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# "Math is Hard," Said Mrs. Ford; "Not for Me," Said Mrs. Honda: Does Culture Matter in Teaching and Learning in Elementary Mathematics?

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# "Math is Hard," Said Mrs. Ford; "Not for Me," Said Mrs. Honda: Does Culture Matter in Teaching and Learning in Elementary Mathematics?

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Abstract

*This article is a discussion of the practices of teaching and learning in elementary mathematics from the perspectives of Eastern and Western cultures. It focuses on the differences in teaching pedagogy in math between the United States and three Asian countries: Singapore, Japan, and China.*

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**"Math is Hard," Said Mrs. Ford; "Not for Me," Said Mrs. Honda: Does Culture Matter in Teaching and Learning in Elementary Mathematics?**

Does culture matter in the teaching and learning of elementary mathematics? In 2003, there were significantly different levels of achievement in math and science education on the Trends in International Mathematics and Science Study (TIMSS) between the East and West (American Institute of Research, 2005). The TIMSS collected data from half a-million students from 46 countries in 1995-96 with the purpose of comparing the mathematics and science achievement in these countries. Students were grouped at three levels (Grade 4, Grade 8, and Grade 12), and the results covered a spread of 300 points from the 5$^{th}$ to 95$^{th}$ percentile. The TIMSS is a sample-based assessment- meaning that is administered to a sample of all students in such a way that the results can be generalized to the larger population (Trends in International Mathematics and Science Study, 2003). In this study, the United States (U.S.) students scored above average at Grade 4 and ranked 16$^{th}$ of 46 participating nations at grade eight. However, the distribution of the U.S. scores starts and ends lower than other nations. This means that the average level of general knowledge in mathematics among students in a majority of these countries matched that of the top quarter of the U.S. students. In fact, scores for the U.S. students were among the lowest of all industrialized countries (American Institute of Research, 2005). On the other hand, Singapore, a small Southeast Asian country with a population about the same as Chicago's, ranked first in the world and their students performed well in all five TIMSS mathematics content areas: (a) fractions and number sense; (b) measurement; (c) data representation, analysis and probability; (d) geometry; and (e) algebra (AIR, 2005). The U.S. students scored significantly lower in all five content areas. These results caused great consternation among educators, providing the impetus to look at what we teach, how we teach it, and how we assess it.

According to a 2001 report by the National Center for Education Statistics, American 12$^{th}$ graders of different ethnicities had very different scores on mathematics tests. Asians and Pacific Islanders scored 319 compared to Whites (308), Blacks (274), Hispanics (283), and American Indians (293). These data showed that ethnic Asians tend to be good in mathematics regardless of whether they are living in their native cultures.

The U.S. educational system has no official national mathematics framework, and state frameworks differ greatly from state to state. In addition, the U.S. framework does not make provisions for students' variability in mathematical ability and therefore does not provide students with alternative frameworks (American Institute of Research, 2005). The National Council of Teaching Mathematics' framework, which emphasizes higher order and twenty-first century skills in a visionary way, lacks the logical mathematical structure of the mathematical framework. It identifies content only within broad grade bands (e.g., K-2, 3-5) and only in general terms, thus providing inadequate content guidance to educators (American Institute of Research, 2005).

In general, the Asian educational system seems to excel at producing students with a strong grasp of mathematical content knowledge, and students in Asian countries tend to receive the highest scoring on the TIMSS. However, according to the TIMSS report, Western systems have other strengths such as being successful at helping students develop problem-solving skills and the ability to apply knowledge to real-life situations (American Institute of Research, 2005).

In this article, I discuss the practice of teaching and learning in elementary mathematics from the perspectives of Eastern and Western cultures. I focus on the differences in teaching pedagogy in math between the U.S. and three Asian countries: Singapore, Japan, and China.

