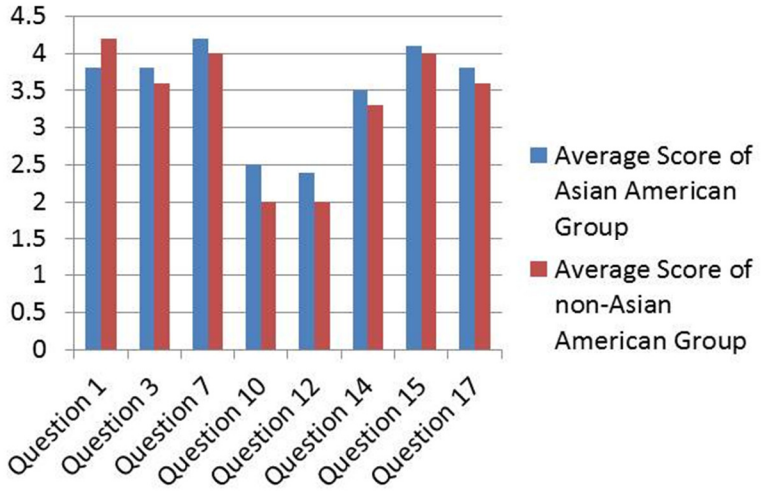

Figure 3.1 Illustration of Table 3.2

Through Table 3.2 and Figure 3.1, three slightly significant differences out of eight statements were discovered and this indicates that these Asian American students held quite similar attitudes towards mathematics as their non-Asian American peers did. All the students agreed that mathematics was important and preferred more learning opportunities in math (statement 7, 14, 15, 17). Asian American students demonstrated slightly stronger math confidence than non-Asian American students (statement 3). However Asian American students don't appear to enjoy learning math (statement 1, 10). Specifically, Asian American participants agreed more on statement 12 "Mathematics is a solitary activity, done by individuals in isolation" than non-Asian American students. This could indicate students' perceptions of how mathematical people work.

Category 2: Attitudes towards group work. There are five survey questions in this category and are mixed randomly among the 20 survey questions. In Table 3.3, I found some assumed results and some unexpected responses as well. Two moderate and one slightly significant difference out of five statements were found in this category.

Table 3.3
Comparison of Attitudes towards Group Work between Two Groups

Question Number	Survey Question Content (1=Strongly Disagree, 2=Disagree, 3=undecided, 4=Agree, 5=Strongly Agree)	Average Score of Asian American Group	Average Score of non-Asian American Group	Degree of Significant Difference (df=5)
2	It is very important for me to feel like a member of my group.	3.8	4.6	Moderately (t=1.65, P<0.1)
6	I learn more when I work in small groups compared to working alone.	3.2	4	Moderately (t=1.614, P<0.1)
13	Working in groups did not help me.	2.4	2.4	None (t=0.032,P>0.5)
18	I would like to spend more time in groups.	3.3	3.2	None (t=0.284, P>0.5)
19	We worked in groups too much.	2.6	3	Slightly (t=1.11, P<0.2)

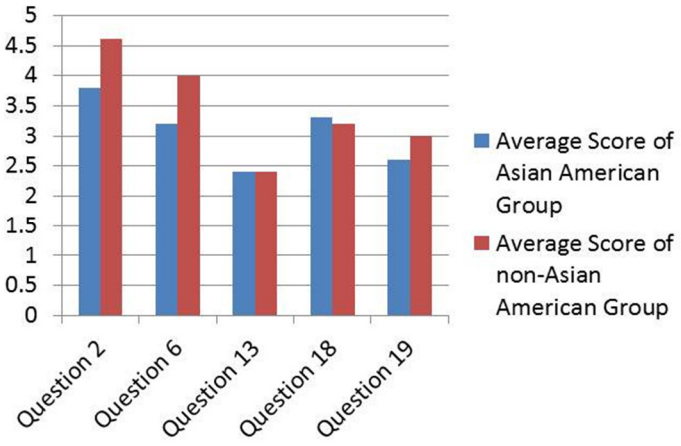

Figure 3.2 Illustration of Table 3.3

The most interesting finding is that the Asian American students do not reject group work as a learning type (statement 13). They claimed that "I would like to spend more time in groups." (statement 18) and even disagreed more than their American peers with "We worked in groups too much." (statement 19). However, Asian American students seemed not to believe in the merits of group work (statement 6) and do not value group work as much as non-Asian American students (statement 2). These complex and struggling phenomena encouraged me to discover the reason that Asian American students enjoyed group work, while they felt less important "to feel like a member of my group" and learned less "when I work in small groups compared to working alone."

Category 3: Self-evaluation for mathematical communication ability. There are seven survey questions in this category and are mixed randomly among the 20 survey questions. Through Table 3.4, I could partly answer my perplexity and realize that mathematical communication ability might be an important factor which impacts Asian American students' engagement in group work.

Table 3.4
Comparison of Self-Evaluated Communication Ability between Two Groups

Question Number	Survey Question Content (1=Strongly Disagree, 2=Disagree, 3=undecided, 4=Agree, 5=Strongly Agree)	Average Score of Asian American Group	Average Score of non-Asian American Group	Degree of Significant Difference (df=5)
4	I often feel nervous when I present to the class.	3.2	2.8	Slightly (t=0.825, P<0.2)
5	It is important to follow the teacher's methods.	4.5	2.8	Very Strongly (t=2.987,P<0.01)
8	I can lead group discussion in a cooperative learning environment.	3.8	4	None (t=0.46, P>0.5)
9	I prefer listening than talking.	3.5	3	Strongly (t=2.124, p<0.05)
11	I can exchange mathematics ideas fluently with others.	3.5	4	Strongly (t=2.097, p<0.05)
16	Communicating with other students helps me have a better attitude towards mathematics.	4	3.4	Moderately (t=1.542, P<0.1)
20	I learn mathematics well from lectures.	4.2	3.2	Strongly (t=2.047, P<0.05)

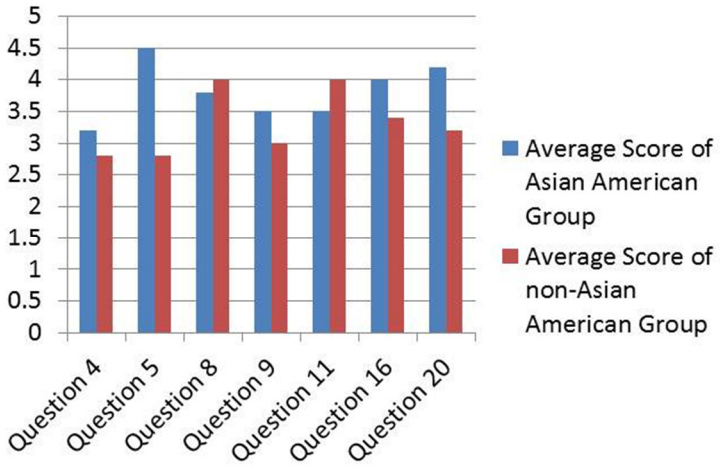

Figure 3.3 Illustration of Table 3.4

One very strong, three strong, one moderate and one slight differences were found in six statements on communication qualities. According to statements 5, 9 and 20, Asian American students like to follow teachers' methods and lectures, and like listening more than speaking. The results of statement 11 showed that these Asian American students have significantly lower confidence or ability on "exchanging mathematics ideas fluently with others." This is a new finding about Asian-American students' math learning, in contrast to their recognized math test scores. Considering that many Asian

American students evaluated themselves as "feeling nervous when presenting to the class" (statement 4), and "can hardly lead a group discussion"(statement 8), this research study is going to help Asian American students with group work engagement, especially on mathematical communication skills. A positive point is that Asian American students valued the importance of communication (statement 16) and it also illustrated they were eager to get improvement on mathematical communication.

Through this 20-question pre-survey, I gained better understanding of Asian American students on their attitudes towards mathematics, group work, and their math communication abilities. On a positive note Asian American students value mathematics highly and are willing to accept group work as a learning method. However, a concern is that Asian American students might have inferior mathematical communication abilities and the accompanying lower confidence in such communication. I believe this is a reasonable explanation for Asian American students' low engagement in group work. This is also the reason that my research study is needed and can become a pathway for them to improve group work engagement. In the next section, I focused on students' discourses in group work and analyzed them in quantitative method.

