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ACCESSING PERCEPTIONS OF HIGH SCHOOL TEACHERS ABOUT THE INFLUENCE OF LANGUAGE AND CULTURE IN THE MATHEMATICS LEARNING OF ENGLISH LANGUAGE LEARNERS (ELLS) STUDENTS

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Abstract: This study discusses the challenges faced by high school teachers in providing an environment that successfully maximizes the learning experiences of English Language Learners (ELL) students. It also focuses on the perceptions of these teachers concerning the challenges faced by ELL students in relation to standardized high-stakes tests. In this regard, one of the purposes of this study is to determine how these perceptions are influenced by an understanding of the influences of the diverse linguistic and cultural backgrounds of ELL students on their academic performance in mathematics. Another purpose is to describe pedagogical approaches such as culturally relevant education and ethnomathematics that high school teachers may implement in their classrooms to meet the educational needs of these students.

Keywords: English Language Learners, Culturally Relevant Education, High School Teachers, Standardized High-Stakes Tests; Ethnomathematics; Mixed-Methods Study

1. Introduction

Many school districts in the United States face the challenge of the growth of English Language Learners (ELL) populations. Demand is growing rapidly for teachers who can effectively manage and harness linguistically and culturally diverse

classrooms. As California becomes even more multicultural, successful instructional strategies will come only to those teachers who have pedagogical competencies and understand the skills to respond appropriately to cross-cultural challenges (Scheurich & Skrla, 2003). This trend has a tremendous effect on high schools in California, especially those with higher percentages of ELL students. In this regard, high-school teachers are accountable for the achievement and performance of these students on standardized high-stakes assessments in mathematics. This aspect of schooling is crucial when ELL students are expected to be proficient on the California High School Exit Exam (CAHSEE) and California Standardized Testing (CST) examinations.

This study identifies specific perceptions of teachers about ELL students as mathematics learners in the nine high schools at Alpha Unified School District (AUSD), which is a suburban school district near Sacramento in California. This approach may contribute to the way that these teachers help ELL students to improve their performance in mathematics assessments. The results of this study may be used to inform high school teachers about programs and professional development opportunities to further enhance their cultural proficiency awareness. An additional benefit could be gained as teachers reflect on their own perceptions about their ELL students. In this perspective, high school teachers in California may be able to build on their understanding of the influence of ELL linguistic and cultural backgrounds for increased achievement and performance in mathematics curricular activities.

2. Statement of the Problem

Teachers must be committed to the process of continuous examination of their own perceptions and practices in order to assure the success of ELL students in a supportive linguistically and culturally relevant school community (Scheurich & Skrla, 2003). However, many teachers are not prepared to deal with the challenges faced by ELL students and the complex issues concerning linguistically and culturally relevant

education. This means that teachers may not be effectively prepared to make appropriate decisions related to educational planning for ELL students.

It is essential to determine the perceptions teachers hold in regard to ELL students and to determine what factors could be linked to these perceptions, as both influence the classroom environment, in order to meet the educational needs of these students. It is imperative that effective high school teachers serving ELL students recognize the challenges and opportunities posed by the increasing cultural diversity in their classrooms. In order to achieve this goal, high school teachers have to become specialists who identify needs, develop and implement curricular mathematics programs, and provide innovative pedagogical ways for constructively managing educational changes for ELL students (Suttmiller & González, 2006). Nelson and Sassi (2000) argued that leading instructional change and reform requires that high school teachers understand the demands of current mathematics standards and assessment program because they must have a clear vision of classroom instruction and pedagogical strategies that increase student learning in mathematics for ELL students.

It has been proposed that high school teachers' content knowledge in mathematics and their perceptions about how the subject is both learned and effectively taught is critical to their effectiveness as high school teachers for the improvement of students' achievement, including ELL students (Stein & D'Amico, 2000) because a strong knowledge of mathematics is the cornerstone for a sound decision making process. From direct and daily experiences, high school teachers have realized that students' future success depends critically on the level of their mathematical, analytical, quantitative, procedural, and statistical skills and abilities that are developed from their learning experiences in mathematics (Nelson & Sassi, 2005). Since mathematics will undoubtedly continue to be an important subject matter in school curriculum, a better understanding of mathematical knowledge and its place in the development of human activities is increasingly necessary for high school teachers.

3. Purpose of the Study

The purpose of this study was to capture and describe the perceptions of high school teachers concerning ELL students in nine high schools in a suburban school district near Sacramento in California, specifically in relation to the challenges faced by these students concerning to their academic success in mathematics standardized high-stakes tests under No Child Left Behind Act (NCLB, 2001).