## Mathematics Teaching: What is the Difference between the U.S., Singapore, Japan, and China?

### Singaporean Math and U.S. Math

According to the results of a study conducted by the American Institute of Research (2005), Singapore has a world-class mathematics system with quality components designed to produce students who learn mathematics to a mastery level. These components include “Singapore’s highly logical national mathematics framework, mathematically rich problem-based textbooks, challenging mathematics assessments, and highly qualified mathematics teachers whose pedagogy centers on teaching to mastery” (American Institute of Research, p. ix). Singapore’s mathematics curriculum places a greater emphasis on developing mathematical concepts and fostering the ability to apply them in mathematical problem-solving situations. In addition, its format is similar to that of the TIMSS study test items.

In spring 2000, the Montgomery County public schools in Rockville, Maryland, conducted a pilot study in an effort to improve and accelerate mathematics instruction. The purpose of the study was to determine whether, and to what degree, implementation of the Singapore Math program in grades one through five in four selected schools could alter how mathematics concepts were presented by teachers, and elevate and accelerate the mathematics performance of the Montgomery County public school elementary schools students (Gross & Merchlinsky, 2002). In the study, Singapore Math curriculum materials were compared to the U.S. curriculum Everyday Math. Results showed that students who participated in Singapore Math were exposed to mathematics earlier than was typical in Montgomery County public schools, and significantly outperformed the students who used U.S. math (Gross & Merchlinsky, 2002).

The Singapore framework lays out a balanced set of mathematical priorities centered on problem solving. It includes an emphasis on computational skills along with more conceptual and strategic thinking processes. The framework covers a relatively small number of topics in-depth and is carefully sequenced grade by grade, following a spiral organization in which topics presented in one grade are covered in later grades, but at a more advanced level. Students are expected to have mastered prior content, not to merely repeat it (Ministry of Education Singapore, 2001).

Singapore mathematics curriculum is based on the concept of mastery learning, which proposes that all children can learn when provided with the appropriate learning conditions in the classroom. Mastery learning is based on Benjamin Bloom's Learning for Mastery model, is predominantly group-based, and utilizes a teacher-paced instructional approach, in which students learn by cooperating with their classmates (American Institute of Research, 2005). Mastery learning does not focus on content, but on the process of mastering it. Mastery learning ensures numerous feedback loops, based on small units of well-defined, appropriately sequenced outcomes. This type of learning works best with the traditional content-focused curriculum that is based on well-defined learning objectives organized into smaller, sequentially organized units. In this approach, the teacher provides frequent and specific feedback by using diagnostic, formative tests, as well as regularly correcting mistakes students make along their learning path. In addition, teachers evaluate students with criterion-reference tests rather than norm-referenced tests.

Singapore Math textbooks and workbooks were meant to be used as a part of a system of learning in which adult supervision and independent practice go hand in hand (Ministry of Education, Singapore, 2001). The main feature of this series is the use of the Concrete Pictorial Abstract approach. The students were provided with the necessary learning experiences beginning with concrete and pictorial stages, and followed by abstract stages to enable them to learn mathematics meaningfully. This approach encourages an active thinking process, communication of mathematical ideas, and problem solving and helps develop the foundation students will need for more advanced mathematics. Practice exercises are designed to provide the students with further practice after they have done the relevant workbook exercises. Review exercises are provided to offer cumulative reviews of concepts and skills (Ministry of Education, Singapore, 2001).

The U.S. math textbook emphasizes definitions and formulas, not mathematical understanding; its assessments are not especially challenging (Emerson, 2007). The U.S. math books produce students who have only learned to mechanically apply mathematical procedures to solve routine problems and who are, therefore, not mathematically competitive with students in most other industrialized countries (Chang, 2008). However, the U.S. mathematics system has some features that are an improvement on Singapore's system, notably an emphasis on twenty-first century thinking skills such as reasoning and communications and a focus on applied mathematics. For example, the Everyday Math textbook uses a problem-based learning approach, which presents multistep real-world mathematics problem. Such application give students practice in understanding how to apply mathematics in practical ways, but lessons using real-world applications without providing the foundation of strong conceptual topic development do help children less in solving skills in mathematical problems (Gross & Merchlinsky, 2002).

