DOCUMENT RESUME

ED 412 088 SE 060 601

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TITLE The Effect of Cultures in Eighth Grade Mathematics Classroom: A Case Study of a LEP Student.
PUB DATE 1997-05-00
NOTE 32p.; Senior Honors Thesis, The Ohio State University.
PUB TYPE Dissertations/Theses (040)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Comparative Education; Foreign Countries; Foreign Students; Grade 8; *Intercultural Communication; Junior High Schools; Language Proficiency; *Limited English Speaking; *Mathematics Achievement; Mathematics Instruction; Middle Schools; *Student Adjustment
IDENTIFIERS Japan

ABSTRACT

The fastest-growing sector of the American school population is the limited English proficient (LEP) students, those students whose native language is not English. When mainstreamed they are usually enrolled in physical education, art, and music classes first. The students then enter mathematics classes under the assumption that mathematics is computation-bound and easier to manage. These students are a new challenge to mathematics teachers who are incorporating new ideas of teaching and learning presented in the reformed state mathematics curricula. This is a case study of an eighth-grade LEP student from Japan. The purpose of the study was to examine the effects that culture and language have in the mathematics classroom: What factors influence the adjustment and experience of the student in the new school setting and enhance his or her achievement in mathematics? Data were collected over five weeks in the form of field notes of observation and interview and also various mathematics-related artifacts. Findings indicate that factors such as teaching differences between cultures, communication, and method of assessment and evaluation greatly influence the adjustment and experience of the LEP student in American classrooms and achievement in mathematics. Contains 31 references. (PVD)

The Effect of Cultures in Eighth Grade Mathematics Classroom: A Case Study of a LEP Student

A Senior Honors Thesis

Presented in Partial Fulfillment of the Requirements for Graduation with Distinction in Elementary Education in the Undergraduate Colleges of The Ohio State University

by

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May 1997

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Abstract

This is a case study of an eighth-grade Limited English Proficiency (LEP) student from Japan. The purpose of the study was to examine the effect which culture and language have in the mathematics classroom. During the five-week period of participant observation, the data was collected in the forms of field notes of observation and interview, and also as various mathematics related artifacts. The study found that the factors such as teaching differences between cultures, communication, and method of assessment and evaluation greatly influence the adjustment and the experience of the LEP student in American classrooms and his achievement in mathematics.

The Effect of Cultures in Eighth Grade Mathematics Classroom: A Case Study of a LEP Student

The changing demographic picture of students in American schools has been widely documented (Delpit, 1995; Friedlander, 1991; Secada, 1992; Short, 1994; Slaughter-Defor et al., 1990; Smart, 1995; Spener, 1988). The fastest growing sector of the population is the limited English proficient (LEP) students, whose native language is not English. U.S. Department of Education estimated that 5.7 percent of the students in kindergarten through twelfth grade were LEP in 1991, and also predicted that more than 5 million immigrant children would enter U.S. public schools during 1990s, who would speak 150 different languages (Banks, 1993; Friedlander, 1991).

There is a wide range of English as a Second Language (ESL) classes or Bilingual Education classes available into which LEP students are often placed. Those special classes are usually transitional in nature, and the students are gradually introduced to regular classes (Spener, 1988). When mainstreamed, they are usually enrolled in physical education, art, and music classes first since it is believed that those classes depend more on hands-on activities and less on English language (Short,1994). The students then enter mathematics classes, under the assumption that mathematics is computation-bound and easier to manage, before enrolling in the classes which require more proficiency in the language such as social studies or English (Greene, 1996; Short, 1994). These students are a new challenge to mathematics teachers who are incorporating new ideas of teaching and learning presented in the reformed state mathematics curriculums (Ohio Department of Education 1990), based on the national standards for reform in curriculum, teaching, assessment, and evaluation in mathematics (National Council Teachers of Mathematics 1988, 1990, 1995). Mathematics is not exclusively taught with numbers: it involves problem solving, reasoning, and oral and

written communication in English (NCTM, 1988). When it comes to assessing LEP students' problem solving and reasoning abilities, there are various factors to be considered that influence the assessment, such as the student's cultural background, and his/her degree of proficiency in language, etc. (Secada, 1992).

Purpose

In today's classrooms, we notice diversity in race, ethnicity, social class, and language among the students. When these differences occur between a student and his/her teacher, misunderstandings in learning may occur.

This study will examine the various effect which culture and language have in a mathematics classroom with a LEP student. What factors influence the adjustment and the experience of the student in the new school setting and enhance his/her achievement in mathematics?