Teacher-designed Asian Culturally Responsive Curriculum Project

Five math tasks suited for all levels of high-school students were designed, given the fact that participants have mixed grade levels 9-12. The following analysis can be divided into three parts: (a) a brief introduction of the five math tasks and my train of thoughts in designing; (b) a full analysis of math task #5 to demonstrate how the NCTM standards and Asian culture were incorporated with the tasks; and (c) a quantitative analysis of the exit survey results on all five math tasks.

Introduction of five math tasks. The five math tasks are based on five ancient Chinese math problems found in the books "九章算术" (Nine Chapters of Arithmetic) and "孙子算经"(Arithmetic Theory of Sunzi) . In each task, students are asked to first translate the math problem from Chinese into English, and then solve the problem using the math knowledge they have. Students who chose group work were divided into groups of four. In each group, students first discussed the English translation of each math problem to make sure that everyone understood the problem correctly. Students were then asked to think about the solution independently, and then discuss their solutions with peers in the group. Each group was asked to prepare a poster and to give a 3-minute presentation on the solution. For students who chose to participate in the research project through independent work, they would have to complete the English translation and solve the problem on their own.

Table 3.5
Problem Content in Five Mathematics Tasks

Original Question	Translation of the Question
我问开店李三公，众客都来到店中。一房七客多七客，一房九客一房空。	One day, Lisan's hotel is full of customers. There will be 7 people left over if he assigns 7 people in each room; while there will be one vacant room if he assigns 9 people in each room. How many rooms are there in Lisan's hotel?
一百馒头一百僧，大僧三个更无争;小僧三人分一个，大小和尚各几丁？	There are 100 monks in a temple to share 100 steamed buns as their breakfast. Every adult monk can have 3 buns, while every 3 young monks have to share I bun. How many adult and young monks are there in this temple?
张家三女孝顺，归家频望勤劳;东村大女隔三朝，五日西村女到，小女南乡路远，依然七日一遭，何朝齐至饮香醇，请问英贤回报。	There are 3 daughters in Family Zhang, who care for their parents very much even though they're all married. The oldest daughter visits parents every 3 days; the second daughter comes every 5 days. The youngest daughter can visit parents every 7 days although she lives quite far away. When do they all meet?
元宵十五闹纵横，来往观灯街上行。我见灯上下红光映，绕三遭，数不真。从头儿三数无零，五数时四盏还未尽。七数时六盏不停，端的是几盏明灯?	In YuanXiao Festival night, I counted beautiful lanterns on the street. There's no left over when I counted them by 3. But 4 lanterns left over when I counted them by 5 and 6 lanterns left over when I did it by 7. Could you tell me how many lanterns are there?
今有鸡翁一值钱五，鸡母一值钱三，鸡雏三值钱一。凡百钱买鸡百只，问鸡翁、母、雏各几何？	In the farmer's market, a roost' value is 5 Qian(ancient Chinese currency unit). A hen's value is 3 Qian, while 3 chicks' value is 1 Qian. How can I spend 100 Qian to purchase 100 chickens?

In selecting the five math problems, the following standards from "Levels of Cognitive Demand" (Smith, M. & Stein, M., 1998) were taken into consideration:

(a) Require complex and non-algorithmic thinking, i.e. a predictable and well-rehearsed approach or pathway not explicitly suggested by the task, task instructions, or a worked-out example.

(b) Demand self-monitoring or self-regulation of one's own cognitive processes.

(c) Require students to analyze the task and actively examine task constraints that may limit possible solution strategies and solutions.

(d) Require considerable cognitive effort and may involve some level of anxiety for the student because of the unpredictable nature of the solution process required.

Among the five math tasks, three (3) are "procedures with connection" tasks. They are "Problem of How to Divide Guest Rooms (客房问题)", "Problem of How to Divide Buns Among 100 Monks (僧分馒头)", and "Problem of Three Daughters Returning Home (三女归家)". What is common with these three math problems is that students need to engage with conceptual ideas underlying the procedures to successfully solve the problem. The other two (2) tasks are "Doing mathematics" tasks. They are "Problem of watching lanterns on Yuan-Xiao Festival (元宵观灯)" and "Problem of hundred chickens (百鸡问题)". These two problems require considerable cognitive efforts and emphasize unpredictable solution processes.

All five problems meet the requirements outlaid in the Problem Solving Standards for Grades 9-12 of Principles and Standards for School Mathematics (NCTM 2002):

- Build new mathematical knowledge through problem solving;
- Solve problems that arise in mathematics and in other contexts;
- Apply and adapt a variety of appropriate strategies to solve problems;
- Monitor and reflect on the process of mathematical problem solving.

In solving the five math problems, students have to adapt and extend the mathematics knowledge they have. In the next section, math task #5 will be analyzed in detail, with respect to how it meets the NCTM standards and reflects Asian culture.

Math task #5. This task is based on a famous ancient Chinese math problem called "Problem of Hundred Chickens (百鸡问题)". The problem was first proposed in the famous Chinese mathematics book "Nine Chapters of Arithmetics (九章算术)."The problem is phrased as "In the farmer's market, a roost' value is 5 Qian (ancient Chinese currency unit). A hen's value is 3 Qian, while 3 chicks' value is 1 Qian. How can I spend 100 Qian to purchase 100 chickens? (今有鸡翁一值钱五，鸡母一值钱三，鸡雏三值钱一。凡百钱买鸡百只，问鸡翁、母、雏各几何?)." Due to the fact the problem has multiple solutions and answers; it has been a popular math problem for people of all levels for more than 1500 years in China. Its popularity also has roots in Chinese culture. China has a long history of an agricultural society, in which it was common for people to raise chickens in their backyards. The chickens were used as feasts on dinner tables as well as for exchange of other living necessities in farmer's market. Usually a rooster has a higher value than a hen, while a chick has the lowest value, due to the length of time and amount of food required to raise them. This problem applies to buying chickens in wholesale, when using a whole integral sum of money such as 100 Qian (money unit in ancient China) to purchase a whole number of chickens such as 100 chickens.

This problem also has strong connection with Asian American students' current life. Many Asian American families still keep the tradition of cooking a whole chicken as a meal and strongly believe that home-grown chickens are better than commercial ones. I, as an Asian individual in the U.S., also inherited the traditional values that roosters,

hens and chicks had different nutrition and should be treated differently when cooking or taking it for a medical purpose. In all, this math task reflected a topic that had such a long history that it still has influence on people even in current Asian American communities. Culturally, this math task reflected some essential elements of culturally responsive teaching examined by Gay (2002), and best reflected the second element "including ethnic and cultural diversity content in the curriculum"(p.106). It used students' cultural knowledge, prior experiences and performance styles to make group work more appropriate and effective.

Mathematically, this problem requires solving a linear equation system which has three variables, but only two equations. The problem is not explicitly worded, and it requires some cognitive math abilities to find out that it is a three-variable problem. Such a problem is new to high school students. Since the problem doesn't indicate a specific solution method, students have to push the boundary of existing knowledge and build up new math skills. Such training helps students learn the thinking processes of how to take on new and unknown math problems, and build up the necessary self-confidence which is a key to future academic success. All this makes this problem meet the requirements of NCTM standards.

It was found that during group work, students were able to apply and adapt a variety of strategies in solving this problem. Without using any equations, one student was able to find one answer: 0 rooster, 25 hens and 75 chicks. He swiftly got some clues from math task #2, and was quick in adapting the same strategy to solve this problem. However, many students realized that the problem has more than one correct answer, so they explored strategies other than "guess and check" to solving this problem.

Students showed their abilities to monitor and reflect on the processes of their math problem solving. After the first answer was "accidentally" discovered, students struggled in filling in tables, solving equation systems and testing different numbers. They knew that if one approach failed, they could come up with second and third approaches. They also showed that they could attack the problem from different angles. In this regard, learning the processes of problem solving is more valuable than finding the correct answers.

In summary, the "Problem of Hundred Chickens" is a rich cognitively demanding math problem which meets NTCM standards. In additions, this problem also reflects Asian culture deeply and responsively. Student feedback on this math task is presented in the next section.