The U.S. math curriculum and pedagogy appear to be quite different from those of the top scoring countries in the TIMSS such as Singapore. The U.S. curriculum contains too many topics and contains more topics in every year from K-12, resulting in learning that is "mile wide, inch deep". In curriculum comparisons, the U.S. mathematics curriculum lacks the coherence, focus, and rigor of the curriculum taught in other countries that participated in the TIMSS (Furner & Robinson, 2004).

In fact, the U.S. textbooks covered 75% more topics than those in any other country in the TIMSS. This indicates that the U.S. textbooks cover many ideas, but do so superficially, leaving students with knowledge of techniques but lacks of mastery of the underlying concepts. The textbooks lack a centrally identified core of mathematical content that provides a focus for the rest of the system (American Institute of Research, 2005).

Zhao (2005) stated that Asian students spend a lot of time on each individual subject, but math is the top priority. Asian students spend much more time on homework than do their counterparts in the U.S. In particular, Singaporean students receive more homework than U.S. students (Ng, 2001). Two-thirds of Singaporean eighth graders were assigned at least 30 minutes of mathematics homework at least twice a week, compared with only 25 percent of U.S. eighth graders (Ministry of Education, Singapore, 2001). In most Asian countries, more than 50% of the homework is in mathematics (Ma, 1999). A high proportion of Singapore's children receive additional after-school help with their school work from private tutors (Ng). Parents pay large amounts of money to pay tuition for these classes. Singaporean parents place a high value on math and understanding mathematics is as important, culturally speaking, as knowing how to read well.

**Japanese Math and U.S. Math**

Japanese teachers widely practice what the international mathematics education research community recommends, while U.S. teachers do so less frequently. Teachers in the U.S. focus primarily on the acquisition and application of skills rather than problem solving and thinking; "While 62% percent of Japanese 8$^{th}$ grade mathematics lessons included deductive reasoning, no American lessons did" (American Institute of Research, 2005, p.1). Most U.S. teachers spend their class time telling students how to do something, and students follow their lead. As a result, students have a very passive view of learning, quite at odds with what we know about how learning actually occurs (Trends in International Mathematics and Science Study, 2003).

Another finding from the TIMSS study was that U.S. teachers focus on skills, whereas Japanese teachers focus on understanding. This is reflected in the U.S. high-stakes tests, which have traditionally valued skill acquisition and speed. However, Bracey (1997) argued that in the U.S. more topics are introduced each year and are repeated in subsequent years to reflect the pursuit of the oft-espoused goal of the "spiral curriculum" (p. 656). He further stated that "the U. S. teachers used overhead projectors 50% of the time whereas Japanese teachers used chalkboard 80% of the time to demonstrate step by step math problems to find the right answers and the teachers left the illustrations up for the entire time for students to refer while they practice the math problems" (Bracey, p. 657). The Japanese teachers also used illustrations as the focus of discussion on the chalkboard, while American teachers use them as a means of directing students' attention before moving on to something else.

In the TIMSS study, 24% of U.S. teachers used lesson activities that are not related to math, such as commenting about the previous night's sports scores. The percentage of lessons that suffered from off-topic distractions was 31% (Stigler & Hiebert, 2007). In Japan, none of the lessons contained off-topic comments. In addition, 70% of the instructional time in the Japanese classroom was devoted to understanding the concepts while U.S. classroom spent math class time on how to work problems (Furner & Robinson, 2004).

Perhaps the most important finding of the TIMSS study is the amount of hours the Japanese teacher spent on class preparation; their preparation time was almost double what the U.S. teacher spent. The Japanese teacher spent one hour of preparation for two hours of instruction time, whereas U.S. teacher spent 30 minutes preparation for two hours instruction time (Trend International Mathematics and Science Study, 2003).