Definition of Terms

English–Speaking Student	Student whose native language is standard–English, and who speaks the language exclusively.
Limited English Proficient Student	Student who uses a language other than English (usually at home, but a broader setting may be given), and the language has some impact on the student (ranging from the student having some understanding of it to being mono–lingual in that language) that the student is not fluent in English, and the student's academic

	performance suffers as a result of that limited fluency --- that is, the student has low academic achievement (Bilingual Education Act, 1988; Iowa Department of Public Instruction, 1983: Michigan Department of Education,1977: Minnesota Education for Limited English Proficient Student Act, 1988: Wisconsin Department of Public Instruction, 1984, as cited in Secada, 1992)
Mathematics Assessment	The process of gathering evidence about a student's knowledge of, ability to use, and disposition toward mathematics and of making inferences from that evidence for a variety of purpose. (The National Council of Teachers of Mathematics 1995)

Literature Review

John J. Macionis (1992) defined culture as "the beliefs, values, behaviors, and material objects shared by a particular people". It is a fact that people in different parts of the world have very different ideas about basic things in life, such as what is pleasant and unpleasant, true and false, polite and rude, right and wrong. What one perceives good in one culture might be totally unacceptable in the other. Everything that makes up a people's way of life can be referred as "culture", and its social influences upon us are enormous; even our identities and behaviors are shaped by our culture (Myers, 1993). What we consider human nature is not grounded in instinct but rather in culture (Barash, as cited in Macionis, 1992).

Language is a very important component of culture because it is a medium of transmitting the culture from one generation to the next. It is our window to the accumulated ancestors' knowledge of centuries. In addition, each language fuses symbols with particular emotions. Sapir–Whorf hypothesis holds that language

amounts to more than simply attaching labels to the "real world" (Sapir and Wholf, as cited in Macionis, 1992). Language is the reality to the people who use it since every language includes words or expressions that have no precise counterpart in other languages. As we speak, we actually experience "distinct worlds, not merely the same world with different labels attached" (Sapir, as cited in Macionis, 1992). When we consider cultures as our vehicles of life, language is the necessary fuel. Culture cannot exist without language. There is a strong correlation between them.

U.S. Department of Education estimated the growing number of LEP students attending American schools in 1990s. Those students come from various cultures and speak many different languages. While in a special ESL or Bilingual Education program, they are introduced into regular mathematics classrooms relatively early, in comparison to social studies or English classes (Short, 1994). It is even believed that mathematics could be a key success to their academic achievement since it does not require proficiency in English (Greene, 1996).

However, the proficiency in English does matter when it comes to mathematics achievement. Secada (1992) presented some studies which indicated relationships between the degree of proficiency in a given language and mathematics achievement in the language. Fernandez and Nielsen (1986) found that for bilingual seniors from the 1980 cohort of whites and Hispanics, there was a significant relationship between their proficiency in English and their achievement in mathematics. Duran (1988) found that logical-reasoning factor was common across both Spanish and English administrations of a battery of logical-reasoning and reading tests given to Puerto Rican bilingual adults. He also found that reading in English predicted performance on the logical-reasoning factor. De Avila and Duncan (1981) reported significant correlation between English language proficiency and mathematics achievement as measured by 1st, 3rd, and 5th grade competency tests of basic skills (CTBS). When compared, it was concluded that language proficiency was the most important factor in mathematics

achievement, even more influential than socioeconomic status of students. De Avila (1988) found an overall correlations between language assessment scales (LAS) and mathematics achievement on the CTBS and the specialized mathematics and science criterion-referenced test linked to the curriculum he was developing. Tsang (1983) also found with his study of Chinese immigrant students that English proficiency strongly affected their understanding of word problems in mathematics. Saxe (1988) concluded in his study that LEP students are handicapped with respect to how mathematics achievement is assessed. These studies and others indicated a relationship between how proficient someone is in a language and performance on a measure of mathematics. However, there is much variance that needs to be explained.

Other studies have linked teacher expectations and student achievement. Often teachers have been blamed for the achievement of minority and low SES students (Secada, 1992). Cooper (1979) suggested that "teacher expectations often serve to sustain, rather than bias, student performance. . . . [But] even the maintenance of below-average performance through teacher-expectation's effect ought to be the focus of societal concern" (as cited in Secada, 1992). In their study, Cocking and Chipman (1988) found that majority teachers thought they were protecting language minority students from failure experiences by setting lower level goals than they set for majority students. It is also found that parental encouragement patterns were similar to those of the teachers. As a result, LEP students are often placed in a classroom in which they find the material taught boring and feel unchallenged.