Findings of exit survey. After completing five math tasks in three weeks, I designed an exit survey (see Appendix C) for students to evaluate each task for its cultural responsiveness and popularity. The survey listed all five math tasks to help students recall the content they worked in group or at home. There were two statements for each mathematics task. The first statement is: "This task reflected Asian culture: strongly /moderately /weakly /I don't know." Students were asked to choose the one best answer based on their experience. This statement was designed to measure the cultural responsiveness of my mathematics tasks. The second statement in exit survey is: "I will suggest this task be adopted into my math curriculum, strongly /moderately /rarely /I don't know". I used this statement to test whether there was any relationship between the culture responsiveness of tasks and its popularity among students. This statement gives

students an opportunity to express their personal experience for the math tasks and also allowed me to think from the students' perspective.

After collecting students' exit surveys, I divided all participants into 3 groups: 28 Asian American students as Group 1, 16 non- Asian American students as Group 2, and 12 students who did not provide their names on the survey sheets as Group 3. Table 3.6-3.8 gives the survey results for each math task by three groups respectively.

Table 3.6
Asian American (Group1) Students' Survey Result - Statement One

	Statement One: This task reflected Asian culture: strongly /moderately /weakly /I don't know			
	The number of students who chose "strongly".	The number of students who chose "moderately".	The number of students who chose "weakly".	The number of students who chose "I don't know".
Task 1	**4**	**9**	**12**	**3**
Task 2	**17**	**3**	**6**	**2**
Task 3	**15**	**8**	**4**	**1**
Task 4	**16**	**7**	**3**	**2**
Task 5	**18**	**4**	**4**	**2**

Table 3.7
Non-Asian American (Group 2) Students' Survey Result - Statement One

	Statement One: This task reflected Asian culture: strongly /moderately /weakly /I don't know			
	The number of students who chose "strongly".	The number of students who chose "moderately".	The number of students who chose "weakly".	The number of students who chose "I don't know".
Task 1	**2**	**8**	**4**	**2**
Task 2	**6**	**7**	**1**	**2**
Task 3	**6**	**8**	**1**	**1**
Task 4	**12**	**3**	**0**	**1**
Task 5	**9**	**6**	**0**	**1**

Table 3.8
Anonymous (Group 3) Students' Survey Result - Statement One

	Statement One: This task reflected Asian culture: strongly /moderately /weakly /I don't know			
	The number of students who chose "strongly".	The number of students who chose "moderately".	The number of students who chose "weakly".	The number of students who chose "I don't know".
Task 1	**0**	**3**	**9**	**0**
Task 2	**8**	**2**	**2**	**0**
Task 3	**1**	**8**	**1**	**2**
Task 4	**5**	**4**	**1**	**2**
Task 5	**7**	**1**	**1**	**3**

As shown in Tables 3.6-3.8, there are some participants believed that they cannot identify whether the math task was Asian culture related. I discarded those data and assigned that "strongly"=3 points, "moderately"=2 points and "weakly"=1 point, such that I could score each task by 1-3 value. Table 3.9 is the average score that students evaluated each task in three groups. Figure 3.4 illustrates the score comparison among three groups.

Table 3.9
Average Cultural Responsiveness Rating for All Groups and Tasks-Statement One

	Average Score Created by Asian American Students in Group 1	Average Score Created by Non- Asian American Students in Group 2	Average Score Created by Students in Group 3	**Final Score created by all participants**
Task 1	**1.68**	**1.86**	**1.25**	**1.60**
Task 2	**2.42**	**2.36**	**2.5**	**2.43**
Task 3	**2.41**	**2.33**	**2**	**2.25**
Task 4	**2.50**	**2.8**	**2.4**	**2.57**
Task 5	**2.54**	**2.6**	**2.67**	**2.60**

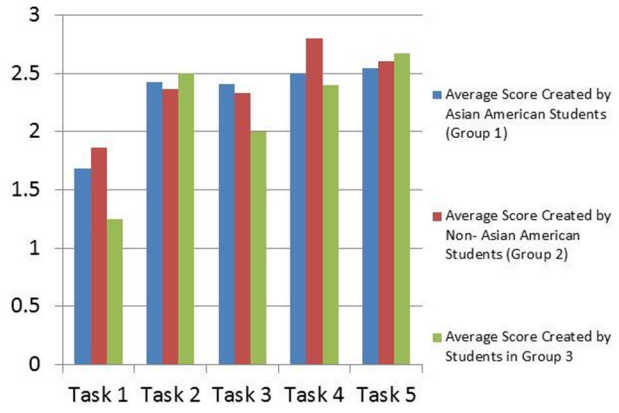

Figure 3.4 Comparisons of Average Score by Three Groups

Three t-tests were applied for the above three groups in pairs and the results (t_1=0.16, t_2=0.05, t_3=0.14; df=3, P>0.5) showed there were no significant differences between the scores from any two groups. Thus, it's statistically appropriate to combine these three groups' scores to get a final score for each task. Please see the last column on

the above table. These final scores show that four math tasks are scored above "moderately related to Asian culture" and the first task was slightly below the "moderately" level. Among these 5 tasks, the last task Problem of One Hundred Chickens was ranked the highest, which indicated students judged it as the task that most closely represented Asian culture. These final scores quantitatively showed that students perceived the teacher-designed project to reflect Asian cultures to a certain extent. This result will be used to discuss the relationship between students' group work engagement and the cultural responsive project.

The second survey statement asked students to suggest the level at which the task should be adopted by their math curriculum. Students were able to choose one answer out of "strongly /moderately /rarely /I don't know". A total of 56 students responded. I performed the same procedures to analyze these data as I did for the first question. These were: (a) divide students into three groups: Asian American group, non-Asian American group and the third group which is composed of students who didn't provide their names on the exit survey sheet; (b) count numbers of students who chose "strongly /moderately /rarely /I don't know" in each group; (c) assign scores of 3/2/1 to "strongly /moderately /rarely" to get an average score on each task for each group. Again, t-tests showed there were no significant differences between the scores of any two groups. Thus, the final scores of task popularity for each task were shown in the second data row of the following table. Task 5 was ranked the highest (2.20) which indicated students would suggest it be incorporated into their math curriculum more than the other tasks (1.98-2.17). To further discover the relationship between the cultural responsiveness and the

popularity of mathematics tasks, I calculated the correlation coefficient between these two variables. See Table 3.10 for data.

Table 3.10
Correlation Coefficient between Average Scores of Two Statements

	Task 1	Task 2	Task 3	Task 4	Task 5
Final Score of the Asian Culture Responsiveness for each task created by all participants (Statement #1)	1.60	2.43	2.25	2.57	2.60
Final Score of the popularity for each task created by all participants (Statement #2)	2.12	1.98	2.08	2.17	2.20
Correlation coefficient between Statement #2 and Statement #1	0.148				

The first data row was the final scores on the Asian cultural responsiveness, statement 1 on the exit card. The second data row was the final score on the popularity of tasks, statement 2 on the exit card. After calculating the correlation coefficient between these two sets of data, I found that there was a very weak relationship (r=0.148) between the cultural responsiveness and students' desire to adopt it in their curriculum. The reason might be quite complex and will be discussed in Chapter 4.

Analyses of Standard Measured Student Interactions in Group Work

Classroom activities were the main body of this research study. Thus, audio transcription of students' group work was the major data to analyze the effect of my project. As previously stated, there are a total of 19 students (13 Asian Americans and 6 non-Asian Americans) who participated in this after-school research study "fulltime." However, students had freedom to choose different activities to attend. The most active students attended four out of five activities, while seven students never showed up. Such attendance made it difficult to trace individuals. So, I used the mean to compare the quantity indicators for one Asian American student with one non-Asian American student. In the next section, I will focus on (a) on average how many words were spoken by an Asian American student and a non-Asian American student in each activity and (b) on

average how many discourses reached Communication Standards of NCTM in each activity. These two categories were used to measure Asian American students' engagement change in both quantity and quality aspects.

Communication quantity analysis of students' engagement. All participants' interactions audio files were transcribed and saved as word documents. I divided all the participants into three groups: Asian American group, non-Asian American group and me as the third group. Then, I classified all the discourses according to the three groups. By using the "word count" function in Microsoft Word, I got the total numbers of words that were spoken by each group. I divided these numbers by the numbers of group members to get the means for each group. Repeating this procedure for each activity, I built the following Table 3.11 for the quantity change through these five activities.