According to the TIMSS, when asked to describe the educational goal, the typical U.S. teacher said it was to teach students how to do something, while Japanese teachers felt the goal was to help students understand the concepts (Furner & Robinson, 2004). A typical Japanese teacher stands up in front of the class, offers a complex, thought-provoking problem, and allows students to work to find a solution. Ideas are exchanged before the teacher intervenes only when necessary or in order to summarize the lesson. Students then practice similar problems. Japanese teachers believe the key to mathematical understanding is the ability to communicate ideas and problems. Mastery takes time as students first experience a problem and then struggle with the solution. "A U.S. teacher is more inclined to instruct the students how to do something rather than to allow the student the opportunity to develop the concepts on their own" (Furner & Robinson, p. 8).

One factor that may contribute to the difference in performance between Japanese students and U.S. students is the teacher's ability to anticipate students' thinking. This ability is an important indicator of good mathematics teaching because it plays an important role before, during, and after the lesson. For example, in the introductory lesson on division with fractions, a second-grade teacher in Japan posed division problem and asked the students to find the answers by using what they had learned (Watanabe, 2001). The students were asked to divide 1¾ by ½, explain how they did the calculation, and make up a good story problem. Many students responded that they knew the answer was 2¼ (how many ½'s in 1 ¾ by using the quotitive meaning of division). The teacher anticipated that students would use various strategies to find the answers they have learned in the previous lessons of division, subtraction, addition. For example, some students will use ⅞ ÷ ½ instead of how many ½'s in 1¾. In the view of the National Council of Teachers of Mathematics standards, this practice is appropriate and meets one of the standards (2000):

> Effective mathematics teaching requires a serious commitment to the development of students' understanding of mathematics. Because students learn by connecting new ideas to prior knowledge, teachers must understand what their students already know. Effective teachers know how to ask questions and plan lessons that reveal students' prior knowledge; they can then design experience and lesson to respond to, and build on, this knowledge (p.18).

There are three major reasons for the high achievement of Japanese students in the international comparisons: (a) their parents' high expectations for education, (b) the diligence of the Japanese people, and (c) a school system with a national curriculum and good teachers (Shimizu, 2001). Students spend extra hours after school working on math problems, and mathematics is regarded as key subject. In mathematics teaching, children receive instruction focused on the procedures to solve problems after they understand the mathematical concepts. Students are able to understand the power of mathematics in applied work rather than see mathematics merely as an exercise in problems assigned by the teacher.

Japanese teachers work very hard to craft lessons that will reach all students (Fuji, 2001; Shimizu, 2001). Although Japanese teachers have larger class sizes, ranging from 40 to 45 students as compared to the 30 to 35 students in a typical U.S. classroom, they provide new instruction for 35 minutes in a 50-minute period daily as opposed to the U.S. teacher who provides new instruction for only 20 minutes in a 50-minute period (Sugiyama, 2001). The rest of the time in U.S. classroom is spent reviewing concepts, going over homework, and offering in-class time for practice. Japanese teachers focused on the procedures to solve problems (Shimizu, 2001) but U.S. teachers focused on the understanding of mathematical concepts (Stigler & Hiebert, 2007). This argument can be explained in the context of how teachers' perspective about teaching math influenced their ability to teach the subject.

The American Institute of Research's (2005) study results show that student's poor performance is actually due to the fact that the teaching pedagogy is not conducive to learning math. This statement is supported by Lee's (2004) findings on the predictors of kindergarten teachers' practice of developmentally appropriate mathematics: attitude toward mathematics, attitude toward teaching mathematics, and pedagogical content knowledge of mathematics. Lee reported that kindergarten teachers' attitudes toward teaching mathematics and pedagogical content knowledge of mathematics were found to be significant factors in predicting whether their teaching practice would be conducive to learning mathematics. In a study of teacher's beliefs about teaching mathematics, Hazelton (2004) indicated that another factor of poor performance and low scores in mathematics was U.S. teachers' belief that students' math ability is innate and difficult to improve. By contrast, Japanese teachers believe that all children can learn math if they are given the "right environment." For example, all Japanese children are taught math at the same level even though they may be behind in some of the concepts because the teachers believe that in this way the children will be in the same pace with other children. The parents of the children who are behind in math will do special math tutoring at home or send their children to after-school math classes evenings and weekends (Shimizu, 2001). Parents will spend a considerable amount of money to pay the tuition because they believe that math is the foundation of good education for their children.