Also the cultural background of LEP students influence their view toward what mathematics is and their achievement in mathematics (Bracey, 1991, 1994; Farley, 1995). Although there is a notion that mathematics is the universal language and students could understand it the same way no matter which culture they are from, in reality, it is taught very differently from one culture to the other. Vygotsky focuses in his sociocultural theory (1934/1987) that the cognitive development of a child is

affected by his/her culture differently through a socially mediated process (as cited in Berk, 1993). For example, American parents and children place greater emphasis on lack of ability to explain low performance in mathematics, while Japanese counterparts place emphasis on lack of effort (Tsang, 1983). From this point of view, Japanese teachers have higher expectations for the students based on the belief that every child can achieve with effort, and encourage them to work hard. Also Japanese culture supports and places high value on children's mathematical understandings (Saxe, 1988). Nagasaki and Becker (1993) found in their study of second grade mathematics class that Japanese teachers focus their lessons to draw out the variety of students' thinking. The teachers spend large part of their instructional time on whole class lecture to stimulate students' thinking. The discussion of students' ideas is also a prominent characteristic in their classrooms where students are expected to give verbal explanation to their thinking. The lessons are organized for the teacher to pull together students' ways of thinking, discuss their mathematical quality, and summarize their knowledge and understanding. The teachers focus on teaching for students' understanding.

Third International Mathematics and Science Study (TIMSS) (1997) found that 44 percent of the Japanese lessons assigned problems in which students had to invent new procedures that require them to think and reason; while little mathematical reasoning was expected in the United States lesson (cited in Rosen, 1977). Bracey (1991) also mentioned that in American mathematics classrooms, teachers spend more time for students to engage in individual seatwork and tests. Classrooms are generally viewed as passive places where teachers tend to do the talking and teaching, and students do the listening and learning (Andersen, Floisand, Martinez, and Robinson, 1997). Cooney (1990) found in his study that American teachers tend to rely on teaching guides and tests and quizzes made by publishers rather than creating them on their own. They are more concerned about covering the topics prescribed in textbooks than students' understanding, and students are often judged on their product regardless

of the process they utilized to achieve it (Delpit, 1995). It is also found in the study that increased lecture demonstration time and a high rate of questioning were correlated with enhanced achievement, while increased seatwork was correlated with lower growth.

Also there is a cultural difference in expectations for the role of families in the students' education. The majority of Japanese students attend Juku (evening tutoring school) daily or have private tutors come to their homes to study long hours after school (Bracey, 1991). It is expected in the culture that families provide such learning environment for the children. While in American public schools, it is typically considered that learning occurs in classrooms and the schools are responsible for the achievement of the students. As we can see from above examples, there is a difference between Japanese and American views toward education, and the students who move from one culture to the other will experience these differences and need to adapt to the changes.

Meanwhile, mathematics assessment has been going under changes in the last decade. As a part of mathematics reform movement, the National Council of Teachers of Mathematics (NCTM) produced The Assessment Standards for School Mathematics. The new assessment approach is philosophically consistent with NCTM's vision which is based on the assumption that "all students are capable of learning mathematics", and it is designed to meet and value the need and development of each child in a diverse multicultural society (NCTM, 1995).

Traditionally, teachers depended upon objective and numerical scores to determine grade of their students (Seeley, 1994). The scores on tests and quizzes were used as the main indicator of students' understanding. It often required students to work on tedious computation exercises, but that did not show their problem solving skills. Under this setting, the message became clear to the students that getting points on tests and quizzes was the ultimate purpose in the classroom and learning was done for the tests.

On the other hand, alternative assessment proposed by NCTM gives teachers better insights for their students' understanding by gathering information from different perspectives and using various methods (NCTM, 1995). For instance, journal writing and interviewing enable students to express their mathematical thinking by communicating their problem solving process with their teachers. Portfolios help students take initiative in assessment process by organizing their own work and demonstrating what they have learned. Alternative assessment gives teachers an opportunity to see what their students can do with mathematics and also clearer pictures of the level of understanding of the students and their growth in mathematics. Moving away from the "rank order of achievement" approach, alternative assessment provides opportunities for students to show what they can do with mathematics in various ways. It will give the group of underrepresented students of mathematics a chance to demonstrate what they know and what they can do, which include LEP students with diverse linguistic and cultural backgrounds.

Method

Participants and Setting

Contacts were made with three school districts who offered their classrooms for university research purposes. One building principal who was initially contacted indicated that a LEP student might be found in Wellington Junior High School. When called, Mr. Brown, the principal of the school gladly informed that they had a fourteen-year-old boy, Ken Sato, who had come to the U.S. the previous year from Japan. They welcomed me in the classroom and mentioned that they hoped I would be able to help Ken adjust to the new culture.

Wellington Junior High School has 437 seventh and eighth grade students: among these students there are 421 whites, 7 blacks, 7 Asians and 2 Hispanics. The

school has had 11 Japanese students in the past nine years since Springmill Technology Inc. was established by Japanese investors in the area. Nine Japanese families have lived in the area during this period with the Satos being the newest addition to the company. The Satos came to the U.S. in April 1996 from Japan. The family consists of a father who works for the company, and a mother who stays home, and their 17-year-old daughter, Mariko, and Ken. Their primary language is Japanese and they do not speak English at home.