This study sought to determine how high school teachers' perceptions are influenced by an understanding of the effects of the ethnic cultural background of ELL students on academic performance in mathematics standardized high-stakes tests. In addition, this research also sought to develop an understanding of the association between culture and mathematics by the identification of linguistic and cultural backgrounds that may explain differences in student mathematics achievement. In this regard, it was also paramount to understand how high school teachers come to entertain alternative viewpoints of their students' linguistic and cultural backgrounds and its influence on standardized mathematics high-stakes tests.

A key point of this study was also related to the focus on culture and its connection to mathematics, which may generate different kinds of classroom climates that utilize students' existing knowledge in order to better impart mathematical knowledge. According to Rosa and Orey (2007), a sense of connectedness to students' linguistic and cultural experiences and mathematics into schools heightens their motivation to learn, leading to an increase in their achievement in mathematics and overall mathematics performance. Finally, it was a goal of this study to develop a series of recommendations for practice that may help high school teachers to successfully meet the specific needs of their ELL population.

4. Theoretical framework

One of the challenges faced by the educational system in the United States is the growing number of students from linguistic and cultural diverse backgrounds (Obiakor & Utley, 1997) coupled with an increasing number of ELL students with

comparatively low academic performance in standardized high-stakes testing. Gándara, Maxwell-Jolly, and Benav íez (2007) affirmed that statewide measures of achievement indicated that ELL students in Californian schools are not performing well. They also stated that the performance of these students in mathematics is far below basic when compared to their English-speaking peers. In comparison to ELL students, almost twice as many English fluent students pass the mathematics section of the high school exit exam and almost three times as many English fluent students score at basic or above in Geometry (CDE, 2009). Therefore, both cultural and linguistic diversity draw increased attention by many teachers, educators, and researchers as areas identified as having connections to failed educational systems. Consequently, there is an emergent sense of urgency to resolve this inability to effectively educate all students.

Particularly, the role played by high school teachers is of vital importance for ELL students because they influence the learning experience outcomes for these students as well as their transformation into active and empowered members of society (Fullan, 2001). Furthermore, high school teachers need to know and understand the complex relations of ELL students' cultural and linguistic backgrounds to school performance and achievement in mathematics. In this regard, it is crucial that these teachers become sensitive to the multicultural needs of their students (Cummins, 2000). In order to grow as culturally relevant teachers, they also need to recognize and address any preconceived notions that they might hold about students' linguistic and cultural backgrounds. In this context, high school teachers are faced with the challenge of providing opportunities for ELL students to learn and perform at the same rate of achievement as mainstream students.

Two decades earlier, C árdenas and C árdenas (1977) stated that ELL students frequently experience failure and frustration as a result of negative societal perceptions about their academic abilities, achievement, and successes. These perceptions create an environment of neglect and low expectation in relation to this student population. Teachers' perceptions serve as one tool to guide them in order to provide different paths that ensure the academic success of all students. In this

perspective, high school teachers might use their own perceptions as a judgment of their capabilities to structure a particular course of action in order to produce desired outcomes. This may inhibit “capabilities needed to succeed in particular achievement situations” (Bandura, 1997, p. 64) for high school teachers, thus limiting the possibilities of success for this specific subgroup of students. VanTassel-Baska and Baska (2004) agreed with this point of view by affirming that “perceptions can be powerful drivers of behavior” (p. 7). For example, high school teachers’ perceptions about significant differences in students’ achievement frequently appear between groups of students of different races because students’ performance is often compared among all the different student subgroups. One of the distorted perceptions about this issue was pointed out by Bainbridge and Lasley II (2000) who stated a mistaken perception that minority students’ achievement gap is related to their skin color and linguistic and cultural backgrounds.

Nevertheless, ELL students cannot be perceived as a monolithic group. Some of them bring experience in academic subjects in other languages to the classroom and need help translating that knowledge into English. Other students bring little academic preparation and come to the classroom years behind their peers. Some have a beginning knowledge of English while others have almost none (NCELA, 2007). Like other groups of students, ELL students bring a range of individual experiences to school that may affect how quickly they learn the English language. The findings of the NYIC (2008) report showed that ELL students “come from a variety of backgrounds with a diversity of skills and needs that will impact the type of programs and services they need” (p. 5). Meeting the needs of these students is a challenging task because instruction needs to be designed to help them to grow in both academic content knowledge and English language skills.

This complexity has always been the case, but increased pressure from No Child Left Behind Act (NCLB, 2001) has put school districts, schools, and teachers in the United States under the microscope. ELL students often fall behind their peers in mathematics achievement assessments. In this regard, Fry (2008) stated that, in the United States, in the five states with large ELL population, the proportion of ELL

students scoring at or above the proficient level on state mathematics tests is often below the proportion of black students scoring at this level of proficiency. As Fry (2008) argued, ELL students “are much less likely than white students to score at or above the proficiency level in mathematics” (p. III) on standardized tests. In agreement with this perspective, Gutiérrez (2008) stated that discrepancies in scores on standardized tests mirror disparities in opportunities and life chances that ELL students experience in their daily lives.