Table 3.11
Comparison of Average Word Quantity Spoken by each Group in each Activity

	Average Word Quantity that an Asian-American Student Spoke in this Activity		Average Word Quantity that a Non-Asian-American Student Spoke in this Activity		Word Quantity that I spoke in the activity
Task 1	131	Increasing Percentage: 430.5%	271	Increasing percentage: 15.8%	59
Task 2	148		285		68
Task 3	213		145		179
Task 4	361		121		358
Task 5	695		314		598

It's clear that Asian American students spoke increasingly more through the five activities, from 131 words in task 1 to 695 words in task 5, an increase of 430.5%. I am very interested in whether the increasing word quantity was related to the Asian cultural responsiveness of the math tasks. Table 3.12 shows a moderate correlation (r=0.622) between word quantity and Asian cultural responsiveness. It indicated that my culturally

responsive project had a relationship on Asian American students' engagement in group work.

Table 3.12
Correlation ship between the Average Word Quantity and the Cultural Responsiveness of tasks

	Task 1	Task 2	Task 3	Task 4	Task 5
Average Word Quantity that an Asian American Student spoke in this Activity	131	148	213	361	695
Final Score of the Asian Culture Responsiveness (Question #1)	1.60	2.43	2.25	2.57	2.60
Correlation coefficient between Word Quantity and Asian culture Responsiveness	0.622				

Considering another possible factor influencing students' group work engagement, I also noticed that I spoke more and more through the five activities. The reason for that is probably because the cognitive demand for each activity was increasing, while the number of participants was decreasing. Subconsciously, I became a group member and attended students' task discussion all through the procedure. In this case, teacher's participation might be an important factor which influenced many group members' engagement. Hence, I created a figure to describe the word quantity change for each group in five activities and calculated the correlation coefficient for every two groups.

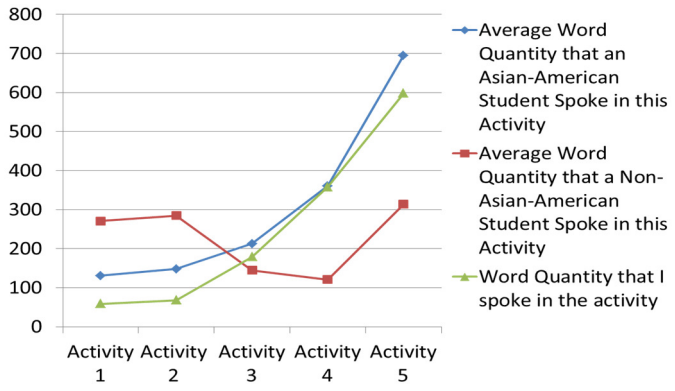

Figure 3.5 Comparison of Average Word Quantity Spoken by each Group in each Activity

Table 3.13
Correlation Coefficient for Each Two Groups

Two Groups	Correlation Coefficient
Asian American Group VS non-Asian American Group	Not Related (r =0.229)
Asian American Group VS the Teacher	Strongly Related (r =0.987)
Non-Asian American Group VS the Teacher	Not Related (r =0.071)

Figure 3.5 gives the word quantity changes from activity 1 to activity 5 for each group. Asian American group and teacher group have very similar curves, which prove to be strongly related by correlation coefficient (r=0.987). It might suggest that I, as an Asian teacher, had a potential influence on Asian American students' classroom performance. In contrast, the other two correlation coefficients showed there were no relation between Asian American group and non-Asian American group(r=0.229), or between non-Asian American group with teacher group (r=0.071).

In summary, according to Asian American students' word quantity change from task 1 through task 5, a significant increasing percentage was found. This change had a moderate correlation with the task's culture responsiveness and a strong correlation with the Asian teacher's participation.

Communication quality analysis of students' engagement. Word quantity is one indicator to measure students' engagement level in group work; however, the quality of communication might be a more important indicator than word quantity. There are various assessments for measuring communication qualities. Considering the goal of this research study is to help students with mathematics learning, I decided to employ Communication Standards 1-4 from Principles & Standards for School Mathematics (NCTM, 2000) to measure students' communication quality.

I read all the transcriptions sentence by sentence and classified them into two main categories. The first category is "High Quality Communication", which is composed of all the discourses that meets at least one of the four standards. I also set each sub Communication standard as the sub category under the High Quality Communication so that I could get a clearer picture of which standard was reached the most. The second main category is General Communication, which contains all the discourses that do not belong to High Quality Communication. The four items of Communication Standards and sample discourses are listed in Table 3.14.

Table 3.14
Sample Discourses for High Quality Communication and General Communication

Communication Categories		Sample Discourse for each Category
High Quality Communication	*CS1. Organize and consolidate their mathematical thinking through communication.*	You could have…five roosters, that are twenty five dollars. You could have…wait that wouldn't work. It would add up to a hundred dollars but you wouldn't have a hundred chickens.
	CS2 *Communicate their mathematical thinking coherently and clearly to peers, teachers, and others.*	So for instance, if you have three chicks and a hen, that would be four dollars, and you have four chickens, so if you multiply that by twenty-five, you would be buying seventy five chicks and twenty five hens.
	CS3 *Analyze and evaluate the mathematical thinking and strategies of others.*	Unless you assume that one of the variables is zero. Like, you could assume that hens is zero. But you won't get whole numbers, I think.
	CS4 *Use the language of mathematics to express mathematical ideas precisely.*	There's just a way to do it with systems of equations which is much more direct.
General Communication		What's it asking for, again? / Oh, that makes sense. / That's what I did.

After classifying all discourses into respective categories, I separated all the discourses in each category into either Asian American group or non-Asian American group. By counting the sentence number in each (sub) category for each group, I could get the amount that how many High Quality sentences that Asian American participants said in this task, etc. Noticing that two students groups had different participant's numbers, I divided their sentences numbers by their group member numbers so that I could compare the communication quality of one Asian American student with one non-Asian American student. In the next section, this research study focus on two types of

data: the number of High Quality Communication and the percentage of High Quality Communication.

The sentence number of High Quality Communication. Table 3.15 shows average discourses classified in each category for Asian American students and Table 3.16 shows the data for non-Asian American students. Figure 3.6 illustrates the number comparison of mean discourse which met one of the four Communication Standards by two group students.

Table 3.15
Mean Discourse Numbers of Asian American Students by Sub-Categories

	Number of High Quality Communication Discourses in each task and in each Standard				Total Number of High Quality Communication Discourses in each Task	Total Number of High Quality Communication Discourses
	Communication Standard 1	Communication Standard 2	Communication Standard 3	Communication Standard 4		
Activity 1	0.5	1.5	0.5	1	3.5	42.17
Activity 2	0	1	2	4	7	
Activity 3	2	0.67	1.33	1.67	5.67	
Activity 4	2.5	2.5	1	3	9	
Activity 5	4	3.5	3	6.5	17	

Table 3.16
Mean Discourse Numbers of non-Asian American Students by Sub-Categories

	Number of High Quality Communication Discourses in each task and in each Standard				Total Number of High Quality Communication Discourses in each Task	Total Number of High Quality Communication Discourses
	Communication Standard 1	Communication Standard 2	Communication Standard 3	Communication Standard 4		
Activity 1	2.5	4.75	1.75	3.75	12.75	45.75
Activity 2	0	7	0.5	1.5	9	
Activity 3	4	2	0	3	9	
Activity 4	2	0.5	2.5	2	7	
Activity 5	2	1	0	5	8	