Ken and I share the same language and cultural background. Even though he was not proficient enough in English to fully communicate with others, we could communicate in Japanese. I could also understand his situation as a student because of the fact that I myself had been an exchange student when I came to the U.S. 12 years ago.

Since the Japanese school year starts every April and ends in March, when Ken and the family came to the U.S. in April 1996, he had just finished his 7th grade. In order to get accustomed to the school environment, he and his sister were sent to school in May for one month. Ken took Physical Education, Art and Music because those courses were considered not to require English proficiency. It was not until the following September that he started taking classes of other disciplines. The study was conducted for the period of five weeks over February and March 1997, and Ken was taking Science, Physical Education, Reading, English, History and Mathematics during that time.

His mathematics teacher, Mrs. Johnson has taught 8th grade mathematics for the past 13 years at the school. She willingly and openly cooperated with me for the study and showed great interest and desire in working with Ken. She teaches four 8th grade average mathematics classes and two Algebra classes every day. The students were required to take Algebra prognosis tests when they were in 6th grade and again in 7th grade to determine their readiness to go onto "higher math" classes. Ken was placed in

an average math class in September not because of his ability and understanding of mathematics but because of his limited proficiency in English. However, he was tested during the period of the study and scored 58 points out of 60 in the Algebra prognosis test to indicate his readiness to go on to the advanced class in highschool.

Upon arriving in this country, other Japanese families in the area suggested that the Satos hire homework tutors for the children. It is customary for children in Japan to have private tutors, and it is typically considered to be a family's responsibility to provide children such assistance. This differs from the viewpoint of Americans who generally perceive it the school's responsibility to make sure the students are learning. Ken and his sister were having two tutors coming daily after school to help with their homework assignments. However, it was the tutors' request that they would rather not tutor mathematics or science. Since the children were having difficulty with science, another tutor was hired especially for that subject; mathematics was left totally to the children.

Design of Study

The method of study was participant observation. The observation of the 8th period mathematics class was conducted for the total period of 5 weeks over February and March 1997. For the first week, the main purpose of the observation was for me to get accustomed to the class routine and to the students. From the second to the fourth week, Ken was observed each day in the mathematics class, and occasionally in the other classes to compare his attitude and behavior in the classrooms. In the 5th week, a formal interview with Mrs. Johnson was held at school, and one with Ken was held outside the school. Also, in that final week, I was asked by the school to attend a conference with Ken's parents, teachers, tutors and Ken himself to assist as an interpreter.

Data Collection

The data was collected in the forms of field notes of the observations and interviews, and also various mathematics related artifacts. Extensive field notes of the daily classroom observations were reviewed and rewritten at the end of each day. Ken was interviewed twice a week and Mrs. Johnson was interviewed once a week during the first four weeks of the observation. A set of structured, open-ended questions was prepared regarding what happened during the week and Ken's achievement in mathematics. Probing questions were asked for further discussions during interviews. Various mathematics related artifacts were collected and reviewed, such as copies of homework, tests, and quizzes as well as Mrs. Johnson's pamphlet of class rules and procedures and Ken's official progress report. Field notes also included information from discussions with Ken's mother, tutor, other teachers, school administrator, and with other Japanese parents in the area, about his adjustment in school and his academic achievement.

Data Analysis

Field notes of the observations and interviews and artifacts were reviewed and color-coded by categories. As new categories emerged, they were coded in the data set. A matrix was created to visualize the relationships between the categories and different sources of data to serve as a resource on triangulations of the data. The data was also reviewed and analyzed by a second person, and after much reflection and discussion, the focused categories emerged over the process of the analysis: Teaching differences between cultures, Communication, and Assessment and evaluation.

Result

Teaching differences between cultures

Ken was in the 8th period mathematics class which was the last period of the day. The period started at 1:43pm and ended at 2:28pm daily. The class consisted of 19 students. Mrs. Johnson taught mathematics by closely following the teacher's manual for the textbook. She typically allotted the first 15 minutes for the peer-correction of homework assignment and the introduction and explanation of new material. The latter 30 minutes of the class was left for the students to work independently on the homework assignment. The main focus of the lessons was on homework problems, and she often showed the students exactly how she expected the assigned homework problems to be done for the following day. It seemed important for her to see her students use the exact procedures she introduced in the class. She emphasized the point by saying "I want everyone to do it as I show you," and "Every problem on your homework sheet must be done this way."