**Chinese Math and U.S. Math**

In most Asian countries, mathematics teachers are well prepared in pedagogical content knowledge and skills (Chang, 2008; Lee, 2004; Ma, 1999). In other words, teachers really understand how to teach mathematics and believe that this understanding makes a classroom genuinely helpful for children. Ma commented,

> While they [U.S. teachers] did not know advanced math, elementary math was simple; they already knew it, and the only need was to learn how to teach. But Chinese teachers thought they still needed to learn about the subject – not only about how to teach. They saw teaching as a way to learn more about math (p. 3).

By contrast, U.S. teachers try to teach what they think they already know. Ma clearly explained that U.S. teachers' mathematical understanding of teaching mathematics subtraction is merely related to their own knowledge and sometimes are incorrect procedures to solve mathematical problems. The difference shows up in the simplest problems: "We can't subtract a bigger number from a smaller one," said one U.S. teacher in explaining how to solve 62 - 49 = 13 (Ma, p. 3). Making false mathematical statements will confuse or create misconceptions for children. Another misleading but common technique for teaching subtraction is the concept of "borrowing" (e.g., the 2 "borrows" 10 from the 6) which "suggests that the two digits of the minuend are two independent numbers rather than two parts of one number" (Ma, p. 3). According to Ma, the language used is the key defining difference between American and Chinese teachers; American teachers "speak like a lay person" (p. 4). Teachers with an understanding use math terms that would make the instruction more clear.

U.S. teachers aimed to teach students correct procedural knowledge, while the Chinese taught problem-solving strategies. However, for more complex problems, such as dividing by fractions, most U.S. teachers did not even get the calculation right. In a study conducted at Michigan State University, many U.S. elementary school teachers were found to have problems with fractions, some in doing and explaining calculations, and more with making up word problems (American Institute of Research, 2005). Chinese teachers were able to put problems on the board and have the students compare the different meanings they represent. Then the students were asked to make up their own story problems to represent different models of divisions by fractions. Most of the examples given by U.S. teachers dealt with round food, like pizza, or money, while the Chinese examples were from many different areas.

Is the Chinese method of elementary mathematics teaching better than the U.S. method? According to Ma (1999), yes. Chinese teachers continue their education after they begin their teaching careers. They study their text books very carefully and figure out different ways to work the problems and explain the materials to students. Most Chinese teachers specialize in only one or two subjects at different grade levels, so that

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they develop a deeper understanding of other levels of mathematics. A number of teachers Ma interviewed had developed what she called “profound understanding of fundamental mathematics” (p. 21). Ma stated, “A teacher with profound understanding of fundamental mathematics is not only aware of the conceptual structures and basic attitudes of mathematics inherent in elementary mathematics, but is able to teach them to students” (p. xxiv).

Chinese students use more abstract or closed-end strategies than U.S. students. U.S. students are less likely than Chinese students to use generalized problem-solving strategies (Ma, 1999). One possible reason for this is that teachers in the U.S. less frequently encourage their students to move to more abstract representations and strategies in their classroom instruction.

A common conception held by some teachers in the U.S. is that concrete representations or using manipulative materials are the basis for all learning. These teachers believe that pictorial representations or concrete materials can facilitate students’ conceptual understanding. However, some research shows that the use of manipulative or concrete experience alone does not guarantee students’ conceptual understanding (American Institute of Research, 2005; Chang, 2008). The purpose of using concrete visual representation is to enhance students’ conceptual understanding of the abstract nature of mathematics, but concrete experiences do not automatically lead to generalization and conceptual understanding. If the concrete strategy does not extend to the abstract level, students’ development of mathematical-reasoning abilities may be limited (Cai, 2000).