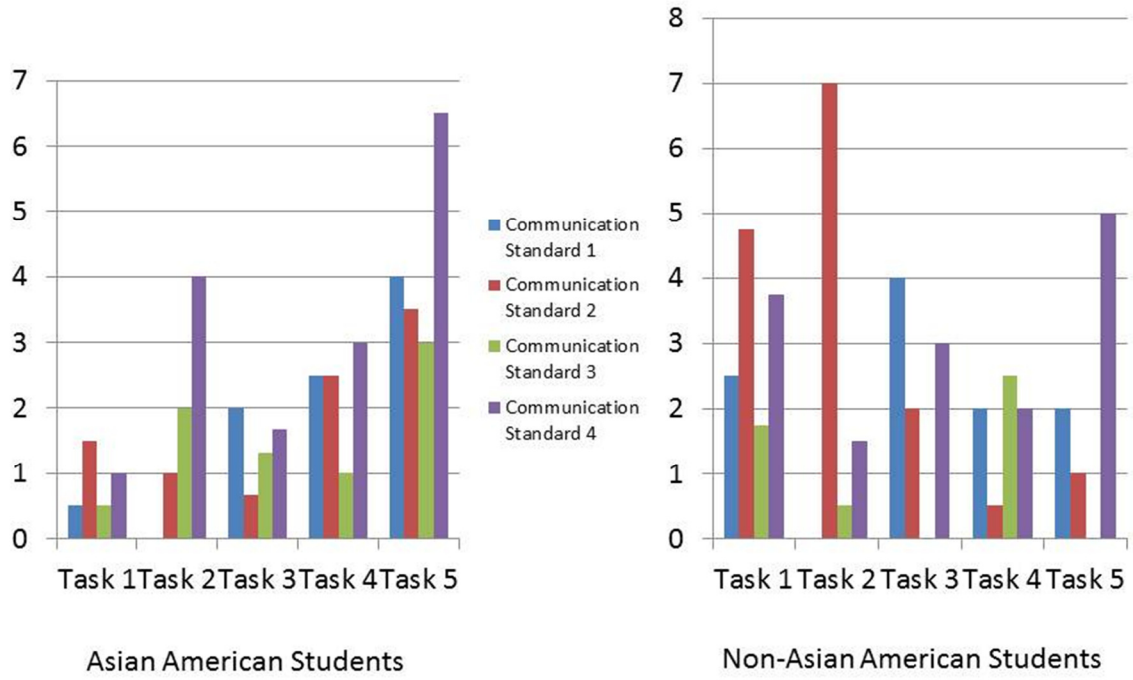

Figure 3.6 Illustrations of Table 3.15 and Table 3.16

Comparing the number of discourses which met the Communication Standards between two students groups, one can see that the Asian American group has an increasing amount. The total numbers of high quality communication discourses in five tasks are 3.5, 7, 5.67, 9 and 17. It increased by approximately 380%. The correlation coefficient demonstrates that Asian American students' high quality communication data has a strong relationship with the task's cultural responsiveness (r=0.72). It suggested that my Asian culturally responsive project can help Asian American students with improving their communication quality to a certain extent. However, the non-Asian American group kept a comparatively steady level on high quality communication (10.625, 13, 11.67, 10.5 and 16). The data also illustrated that non-Asian American students' High Quality Communication discourse number had very weak relationship with the Asian cultural responsiveness (r=0.096). In summary, the improvement of the number of Asian American students' High Quality Communication discourse had a

positive relationship with the Asian culturally responsive tasks. However, non-Asian American students' performance had nothing to do with the cultural responsiveness in group work.

The comparison also demonstrates that Non-Asian American students' discourses which met the Communication Standards (45.75) are more than that of Asian American students (42.17). To analyze these data more precisely, another quantity comparison between High Quality Communication discourse and General Communication discourse was employed in the following section.

The percentage of High Quality Communication. The quantitative method is to calculate the ratios of High Quality Communication to all the discourses created by student groups in each activity. Table 3.17 shows the average data for Asian American and non-Asian American group. Figure 3.7 gives the graphical views of percentage changes for both groups.

Table 3.17
Percentage of High Quality Communication in Two Student Group

	Asian American Students			Non-Asian American Students		
	Sentence Number of High Quality Communication	Sentence Number of General Communication	Percentage of High Quality Communication	Sentence Number of High Quality Communication	Sentence Number of General Communication	Percentage of High Quality Communication
Activity 1	3.5	10.625	25.69%	12.75	10.75	54.26%
Activity 2	7	13	35%	9	12.5	41.86%
Activity 3	5.67	11.67	32.70%	9	9	50%
Activity 4	9	10.5	46.15%	7	9	42.75%
Activity 5	17	16	51.52%	8	11	42.11%

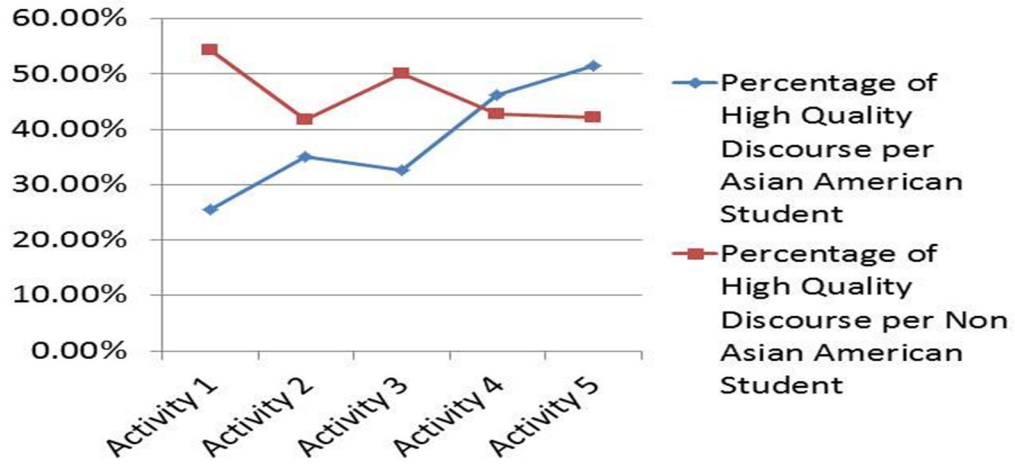

Figure 3.7 Comparison of High Quality Discourse Percentage for Asian American and non-Asian American Students

Two findings could be summarized by the percentage data. The first is that Asian-American students' High Quality Communication percentage ranged from 25.69% to 51.52%, an increase of 100.5%, but with an average of 38.21%. Non-Asian American students' range was comparatively steady from 41.86% to54.26%, but the average was 46.2%. This data reflected that high quality communication discourse can only occupy less than half of the students' discourse as a total, and Asian American students had lower percentage in this category. It confirmed that Asian American students had weaker high quality communication abilities than their non-Asian American peers, as they evaluated themselves in the pre-survey. Comparing with communication quantity, the communication quality is harder to improve.

Secondly, although the High Quality Communication percentage of Asian American students is less than that of non-Asian American students, it's still notable that Asian American students improved their percentage from 25.69% to 51.52%, an increase of 100.5%. It could be a hint that Asian American students have more potential to

improve their communication quantity and quality, if given a suitable development environment. To test whether the Asian culturally responsive project positively contributed to Asian American students' improvement in high quality communication level, this research employed correlation analysis between the following variables. Table 3.18 showed that Asian American students' High Quality Communication percentages had a strong correlation (r=0.90) with their communication quantity changes. It also had a strong correlation (r=0.86) with the culture responsiveness of the tasks (Table 3.19).

Table 3.18
Correlation ship between High Quality Communication Percentage and Communication Quantity

	Task 1	Task 2	Task 3	Task 4	Task 5
High quality communication percentage that an Asian American student produced in this activity	25.69%	35%	32.70%	46.15%	51.52%
Communication (Word) quantity that an Asian American student produced in this activity	131	148	213	361	695
Correlation coefficient between high quality communication percentage and communication quantity	0.90				

Table 3.19

Correlation ship between High Quality Communication Percentage and the Task's Cultural Responsiveness

	Task 1	Task 2	Task 3	Task 4	Task 5
High quality communication percentage that an Asian American student produced in this activity	25.69%	35%	32.70%	46.15%	51.52%
Final Score of the Asian Culture Responsiveness (Exit Survey Question #1)	1.60	2.43	2.25	2.57	2.60
Correlation coefficient between high quality communication percentage and Asian culture Responsiveness	0.86				

These data suggested that the quality improvement of Asian American participants' communication had a positive relationship with their communication quantity and the task's cultural feature. It also partly indicated the impact of applying my culturally responsive teaching on engaging Asian American students in group work. In short, this research showed that my teacher-designed project had a positive influence on

Asian American students in their communication quantity and communication quality, such that their group work engagement was improved to a certain extent.

Other possible reasons leading to improved high quality communication percentage might include teacher's participation, etc. It will be discussed in the next chapter.