This differs considerably from a typical Japanese classroom where "teachers rely on students as an 'information source'" and "the main role of the teacher is that of a guide, not a dispenser of knowledge"(Nagasaki and Becker, 1993). Ken, with a different mathematical background, often approached homework problems differently. When Tsang studied a group of Chinese students in American mathematics classrooms (1983), he discovered that the students found the presentation of mathematics concepts too profound and complicated, and when homework assignments could be done with the rules and formulae they had learned before immigrating, they would ignore the lengthier approach taught in the class and would proceed with their own method. Ken's answers to the homework assignments were often marked wrong since he had not used the procedure introduced in the class. Mrs. Johnson seemed to understand this problem and said that she usually tried to look over Ken's homework again, but some points were still

taken off for not following her directions. Her expectations for Ken were different from the expectations for other students in her class. She said, "but Ken is doing well. Those homework points should not harm him. He is not getting a letter grade anyway for this year. He needs just enough points to pass." From Ken's point of view, homework assignments were not important, either. Since "homework is hard to look over because the other students in the class grade it, and they usually do not put correction on it like they do in Japan," he simply put away his homework sheets as soon as they were returned, without looking at them. Even though it seemed that completing homework problems was the main objective of the class, it was surprising that neither Mrs. Johnson nor Ken felt that it was very important.

For the first week of observation, all Ken did in his mathematics classes was his homework assignments. On a typical day, as soon as he came in, he copied the new homework list on the board, which Mrs. Johnson revised daily, then immediately started working on the assignment. Sometimes this started even before the bell which signals the beginning of the period. He stopped to correct his classmate's homework (Mrs. Johnson quickly read down the answers from her manual for the correction with little explanation, and it was simple enough for Ken to follow), but as soon as it was over, he went back to work. He worked so intensely that he usually did not pay any attention to Mrs. Johnson's lesson. He typically spent 20 to 30 minutes of the class time on the homework assignment this way, and by then Mrs. Johnson's lesson was over. When he was done, he put his textbook and papers away and put his head down on his desk, lying on his side. Sometimes he doodled on a piece of paper, sometimes he observed his peers' interactions; yet at other times he seemed totally unfocused, staring in the air.

Mrs. Johnson said that at the beginning of the year, she had Ken sit directly in front of her desk. She tried to help him and keep him on task by paying special attention to him. However, she felt that he did not like that arrangement since one time, he pulled a piece of paper away from her as she tried to help him. After that, she

decided to let him do as he wished unless he indicated to her that he had a problem. She described him as "being angry all the time." Now Ken, by choice, sat in the middle of the classroom. Mrs. Johnson, being sensitive to the cultural difference, was afraid to do anything with him for fear of unknowingly creating a conflict. She perceived Ken to be rude and disrespectful in the way he did not pay attention in the classroom, but at the same time, she was uncomfortable with the idea of talking to him about it in the consideration of cultural and linguistic difference between them.

She also believed that the material she was teaching must have been too easy and boring to him. He was seen to have good understanding of mathematics and believed to be more advanced than most of his peers in the room. She attributed the reason of his inattentiveness to the material they were studying. Cocking and Chipman (1988) found in their study of minority students that teachers and also parents consistently direct language-minority students away from advanced mathematics courses in order to protect them from failure experiences. When asked, both Ken and his mother said that they preferred he remained in the average mathematics class because of the linguistic difficulty. It appeared that this kind of tracking of a LEP student might influence his attitude toward learning and achievement as well as his self-esteem in a long term.

During an interview with Ken in the second week of observation, it was suggested that he needed to pay more attention in the classroom. It was indicated that he would still have enough time to finish his homework in the latter 30 minutes of the class after Mrs. Johnson's lesson, and it should be good for him to listen to her while she talked. Since he had learned the same material before in Japan, listening to the lesson in English should help his English comprehension. He reluctantly agreed, but a gradual improvement in his behavior was observed. Not only did he become attentive, he started to ask questions and interact with his peers more. It seemed that by participating in the class and paying attention, it helped him to feel as if he was a member of the

group. Mrs. Johnson also mentioned that "his attitude in the class has definitely improved in the last few weeks since Mrs. Duncan came," during the conference they had in the last week of observation.

When a student and his/her teacher are from different cultures, the explicit content of utterance may be understood differently and, as a result, the speakers' intentions may be unclear or misunderstood completely (Stone, 1988). It appeared that Ken did not understand Mrs. Johnson's expectation about classroom behaviors. Even though some rules were outlined in her pamphlet of class rules and procedures, Ken felt the pamphlet was too difficult to read. For other American students, the rules could be familiar because of their previous school experience, but it was not the case for Ken. The language and cultural barriers were the reason why Mrs. Johnson hesitated to reinforce the rules as she would have on other students. It seemed, however, even more crucial to explain them to Ken because of the different school experience he had had in his culture; his perception of the mathematics classroom was different from other students'.

Communication

Learning something in the language you are not fluent in is very difficult. On the front page of Mrs. Johnson's pamphlet of class rules and procedures, it is clearly stated: "Vocabulary is very important. The students cannot perform the required tasks on a quiz/test if they do not understand the words in the directions." It appeared that she recognized the difficulty LEP students have.