When teachers use manipulatives such as cruisers or counting beads, children will understand because they can visualize the ideas. However, when faced with actual figures and numbers, many children cannot transfer the skills. On the other hand, if students have been trained to solve problems using mental math, they will calculate answers in their heads instead of visualizing beads or cruisers. They think of numbers rather than objects. Teaching mental math helps students solve most problems using logical steps; they often do not need to use pencil and paper. Mental math allows children to quickly calculate answers rather than memorize facts and figures. Therefore, children are requiring a firm mathematical foundation and mathematical thinking (Cooney, 2001).

Fifty percent of U.S. teachers used overheads on a regular basis as compared to Chinese teachers, who virtually never use the overhead (Cooney, 2001). Some U.S. teachers spend less time talking through and detailing the steps to all levels of student’s ability. Chinese teachers spend more time in explaining and detailing the steps of how to solve the problems. Chinese teachers thoroughly explained math problems step by step on a chalk board until the students understand and can do the exercises on their own to find the correct answers. Ma (1999) indicated that mathematics teaching and learning require a substantial amount of time to understand the concepts and to practice the skills to solve problems. In contrast to Chinese students, U.S. students do not spend much time in math practice either at school or at home (American Institute of Research, 2005).

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Many parents in Asian countries see knowledge of mathematics as basic to the foundation of learning that allows them to master other learning areas such as language arts or reading. Asians do not see learning math as just another class to pass but as the way people solve problems in everyday life (Chang, 2008). In contrast, parents in the U.S. are worried if their children cannot read or write well in the elementary grades and are not as concerned about whether they can solve mathematical problems (Bracey, 1997).

Many U.S. children lack understanding of number facts. For example, when they see a certain fact such as 3 + 2 = 5 or 5 – 3 = 2, the children must calculate the answers each time rather than knowing them by heart. They also had trouble understanding how to conserve quantity as well as the concepts of centering, transductive reasoning, and irreversibly. Six-year-olds can count objects accurately to 100 by ones, twos, fives, and tens, add and subtract vertically, and do equations, but they have difficulty understanding equations in which the unknown is in different positions such as 3 + □ = 5 or 5 - □ =2 (Lee, 2004).

In addition, many U.S. children often understand things on a concrete level but have trouble with the written expression of the same idea. In the first grade, children have to learn the chevron symbols for greater than or less than, and learn about measurement and understand the concepts. Among the concepts that first grade U.S. children find most difficult is the associative property of numbers, known as regrouping. An example of regrouping is found in the following problem: 5 + 3 = 8, 5+ (2 + 1) =?, 7 + 1 + □ = ? (Trends In International Mathematics and Science Study, 2003). However, this issue does not appear for most Asian children (Cai, 2000; Cooney, 2001).

## What are the Problems of U.S. Math Teachers?

Math reformers argue that we should be teaching for understanding; however, teachers who themselves do not fully understand even the most basic mathematical operations cannot be expected to help their students build reasoning skills (Gorman, 2006; Ma, 1999). Most of U.S. children's failure in mathematics is due to poor teaching. Some teachers are unable to do their jobs effectively. For example, Gorman found that very few teachers have more than a limited understanding of concepts as basic as subtraction. Ma wonders, "What kind of 'teaching for understanding' can we expect from teachers who do not have a 'profound understanding of fundamental mathematics' themselves" (p. 34)? A teacher with profound understanding of mathematics is not only aware of the conceptual structure and basic attitude of mathematics inherent in elementary mathematics but is also able to teach them to students. In addition, teachers need a corresponding understanding of how children learn. Teaching mathematics with understanding means creating experiences in which these interconnections can be made. Without these interconnections, there is a real danger that questions offered in isolation would make the learning process piecemeal and incoherent.