In accordance with the California Department of Education (CDE, 2009), in 2008, California's Standardized Test (CST) results indicated that approximately 89% of all students tested in grades 9-11 scored below proficiency in Algebra I. In this same year, approximately 98% of all ELL students in these same grades scored below proficiency level in Algebra I. In 2008, 40% of all students in California failed the mathematics portion of the CAHSEE while 64% of all ELL students did not pass this portion of the CAHSEE.

A passing score required on the CAHSEE is a tool used in California State's accountability report as a necessary component for students to receive a high school diploma. According to Gándara, Maxwell-Jolly, and Benavídez (2007), ELL students are not performing well because they “must master at least two basic bodies of knowledge, English, more specifically the academic English of the classroom and of texts, and disciplinary content material such as history, social studies, science, mathematics, and literature” (p. 4). Gándara et al (2007) affirmed that this mastery is a daunting task for school teachers, who also have to provide ELL students access opportunities to a rigorous academic curriculum such as mathematics.

Culturally Relevant Education is an educational approach that may provide ELL students' access to a rigorous academic school curriculum. It also values the cultural experiences and knowledge of all students regardless of whether they are represented by dominant or non-dominant cultural backgrounds. Klotz (2006) defined Culturally Relevant Education as an educational system “that honors, respects, and values diversity in theory and in practice and where teaching and learning are made relevant and meaningful to students of various cultures” (p. 11). This is a system that

educates all students by incorporating their diverse emotional, social, cognitive, linguistic and cultural experiences into a successful teaching-learning environment. It also empowers all students intellectually, socially, emotionally, and politically by using cultural referents to include student knowledge, skills, and attitudes within the pedagogical work in schools (Ladson-Billings, 1994). Culturally Relevant Education combines an examination of the cultural and socioeconomic influences on teaching and learning. According to Rosa (2010), Culturally Relevant Education includes knowledge along with a commitment to the challenging of social injustices and reflections upon educational challenges by identifying obvious and subtle individual, institutional, linguistic, and cultural actions that perpetuate social structures.

Culturally Relevant Education instills ethics of care, respect, and responsibility in the “professionals who serve culturally and linguistically diverse students” (Klingner, Artiles, Kozleski, Harry, Zion, Tate, Duran, & Riley, 2005, p. 8) such as school leaders, teachers, and staff. In this regard, Culturally Relevant Education creates and implements spaces for teachers’ reflection, inquiry, and mutual support around issues of linguistic and cultural differences. According to Beauboeuf-Lafontant (1999), these spaces encourage teachers to understand and respect individual differences and strive for high educational standards and levels of achievement for all students.

In so doing, an important change in mathematical instruction needs to take place to accommodate continuous and ongoing change in the demographics of students in mathematics classrooms in California. It is necessary to integrate a culturally relevant curriculum into the existing mathematics curriculum. Torres-Velasquez and Lobo (2004) affirmed that this perspective is an essential component of Culturally Relevant Education because it proposes that teachers contextualize mathematics learning by relating mathematical content to students’ linguistic, cultural, and real-life experiences. According to Rosa and Orey (2007), an ethnomathematics approach to the mathematics curriculum is the pedagogical vehicle for achieving such goal.

In this perspective, the field of ethnomathematics links students’ diverse ways of knowing, learning, and culturally embedded knowledge to academic mathematics. It explores academic and culturally ways to provide more inclusive developmental

programs for the diverse populations served at educational institutions (D'Ambrosio, 1990). Ethnomathematics is a program that includes cultural relevance and builds curricula around the local interests, language, and culture of the learners (Rosa, 2005). Teaching mathematics through cultural relevance and personal experiences helps students to know more about reality, culture, society, and environmental issues by providing them with mathematics content and approaches that enable them to successfully master academic mathematics.

Classrooms and learning environments cannot be isolated from the communities in which they are embedded because they are part of a community with defined cultural practices, which use a cultural context focused on school mathematics and the effect of cultural factors on teaching and learning academic mathematics. In this regard, Bandeira and Lucena (2004) and Lean (1994) identified cultural mathematics and its acquisition in traditional school settings. Borba (1993) stated that classrooms might be considered environments that facilitate pedagogical practices, which are developed by using an ethnomathematical approach. Moreover, Eglash (1997) and Rosa and Orey (2007) argued that including cultural aspects in the curriculum have long-term benefits for mathematics learners.