At the beginning of the school year in September, Ken's mother and all his teachers had a conference, and decided that Ken would not be receiving letter grades for the year. They were to grade him Pass/Nonpass. The mother recalled that the meeting had been very intimidating. Not only did she not completely understand what was said, she felt that the messages given were all negative. "Teachers said that they did not

know what to do with Ken because he would not say anything in the class. They suggested that he should ask questions when he did not understand. I felt that the suggestion was very unreasonable. He did not say anything in the class because he was incapable of doing so. Yet I could not say that to them because my English was poor."

This was not the first time the district had a LEP student. They had had eleven Japanese students since Springmill Technology Inc. opened 9 years ago. During our initial interview, the building principal said, "All the Japanese students we had were hard workers and high achievers. I often wished our American students shared their work ethic and value. But Ken is different. We do not believe that he is too serious about studying." Mrs. Johnson also noted that "It's almost as if Ken has the typical American students' attitude of not caring about learning. The other Japanese students I had were at least pleasant in the room. Even though they might not have been able to understand everything happening in the classroom, they paid attention and I could see that they were trying to learn. Ken is different. He refuses to show his work, and I think he is angry about something all the time." He was perceived as a low achiever, and it also appeared that everyone depended upon his tutors heavily for his learning. The principal noted that all the other Japanese families had obtained some kind of tutoring outside the school, and he believed that had helped them. "When we first got several Japanese students 9 years ago, we purchased some books and teaching guides of ESL, but the teachers were never given any direction for incorporating them into their lessons. I believe the families got ESL help from somewhere else." In the nearby city of Fairfield, there is an ESL class available, but it is mainly taught for recent immigrant adults from different countries, and the families decided that it would not be much help for the children. They hired tutors through the company the fathers worked for.

Ken spends an average of 1.5 hours a day with his tutors. His tutors are Americans and do not speak Japanese. The main purpose of tutoring was not helping him understand, but getting the homework assignments done. When I observed a

tutoring session, it appeared that although the tutor was trying to encourage him to think himself, he was given the answers to the homework questions. The tutor mentioned that she was having hard time communicating with him, and also believed that "Ken does not seem to be motivated to learn."

Despite the fact that Ken was seen as a low-achiever, he kept a positive attitude toward being in a foreign environment. During an interview, he mentioned that he preferred the relaxed atmosphere of American schools. He had not enjoyed schools in Japan because it was "too hard and too competitive". In his journal in Japanese, he wrote,

> The first thing I realized when I came to the U.S. was that I had to speak English. I can't do English at all, and it is very, very hard. . . . . I think Americans are happy and fun people. I had no trouble making friends, and I also feel that I became happier being with them.

Considering the gap between the picture of an unhappy child that others painted about Ken and how he described his experience in the new culture, it was obvious that he was having difficulty expressing himself. Apparently, those people who thought he was unhappy did not know that he enjoyed his American school more than his former Japanese school. This illustrates that you should not assume how a LEP student feels or thinks based on your perception only.

Ken uses his English-Japanese dictionary intensively in mathematics class. He likes simple calculations better than word problems which take him a longer time to comprehend than to solve. "The hardest part of mathematics is to understand what is said in the problems." Tsang (1983) found in his study also that English proficiency affected the LEP students' understanding of mathematical word problems differently according to their mathematics achievement. He found that higher-achievers tended to be able to decode the mathematical content underlying all the English words, but lower-achievers tend to be more dependent on their English proficiency. Ken was able to

decode the mathematics content of problems by using his English–Japanese dictionary, but was often not given credit because he did not use the teacher's procedural methods to solve the problems. Sometimes, though, the language interfered with his comprehension of the problems. The following is an example of his homework problems analyzed during an interview:

> When traveling in New England, Yoshi bought twice as many bottles of maple syrup as jars of plum jelly. Both the syrup and the jelly cost $6 each. Yoshi spent $90. How many bottles of maple syrup did he buy? (Houghton Mifflin, 1992)

When asked to translate, Ken said the following in Japanese:

> A person named Yoshi traveled New England and bought 2 syrup and jelly each. He had $90. How many could he buy?

Although he could get the general meaning of the problem, he was confused with the phrase "twice as many." After a long silence followed, he told me that he did not think he could solve it. When I explained what "twice as many" meant, he solved the problem very quickly:

> Since he bought twice as many bottles of syrup than jelly, if he bought x bottles of jelly, he must have bought 2x bottles of syrup. Since the price per bottle is $6, you can multiply the number of bottles, 3x, by $6. 3x*6=90 When you divide 90 by 18, the answer is 5, so that's how many bottles of jelly he bought, and he must have bought 10 bottles of syrup.

He said that he felt his listening comprehension skill had improved greatly since the beginning of the school year. He believed that he understood probably 80% or more of what being said in the classroom. When I asked him to do an experiment in the classroom by raising his pencil to signal me whenever he did not understand something, he cooperated gladly, was attentive and ended up not raising his pencil at all. He said that he understood everything that day.