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Teachers' attitudes towards mathematics content and teaching mathematics indirectly influence their students' learning of mathematics (Lee, 2004). Future teachers must realize that all students really need to graduate from high school feeling good about their math performance, because it can influence their future career choices. It truly is a teacher obligation to foster students' positive attitudes toward math. Teachers who lack strong content knowledge should attend practical training as part of their professional development. According to Ma (1999), "Math is not a mastery that cannot be solved. I believe that anyone can learn math. The problem is how we teach them. We have to build math concepts and skills step by step" (p. 58).

**Undergraduate Mathematics Teacher Preparation in the U.S.**

Continued improvement of mathematics education in the U.S. is crucial. Evidence from a variety of sources makes it clear that many students are not learning the mathematics they need or are expected to learn. The reasons for this deficiency are many. In some instances, student teachers have not had the opportunity to learn important mathematics concepts. In other instances, the curriculum offered to students does not engage them. The quality of mathematics teaching is highly variable. Nevertheless, mathematics teaching cannot be improved substantially without taking into consideration the teachers' pedagogy content knowledge and teacher preparation programs (American Institute of Research, 2005; Cain, 2000; Cooney, 2001).

Teacher training colleges and university must make a requirement that all students entering teacher programs take at least three levels of math education: elementary, tertiary, and advanced. Many teacher education programs' preparation for teaching math is lacking. In some colleges and universities, mathematics education courses are offered through the Math department rather than in the elementary education programs. There are huge differences between mathematics courses taught in Mathematics departments and in Education departments. Courses taught in Mathematics departments are about how to *learn* math, while courses in Education departments are about how to *teach* math.

Courses in school mathematics should focus on a thorough development of basic mathematical ideas (Wu, 2009). Attention to the broad and flexible application of basic ideas and modes of reasoning is preferable to superficial coverage of many topics. All courses designed for future teachers should develop careful reasoning and mathematical common sense in analyzing conceptual relationships and in applied problem solving (Gorman, 2006). National Council of Teachers of Mathematics (2000) suggests that future teachers should learn how basic mathematical ideas combine to form the foundation on which specific mathematical lessons are built. Teacher preparation programs should consider collaborating with Professional Development Schools in order to let pre-service teachers work with classroom teachers and students to better plan effective lessons (Wu, 2010). Brewer and Daane (2002) have shown that when a team of teachers work together and discuss best practices and constructivist teaching approaches, all teachers on the teams are more likely to translate theory into practice in their classrooms.

Classroom teachers must have more time to plan for instruction in order to craft each math lesson the best possible lesson for all students (Stigler & Hiebert, 2007). An increase in educator's instructional planning time to craft quality lessons must be viewed as high priority. Teaching math is challenging. Teachers must not only understand the mathematics that they are to teach but also know how to engage students in the content (Wu, 2009). Teachers need scientific knowledge about how children learn mathematics as well as knowledge of mathematics itself (Hill, Rowan, & Ball, 2005). Prospective teachers need a solid basis on which to build their understanding of mathematics a basis that includes not only mathematical knowledge and attitudes but also a sense of how students learn.

Prospective mathematics teachers need to "be able to represent mathematics as coherent and connected enterprise" (National Council of Teachers of Mathematics 2000, p. 17). They must be capable of developing and fostering classrooms in which students can use their imagination, skills, and knowledge to explore new situations with confidence and with the expectation of success. From their mathematical experiences, students should understand the importance of rigor and communication. Prospective teachers should be taught to educate in this manner (National Council of Teachers of Mathematics). Now, can we ask teachers who are teaching math in elementary schools to accept the fact that they need a right way to teach math to young children? Our biggest long-term problem, according to Stigler and Hiebert (2007), is not how we teach but that we have no way of getting better. It is more helpful to direct attention to the factors most closely connected to students' performance, the curriculum they experience, and the effectiveness of the way that teachers teach the curriculum. In the U.S. there is a "vicious circle formed by low-quality mathematics education and low quality teacher knowledge of school mathematics" (American Institute of Research, 2005, p. 2).