Summary of the chapter

There are three major findings to answer the corresponding research questions. (1)What are some features of an Asian culturally responsive mathematics project? This research study found a qualified Asian culturally responsive mathematics project should reflect high cognitive demand level and Asian cultural characters as well. The math task 5 is a successful sample which was a "doing math" problem and also was ranked the best culture responsiveness by all participants. (2)What is the experience of Asian American students in mathematics group work? The pre-survey of this research study showed that Asian American students held a similar attitude towards mathematics as a subject with their non-Asian American peers. However, Asian American students held a little complex and struggling attitude towards group work, and a significantly inferior self-evaluation than that of non-Asian American students on mathematics communication. This finding led to my next research question: (3) what is the relationship between my culturally responsive mathematics project and Asian American students' mathematics communication? This research study showed that the project could positively influence Asian American students' communication quantity and quality to a certain extent. Both improvements had a moderately-strong correlation with the culture responsiveness of math tasks. Comparing the communication quantity (word) change with the

communication quality change, one could find that the former would be improved more swiftly in a short time period, while the latter needed more time on practice. Hence, how to improve Asian American students' communication quality became the key question to engage them in group work. Finally, other possible influencing factors should not be ignored in these activities. They will be discussed in the next chapter.

Conclusions

Based on previous research findings, this chapter has three sections. (a) It connects current findings to research findings in the literature. (b) It provides implications on the curriculum instruction of a culturally responsive project, suggestions on strategies for improving Asian American students' mathematics communication. (c) It explores the potential opportunity to optimize the data analyzing method, and discusses a related new research topic. A flowchart of implication was also provided.

Relating Findings of the Research Project in the Literature

During this action research project, I explored the impact of the Asian culturally responsive mathematics tasks on engaging Asian American students in group work. This represented a blend of the research on culturally responsive teaching, group work engagement, and mathematics communication. No research was found that specifically studied the effects of culturally responsive projects on group work engagement, especially for Asian American students. I developed this study for Asian American students who had challenges in mathematics communication.

First of all, through quantitative methods, this research study showed that this Asian culture-reflected mathematics tasks helped Asian American students with engaging in group work to a certain extent. In other words, this research study is a good sample to experience culturally responsive teaching as "a means for unleashing the higher learning potentials of ethnically-diverse students by simultaneously cultivating their academic and psychosocial abilities" (Gay, 2000, p. 20). The statistical evidence is that Asian American students' communication improvement has a moderately-strong correlation with the cultural responsiveness of the tasks. To some extent, it verified that mathematics

communication ability, an academic and psychosocial ability, could be cultivated by culturally responsive teaching. Therefore, this research study could contribute to the accumulation of culturally responsive teaching and be a successful case for future reference.

Secondly, the finding of this research study is a contribution to the development of mathematics communication evaluation system. I read and compared some research articles on mathematics communication and found most of them depended on the National Council of Teachers of Mathematics (NCTM) Communication Standard (2000b) as their evaluation system in researches. For instance, Walshaw and Anthony (2008) summarized that mathematical discourse involved explanation, argumentation, and defense of mathematical ideas, which is an abbreviation of the four communication standards of NCTM. However, it is rarely found that researchers employed the Communication Standards directly to classify students' discourses. Through some literature comparison, the definition of High Quality Communication and General Communication in this research could be recognized reliable and extensive. It can be another good example in the field of mathematics communication-research.

Finally, Bonner (2009) stated that "Within schools, dominant norms and ways of teaching are often based in white culture, mirroring Euro-centric norms. The resulting practices contribute to cultural incongruities in classrooms and schools, leading students of color to perform below their potential (p.2)." It is also true for Asian American students in mathematics communication. In the current study, my Asian American participants presented significantly inferior self-evaluations than their non-Asian American peers did. Through the five mathematics tasks, Asian American students'

communication quantity was improved greatly, while their communication quality was still below non-Asian American participants. This research finding confirmed the concerns for students of color.

Although this research study showed that Asian American students' mathematics communication quality could not be improved as significantly as their communication quantity, the great improvement was still worthy of recognition. The significance of this research study could be a contribution to culturally responsive teaching, the field of mathematics communication, and the field of Asian American students' study.

Implications of Findings and their Relevance to Future Educational Practices

According to my three research findings, there are three main implications, respectively. (a) The Asian culturally responsive curricular project suggested the possibility for teachers to select, modify and design a multicultural mathematics task. (b) The findings of the Asian culturally responsive project gave two sub-implications: to commence with communication quantity and move forward with communication quality gradually. (c) The pre-survey and the result of communication quality comparison suggested classroom teachers pay attention to Asian American students' weak ability and low confidence in mathematics communication. More explanations and a flowchart are provided as the following.

Teachers can design a culturally responsive project. After connecting the culturally responsive teaching theory with Asian American students' current life, I designed five mathematics tasks to help Asian American students with mathematics communication. The finding suggested that it was a successful project and brought positive effect on engaging Asian American students in group work. Furthermore, my

experience can be applied to other ethnic groups and help more students with similar situations. This research study suggested the possibility and extensiveness for teachers to design a mathematics multicultural task. At the beginning of the project design, the question of what a sample of Asian culturally responsive task looks like gave me pressure, but more hope. The reason is that it is a comparatively new field in culturally responsive teaching and it is my opportunity to explore. During the designing procedure, I created two principal ideas. They are:

(a) the problem should be a high cognitive demand task,

(b) it can reflect the corresponding culture.

A high cognitive demand task means a task should be ranked as "doing mathematics". The specific requirement is available on The Mathematics Tasks Framework (Smith, M. & Stein, M., 1998**).** The corresponding culture refers to the cultural elements that are still adopted by the current American ethnic families. By meeting these two requirements, a designer can implement high quality teaching practice in a rich multicultural context, such that students can benefit and get more involved in mathematics group work.

Two strategies to reinforce students' mathematics communication. The claim of mathematics communication penetrates the whole NCTM standards from Grade 1 through Grade 12. The significance of reinforcing this claim is not limited to mathematics learning itself. It can be extended to other subjects, other fields, and students' lives. The process of the development can be a long-term and challenging task for educators. This research study used an Asian culturally responsive project to help Asian American students improve their mathematics communication ability and gained a valuable

experience. It suggested that educators to commence with communication quantity and move forward with communication quality gradually.

Commence with communication quantity. In this research study, the number of words spoken by participants was employed to represent communication quantity. The communication quantity plays an important role in engaging Asian American students, because: (a) communication quality had a strong correlation with communication quantity. (b) Research showed that communication quantity could be improved in a shorter period than the communication quality. Therefore, teachers can commence with communication quantity to help Asian American students with their mathematics communication. According to this research study, Asian American students' communication quantity had a strong correlation with teacher's participation. Hence, teachers are recommended to give more attention and participation on the groups which involve Asian American students. It is also suggested for teachers to model group work discussion for these students and let them feel supported. With an educator's care, Asian American students can be encouraged to speak generously, and improve their communication quality afterwards.

Move forward with communication quality gradually. I employed NCTM Communication Standards to classify participants' discourses into the High Quality Communication category and the General Communication category. Then I analyze the classified data according to Asian American and non-Asian American groups throughout five tasks. The finding demonstrated a strong correlation between the communication quality and the tasks' cultural responsiveness. To best predict Asian American students' development on mathematics communication, I simulated some data in this research to

present the characteristics of the developing trend. Figure 4.1 illustrated the simulated graph which employed the cultural responsiveness value as the independent variable and the High Quality Communication Percentage as the dependent variable.

According to the characteristics of this graph, the High Quality Communication percentage rapidly grows with the Cultural Responsiveness value. The growth is so considerable in the last three tasks that one could estimate the great future prospect. This graph suggests that teachers could widely adapt various culturally responsive tasks to help Asian American students with their communication quality.