While listening had become easier, it was still hard for him to initiate conversation. When he had a question to ask in a class, he usually went to Mrs. Johnson with some written material and pointed to where he did not understand. Mrs. Johnson typically read the words, and she sometimes explained them in other terms. I also witnessed him communicating with other students by writing sentences on a piece of paper. It appeared that he found ways to communicate with others nonverbally. In class, also, he often looked around to see what other students were doing in order to understand what he was supposed to do. For example, one day when the class did an activity of finding a relationship between diameter and circumference of circle, he did not hear the initial directions from Mrs. Johnson since he was intently working on his homework assignment. When other students started moving around to get ready for the activity, Ken noticed something was different. He looked around to see what the other students were doing and then understood to measure the diameter of the cap of a mustard bottle which was passed to him. When other students started getting up to put their results on the board, he seemed puzzled. Mrs. Johnson went over to explain what circumference is and how to get the value of 'circumference divided by diameter' using the calculator. Ken simply got up and wrote 3.14 on the board, without measuring the circumference or using the calculator. He said that he knew π=3.14.

Learning without a good medium of communication is difficult. When De Avila and Duncan (1981) investigated performance on several academic, cognitive and linguistic tasks, they found that language proficiency was the most important predictor of mathematics achievement relative to any other factors in the case of LEP students. Even though Wellington School Administrators and his teachers seemed to understand and sympathize with the difficulty, there was no help available to Ken at school. In the studies of school effectiveness with language minority Mexican Americans, Donato (1994) noted that success with LEP students required schools to put high priority on services and attitudes which go further than academic instruction. In effective schools

he studied, teachers, counselors, administrators and support staff placed value on language and culture, held high expectations for students, provided a staff development explicit to language minorities, offered a varieties of course options, gave special counseling attention to LEP students and their parents, and shared a strong commitment to empower these students.

The education of LEP students did not appear to be a pressing concern of the school district. It is probably because 1) they were relatively new to the situation, 2) the number of students they have had is very small, and 3) the limited number of LEP students they had were successful in adapting to the new school culture without extensive help from the schools.

During the discussion with a Japanese parent who had come to the area several years prior to the Satos, it was mentioned that there was a retired teacher who volunteered her free time reading picture books and working on basic English vocabulary using flash cards with her daughters. It meant so much for the girls to know there was someone who was committed to them, and they could go to this person if they had a problem or a question. It seemed that the teachers at Ken's school needed some guidelines about the instruction of the LEP students in their classrooms. Mrs. Johnson was culturally sensitive, yet she still needed guidance and support. Staff development may be the first step in the district in effort to promote awareness about educating LEP students.

It also appeared that the dependency on tutors might have long-term effects upon Ken. In order to help him obtain high self-esteem and self-worth, his teachers should realize that it is crucial to give him homework assignments at his level which he could work within his limited fluency with a little outside help. This was mainly the issue with subjects other than mathematics. However, during the last week of the study, when Mrs. Johnson assigned homework which required the students to apply language skills in mathematics by finding articles in newspapers and magazines with percentages

and explain how they were used, Ken mentioned that he had not even tried to find one since he thought it would be too hard for him to do. When I explained this to Mrs. Johnson, she said, "I thought it might be too difficult for him. I hope his tutors can help him." It seems important to consider his limited fluency in English when assigning him a realistic project. Homework assignments were supposed to be for Ken to do and learn from and not for his tutors to do.

Also, it seemed that his parents and teachers were more concerned about Ken's achievement in other subject areas and not mathematics since they assumed that mathematics is computation-based and easy for him. They believed that he should be able to do it himself because he had learned the same material in Japanese schools. However, it appeared that the mathematics classroom was the best place for Ken to deepen his understanding of the new language and culture. First of all, he was less threatened being in the mathematics class since he felt less penalized for the linguistic difficulty than when he was in the other classes. He seemed more relaxed and confident with the subject matter. Secondly, since he knew the material so well, he could connect easily what was said in the classroom with what he already knew. For Ken, the mathematics classroom could be the window for understanding the new language and the culture. Instead of focusing on getting help for other subjects, having an interpreter in the mathematics classroom would help him understand the cultural aspects of the American classroom that were different from his former experience in Japanese classrooms. It seems that it would help him in other classes, too, because there are many routines that are similar across the disciplines.

Assessment and Evaluation

Mrs. Johnson used a point system in her grading and she totally depended on the paper-and-pencil, traditional type of assessment for grades. Daily homework

assignments earned 3 points if 75% of all the answers were correct. She occasionally assigned special projects which earned up to 15 points. Weekly quizzes earned from 10 to 50 points, and chapter tests were worth from 50 to 100 points. The total number of points varied between each 6–week grading period, and students' grades depended on the points earned in the relationship to the total possible points. For grading period 4 (the period of the study), Ken earned 308 points out of 330 possible, which was 93.3% of the total; he received a grade of B+. This grade was .7 point away from the next grade of A–. When asked, Mrs. Johnson explained that she would give him the grade of A– in this case, considering his understanding of mathematics and also his linguistic difficulty. However, she also mentioned that she was trying to stay away from alternative assessment since some parents had questioned her subjectivity in assessment before. She wanted to avoid that kind of conflict.