Changing how mathematics courses in undergraduate teacher programs are taught is a more difficult challenge, but is even more essential. Pedagogical changes both in undergraduate content and in method courses will happen only if the culture of the collegiate faculty changes (Furner & Robinson, 2004).

It is the teacher's job to understand how children think about mathematics when they come to school and to build on this informal understanding (Brown, 2005). However, parents play an equally important role in helping their children with math homework. It is the parents' job to make sure their children understand how to apply math in their everyday life (Cai, 2000). This is one way to make sure that math learning is meaningful. Successful mathematics learning can be measured by how accurately students use math skills and concepts in their everyday lives.

## Cultural Resources of Asian Children

Literature on Asians' success in math has focused on claims that they have access to cultural resources which place primary emphasis on the academic and stress effort, rather than natural ability, as the key to success (Md-Yunus, 2006; Pearce, 2006): "This emphasis on effort over ability is a central component of Asian success in math" (Pearce,

p. 81). One of the foundations of the educational frameworks in many Asian countries is based on the Confucian philosophy of teaching and learning for young children (Md-Yunus). Confucius emphasized achieving goals and using philosophy to guide achievement. In many cases, children nurtured with this mentality tend to be more receptive to what they are told by parents. Moreover, this kind of philosophy, in which receptiveness and diligence are considered virtues, helps Asian children more easily become accustomed to studying mathematics. Children are often exposed to situations in which adults are using numbers. Nurtured in a situation where adults are very good at counting and computing, children feel a desire to emulate them. The more they are exposed to situations that use numbers in daily life, the better the environment is for mathematics education.

Teaching and learning mathematics can be perceived in relation to the nature of society and its values. The results of the TIMSS study give a comprehensive look into math performance and instruction on a global level. Perhaps U.S. math teachers must decide, which if any, of their societal circumstances have implications for teaching and learning mathematics. Asian students' success in mathematics has been seen to be related to the nature of their society and its values. The high achievement of Asian students in mathematics seems to be a result of a combination of various factors, including the importance given to education in general, parental commitment to their children's education, teachers' preparation, and the significance of mathematics for every student's successful future. Uy (2001) summed up the distinct educational values hold by the Asian parents and children:

> Parents point out early in life that nothing is handed out freely, that everything must be earned, that hard work and effort will pay off in the future, and that children must be patient as their time will come. This approach to life is very Confucian – both hard work and discipline are essential in success. When an Asian student performs badly, she or he blames herself or himself for failing to exert enough effort. When confronted with something unfamiliar in a test, Asian students often blame themselves for failing to anticipate such a problem. The bar is always set higher. Asian students and parents rarely blame teachers for low grades. They simply accept it and hope to do better next time (p. 25).

## Conclusions

No one argues that learning math is one of the primary sources of lifelong learning and helps the country to the progress for civilization. Math education in some Asian countries is designed for the students in those countries and may be not suitable for students from other countries. Although the U.S. needs to acknowledge the excellence of math programs and the success of some Asian students, the U.S. has its own math programs, curricular, and pedagogy which are based on the culture of its society (Stigler & Hiebert, 2007).

In addition, U.S. educators also need to examine both the effective and ineffective practices of other system before making assumptions that other nations' programs are better than those in the U.S. System of Teaching mathematics are not easily transported from one culture into another. We need to look at each strategy and practice in an integrated manner to produce the desired effects. U.S. teachers also must examine other nations' experiences from their own perspective and culture, so that they do not misinterpret what we defined as "excellence and less competitive" in the U.S. educational system. It is important to realize that cultural expectations play a large role in determining how we educate our children. Teaching, as a cultural activity, fits within a variety of social, economic, and political forces in individual society. The effects of teaching are determined, in part, by all of these forces.

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