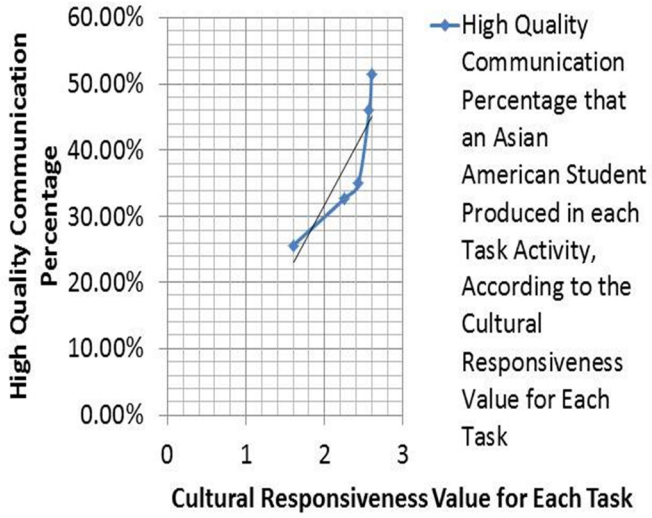

Figure 4.1 Trend Graph of High Quality Communication Percentage to the Cultural Responsiveness Value

The research finding also demonstrated a strong correlation between the communication quality and the communication quantity. Similar to the previous work, I specifically simulated the data to present the characteristics of the developing trend. Figure 4.2 illustrated the simulated graph which employed the communication quantity, the number of words, as the independent variable and the High Quality Communication percentage as the dependent variable.

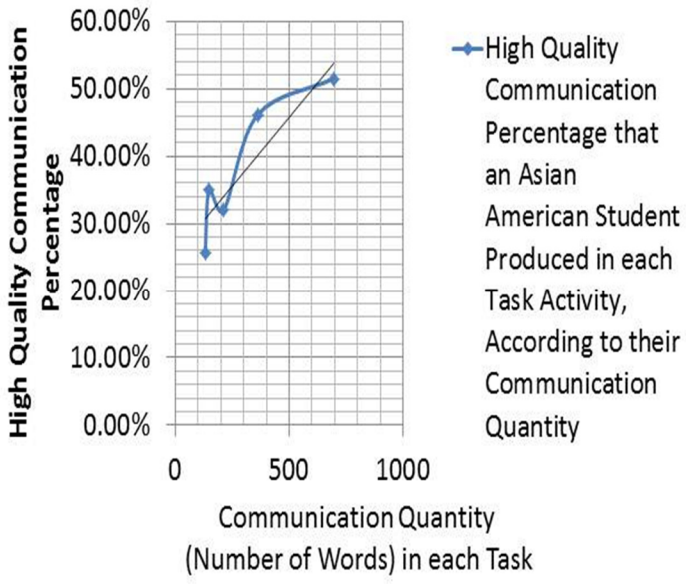

Figure 4.2 Trend Graph of High Quality Communication Percentage to the Communication Quantity (Number of Words)

According to the characteristics of this graph, the High Quality Communication percentage intricately grows with the Communication Quality. Three phrases are discovered. The first phrase showed a rapid growth which happened between the first and the second task. The second phrase happened between the second and the third task, and it showed a slight decrease. The last phrase happened among the third to the last task, and it showed slow growth. This graph suggested that teachers could improve Asian American students' communication quality by exciting them to speak in a great amount, but it would help little after their communication quantity reached approximately 500 words per student. The graph characteristics indicate that the strategy of improving communication quality by improving communication quantity, especially after the beginning period, was neither effective nor recommended. The following chart is for

teachers' reference to implement this research study in mathematics group work activity.

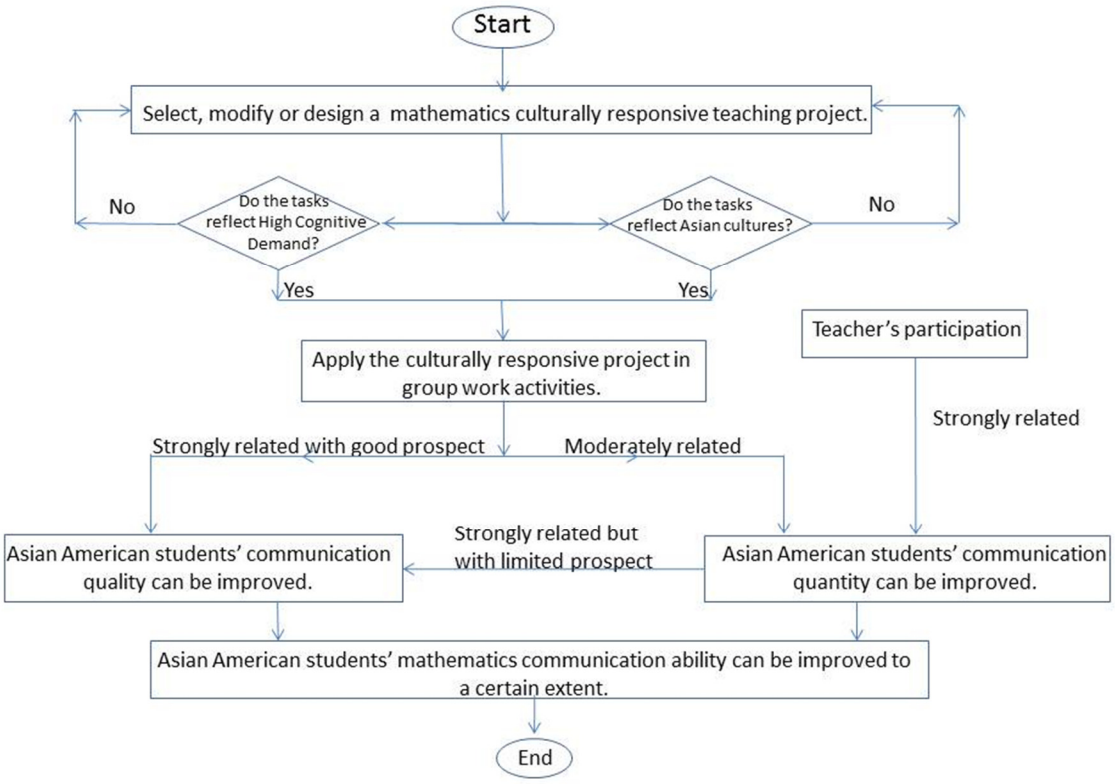

Figure 4.3 Implication Chart for the Current Research Study

Asian American students' mathematics ability was concerned. As the pre-survey suggested, Asian American students held the similar attitude towards mathematics and group work, which was a great change from the research results ten years ago. However, Asian American students had significantly weaker ability and lower confidence in mathematics communication. This phenomenon might be hidden below their comparatively higher test performance. The pre-survey reminded teachers that the current challenge for Asian American students is "How Group Work?" instead of the previous "Why Group Work?" Teachers can focus on the communication ability to help them with the real problem. This is the sub-implication from the pre-survey.

The other sub-implication was from the comparison of communication quality between Asian American and non-Asian American students. Through the culturally responsive project, Asian American students' communication quality was improved to a certain extent. However, their average level is still 10% below their non-Asian American peers. This research study suggests that the development of communication quality could be a long-term process and needs teachers' considerate work. It also suggests that teachers may comprehensively use all possible means to engage Asian American students in group work. The culturally responsive project might be one of the means to practice.

Questions for Future Action Research

Though this study supported some of the findings in the culturally responsive teaching theory, there were questions that arose that could be addressed in group work practice. The main question is that whether I can employ more qualitative methods to provide auxiliary support in this research study. Thus, there are three statements could be explored in the future by different methods and angles.

The evaluation of the cultural responsiveness of tasks. There is little literature available discussing on the standards or the evaluation system for a cultural responsive task. The exit survey in this research study scored each task with a 1-3 value, which made it possible become an independent variable in the later data analysis. However, this simple assessment system could not present details in cultural characteristics. Hence, an interview could be adapted to the future research study. The interview topics may include: (a) what are the Asian culture elements that Asian American students can recognize? (b) Reviewing all the tasks, I wonder which part reflected Asian culture the closest? Which part the weakest? (c) What are the comments and suggestions for these tasks? Through

such an interview, researchers could understand students' thinking and modify these tasks later.

In addition, this research study found that the task popularity had nothing to do with its culture responsiveness. This unexpected result raises three questions for researchers: (a) why a task's culture responsiveness had weak connection with its popularity in this research study? (b) How students define the popularity for each task? (c) What are the successful features that a popular task should own? Answering these questions can help educators understand students' expectations and connect theory and practice well.

The analysis of Asian American students' complex mathematics communication ability. I conducted a pre-survey to investigate Asian American students' self-evaluation on communication ability. It showed Asian American students had inferior ability and lower confidence than their non-Asian American peers. However, this research did not explore the reasons behind the self-evaluation. It also could not provide further information on students' attitude towards mathematics communication. Do they think mathematics communication is important? Do they have language barriers? Do they lack general communication skills? These are all questions that are worth discussing.