Ken was receiving Ds and Fs in September, but his grades had definitely gone up in the months thereafter. Mrs. Johnson believed that he was receiving lower grades at the beginning of the year not because he did not understand the material but because he had no idea what was due when. Even when she or other students in the classroom tried to explain it to him, he still did not seem to understand.

Mrs. Johnson believed that her usual method of assessment would be totally unfair to LEP students who were new to the country; therefore she initially graded Ken with Pass/Nonpass. However, after 6 months, considering his level of understanding in mathematics, she was beginning to think he might be ready for letter grades. She believed that what she was looking for in terms of her assessment should be clear to him now. During the conference, she shared this belief with others and explained that it was clear he was more advanced than his classmates. She said that once she started to give him a letter grade, she intended to take points off when he would not follow directions or show his work, just as she would do to the other students, but that should not affect him more than one letter grade. He had a B average. When asked, Ken said without

hesitation that he wanted a letter grade for his mathematics. He said, "I know I can do it. It will be easy."

When assessing students' achievement, fair and representative indicators of students' learning should be used. While Mrs. Johnson appeared to have strong beliefs about avoiding alternative assessment, it seemed that, for a LEP student such as Ken, the new forms of assessment presented by NCTM (1995) would not only have given insight to Mrs. Johnson about what Ken knew and what he could do but also would have created a way of communication between them. For Ken, interviews and performance-based assessment would give him a better understanding of what is going on in the classroom and also provide him good opportunities to talk and interact with his teacher and classmates. NCTM's new assessment standard is intended to meet and value the need of each child in a diverse multicultural society (NCTM, 1995). This approach, when incorporated, would benefit both LEP students and their teachers. It will give teachers a broader picture of what students understand and can do, and open lines of both written and oral communication. It would also show a LEP student that they are valued by recognizing their different perspectives and learning styles.

A New Challenge to American Education

The more students of different cultural and linguistic backgrounds come to American schools, the more teachers will face the problem of how to help them learn effectively and also how to assess their learning when there is a limited medium of communication. The situation Mrs. Johnson was in seemed typical for a classroom which is new to having a LEP student. Communication will be one of the crucial factors because the student and the teacher do not share the same cultural background. Their perceptions would likely be different. Even classroom rules which are considered to be common sense to American students need to be explained because the LEP

students' prior school experience and their perception might differ considerably. On the front wall of Mrs. Johnson's room, above the chalkboard, there was a sign which was directed to everyone in the classroom: "Assume Nothing." That could be a message to the teachers who are working with LEP students.

LEP students are a challenge not only to classroom teachers who face them every day but also to a school as a bigger picture. It clearly appeared that Mrs. Johnson needed some professional assistance and guidelines which would help her with Ken. The teachers seemed to believe that the adjustment they had made at the beginning of the school year about grading should be sufficient to accommodate him to the school system, and they left the rest to him and his family. However, there were many other factors that could have been considered in order to make the classroom situation more pleasant for everyone and help Ken's learning. Communicating with other districts and teachers who have had LEP students, involving Ken's family as well as the Japanese people who live in the area in the school to learn from each other, and also having good communication with the tutors whom Ken was working with daily should make a difference in his learning and adjustment.

Also, teachers must be open to the idea of alternative assessment when there is a limited medium of communication existing in the classroom. It is likely that LEP students have difficulty expressing what they know in the same way that English-speaking students do. Alternative assessment could provide teachers better ways of communication with the students as well as giving LEP students ways to understand the new culture and language.

In summary, it should be stressed that we need to realize there is more than cognitive aspect in learning mathematics. If all children, regardless of cultural or linguistic backgrounds, are to be successful in learning mathematics in American classrooms, we must support diverse learning styles and more flexible curriculum content and assessment. For LEP students, this means that their classroom experience

need to be beyond the textbook-based instruction and the traditional assessment. Tsang (1983) mentioned in his study that failure to understand the math achievement of LEP students is a failure to tap information that may benefit our understanding of American education and how it might be changed for the betterment of all students.

Working with LEP students will help us see American education from different perspectives. Support is needed for more research in this area that explores and studies the various effect LEP students have on American classrooms as well as the impact the classroom has on them in order to understand the dynamics and benefit from the diverse student population in our schools.

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esented in Partial Fulfillment of the Requirements for Graduation with Distinction OVER
Elementary Education in the Undergraduate Colleges of The Ohio State University,
Project Advisor: Dr. Mary Ellen Schmidt