On the other hand, this research study discovered some patterns for Asian American students' communication improvement, but could not provide further analyses for the reasons. For example, one of the findings is that the teacher's participation could significantly influence Asian American students on their communication quantity. The implication might be clear, while the fundamental reasons are still not clear enough. Is it because the teacher has a good relation with students? Is it because the researcher teacher

is Asian? Similarly, this research study could not answer "why did the cultural responsiveness of tasks can influence more on communication quality than that on communication quantity?", "Why did the communication quantity have only limited influence on communication quality?" In the future, researchers can employ more qualitative methods, interviews, for instance, to analyze these complex phenomena and answer them with specific case studies. Through this work, researchers can adjust strategies, eliminate interference and make the research result more reliable.

The definition of group work engagement. This research study used audio-recorded students' discourses as target data and analyzed them by quantitative methods. It was used as the indicators for mathematics communication and then represented Asian American students' group work engagement. This practice was based on the understanding that communication is the important factor of the group work and the Asian American students had lower communication ability as they self-evaluated. However, group work engagement can also include students' physical performance, focusing time and attitude towards peers. In addition, mathematics communication ability could also include mathematics writing ability and mathematics technology ability. Therefore, it could be expected that there will be a wider definition of group work engagement in the field of mathematics communication.

Epilogue

The starting point for this study originated from my own school experience as an Asian American in American society. I understand that many Asian American students, including myself, prefer listening rather than talking, prefer individual work rather than group work, and feel challenged when communicating with other people. Based on the

pre-survey of this research study, the current situation of Asian American students has not changed dramatically in the recent twenty years. An Asian culturally responsive project is one of the possible approaches to help Asian American students feel supported to speak more and practice their mathematics communication with a familiar topic. As Asian American students engage in group work gradually, I believe they can help themselves and other students with mathematics learning more and more.

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Appendix A Introduction of Ms. Han's Research Study

This is an after school program which is an extending learning opportunity for mathematical achievement in ancient China. These middle-school level math questions have nothing to do with your current math knowledge and they are good for you to explore Chinese Mathematics history. It is beyond our current Chinese language curriculum and your participation is completely voluntary. Ms. Han will conduct this after school program for you to expand your cultural knowledge and for her research study as well. We will work around 3:00pm-4:00pm at Room 116, on Oct.21st, Oct.25th, Oct.27th, Oct.29th and Nov.2nd. Total of 5 group work opportunities will help you earn 25 points for your active participation. As a group leader, you will earn **5 more** extra points for your additional work. You may also earn points by doing these Chinese math projects independently; however, it's not very easy to do it alone.

First, please decide whether you want to earn these 25 extra points.

A. No, thanks.
   Please return this sheet to Ms.Han and give your name here:_____.

B. Yes, 25 extra points are good.
   Please give information to apply for this culturally responsive teaching program.

   - My name:_____,
   - I am female/male, in Grade 9 / 10 / 11 / 12
   - I am an Asian American / non-Asian American.

Second, if you have finished Part B above, please decide whether you want to work independently or work in group

A. I prefer to work independently. I also understand I can earn extra points by finishing these questions correctly.
   Please circle the most important reason(s) for you to choose working independently.
   - I don't have after school time to attend this activity.
   - My math ability is good enough to finish common questions by myself.
   - I do not like group work.
   - I have to catch school bus at regular time.
   - Other reason:_____.

B. I prefer to attend the after school activity.
   Please understand we will work around 3:00pm-4:00pm at Room 116, on Oct.21st, Oct.25th, Oct.27th, Oct.29th and Nov.2nd. You may **select your convenient date** to participate. You have to be responsible for your own transportation. You may bring the information brochure to home and talk about it with your parents. Please sign the Informed Consent Agreement and finish the questionnaire afterward to start our research work. You can earn 5 points for one participation and other 5 more extra points if you are our group leader. Please return your completed forms on Thursday and we will start our work on Thursday afternoon. Thank you for your participation.

Appendix B Pre-survey

How do you think about Mathematics Learning?

I'm interested in your ideas about mathematics, cooperative learning and your roles in a group work environment. Your answers to the questions that follow will help me understand what you think before and after this research program.

This questionnaire is not something to be graded and your answers are completely anonymous. There are five choices: ***1****= Strongly Disagree(**SD**), **2**= Disagree(**D**), **3**= Undecided(**U**), **4**=Agree(**A**), **5**=Strongly Agree(**SA**)* for each question. Please **circle** to indicate how true each of the following statements is for you. Thank you for your help!

Question	*SD*	*D*	*U*	*A*	*SA*
1. Mathematics is enjoyable and stimulating to me.	1	2	3	4	5
2. It is very important for me to feel like a member of my group.	1	2	3	4	5
3. In mathematics I can be creative and discover things by myself.	1	2	3	4	5
4. I often feel nervous when I present to the class.	1	2	3	4	5
5. It is important to follow the teacher's methods.	1	2	3	4	5
6. I learn more when I work in small groups compared to working alone.	1	2	3	4	5
7. I try to learn mathematics because it helps develop my mind and helps me think more clearly in general.	1	2	3	4	5
8. I can lead group discussion in a cooperative learning environment.	1	2	3	4	5
9. I prefer listening than talking.	1	2	3	4	5
10. Mathematics makes me feel uneasy and confused.	1	2	3	4	5
11. I can exchange mathematics ideas fluently with others.	1	2	3	4	5
12. Mathematics is a solitary activity, done by individuals in isolation.	1	2	3	4	5

13. Working in groups did not help me.	1	2	3	4	5
14. Mathematics is important for my chosen profession.	1	2	3	4	5
15. Mathematics is needed in designing practically everything.	1	2	3	4	5
16. Communicating with other students helps me have a better attitude towards mathematics.	1	2	3	4	5
17. I am interested and willing to acquire further knowledge of mathematics.	1	2	3	4	5
18. I would like to spend more time in groups.	1	2	3	4	5
19. We worked in groups too much.	1	2	3	4	5
20. I learn mathematics well from lectures.	1	2	3	4	5

http://people.oregonstate.edu/~schorir/ocept/survey.html

Appendix C- Exit Card for Research Study

Please mark "X" in appropriate cells in the following table to evaluate our five Asian culturally responsive math questions.

Original Mathematics Question in Chinese Characters	Translation of the Question	This question reflected Asian culture				I will suggest this question be adopted by my math curriculum			
		strongly	moderately	weakly	I don't know.	strongly	moderately	hardly	I don't know
我问开店李三公，众客都来到店中。一房七客多七客，一房九客一房空。	One day, Lisan's hotel is full of customers. There will be 7 people left over if he assigns 7 people in each room; while there will be one vacant room if he assigns 9 people in each room. How many rooms are there in Lisan's hotel?								
一百馒头一百僧，大僧三个更无争小僧三人分一个，大小和尚各几丁？	There are 100 monks in a temple to share 100 steamed buns as their breakfast. Every adult monk can have 3 buns, while every 3 young monks have to share l bun. How many adult and young monks are there in this temple?								
张家三女孝顺，归家频望勤劳东村大女隔三朝，五日西村女到，小女南乡路远，依然七日一遭，何朝齐至饮香醪，请问英贤回报。	There are 3 daughters in Family Zhang, who care for their parents very much even though they're all married. The oldest daughter visits parents every 3 days; the second daughter comes every 5 days. The youngest daughter can visit parents every 7 days although she lives quite far away. When do they all meet?								
元宵十五闹纵横，来往观灯街上行。我见灯上下红光映，绕三遭，数不真。从头儿三数无零，五数时四盏还未尽。七数时六盏不停，端的是几盏明灯？	In YuanXiao Festival night, I counted beautiful lanterns on the street. There's no left over when I counted them by 3. But 4 lanterns left over when I counted them by 5 and 6 lanterns left over when I did it by 7. Could you tell me how many lanterns are there?								
今有鸡翁一值钱五，鸡母一值钱三，鸡雏三值钱一。凡百钱买鸡百只，问鸡翁、母、雏各几何？	In the farmer's market, a roost' value is 5 Qian(ancient Chinese currency unit). A hen's value is 3 Qian, while 3 chicks' value is 1 Qian. How can I spend 100 Qian to purchase 100 chickens? (It's a famous math question in the world around year 550 due to its multiple answers)								