This means that cultural aspects contribute to recognizing mathematics as part of daily life, enhancing the students' ability to make meaningful connections, and deepening their understanding of mathematics. In this regard, Chieus (2004) affirmed that the pedagogical work towards an ethnomathematics perspective allows for a broader analysis of the school context in which pedagogical practices transcend the classroom environment because these practices embrace the sociocultural context of the students. Damazio (2004) agreed with this perspective by suggesting that pedagogical elements necessary to develop the mathematics curriculum are found in the school community.

A Culturally Relevant Mathematics Curriculum based on an ethnomathematical perspective infuses the students' cultural backgrounds in the learning environment in a holistic manner (Adam, Alangui, & Barton, 2003; Rosa & Orey, 2003). One possibility for an ethnomathematical curriculum may be labeled as mathematics in a meaningful

context in which students are given opportunities to relate their new learning experiences to knowledge and skills they have previously learned. According to Bandeira and Lucena (2004), mathematical curriculum conceived in an ethnomathematical perspective helps to develop mathematical concepts and practices that originate in students' culture by linking them to academic mathematics. The understanding of conventional mathematics then feeds back and contributes to a broader understanding of culturally based mathematical principles. The work of Lipka (2002) in Alaska is an example of this type of approach to curriculum innovation. It is assumed that a curriculum of this nature motivates students to recognize mathematics as part of their everyday life and enhances their ability to make meaningful mathematical connections by deepening their understanding of all forms of mathematics.

In so doing, it is necessary that high school teachers develop a different approach to mathematics instruction that empowers students to understand mathematical power more critically by considering the effects of culture on mathematical knowledge and work with them to uncover the distorted and hidden history of the mathematical knowledge. According to Rosa (2000), this methodology is essential in developing the curricular practice of ethnomathematics and culturally relevant education through the investigation of the cultural aspects of mathematics and an elaboration upon mathematics curricula that considers the contributions of people from other cultures.

5. Research Questions

In this study, the following research questions provided a guideline for the investigation of high school teachers' perceptions concerning ELL students:

1. What are the general perceptions of high school teachers in relation to their ELL population?

2. What are the perceptions of high school teachers about ELL students' cultural backgrounds as challenges to their academic performance on mathematics standardized high-stakes tests?
3. What are the perceptions of high school teachers in relation to the association between mathematics and culture?
4. What are the perceptions of high school teachers about ELL students' linguistic background as challenges to their academic mathematical achievement?
5. What are the high school teacher's perceptions of ELL students' performance on standardized high-stakes tests in mathematics?

6. Methodology

A mixed-methods approach was used in this study to “build on the synergy and strength that exists between quantitative and qualitative research methods in order to understand a phenomenon more fully than is possible using either quantitative or qualitative methods alone” (Gay, Miles & Airasian, 2006, p. 490). According to Patton (2002), researchers use mixed-methods “to be responsive to the nuances of particular empirical questions and the idiosyncrasies of specific stakeholder needs” (p. 585). In other words, it is not enough to simply collect and analyze quantitative and qualitative data because they need to be mixed so that together they form a more complete picture of the problem under study than they do when standing alone.

6.1. Research Design

This study combined quantitative and qualitative methods (QUAN + QUAL) in order to capitalize on the strengths of each approach. Creswell (2002) stated that a mixed-methods design provides a comprehensive answer to each research question of the study and argued that a research design that integrates different methods is likely to produce better results in terms of quality and scope. By mixing the datasets, the researcher was able to provide a better understanding of the problem under study than

if either dataset had been used alone.

6.2. Context of the Study

The population of this study was comprised of 26 ELL teachers in nine high schools in AUSD, which is a suburban school district near Sacramento, California. In the 2007-2008 school year 4,455 (9.4%) of the 47,400 enrolled students were ELL students. In addition, 52.6% these ELL students spoke Spanish. The most spoken languages in AUSD were Spanish, Russian, Ukrainian, Rumanian, and Farsi (CDE, 2009).

It is important to note that during the 2007-2008 school year, according to the California Department of Education (CDE, 2009), the percentage of ELL students in the nine high schools of the AUSD selected for this study ranged from 0.7% to 22.3%. In this same school year, 618 of the 13,188 students enrolled in these nine high schools were ELL students, representing 4.7% of the total of the high school student population. For ELL students, the most spoken languages in these nine high schools were Spanish, Russian, Ukrainian, Rumanian, Farsi, Korean, Punjab, Hmong, and Filipino. The Spanish language was spoken by 46.5% of ELL students.

Table 1: Demographic Information for Each High School in AUSD during 2007-2008

	School Year								
<i>School</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>
<i>Enrollment</i>	1,226	1,696	745	851	1,661	1,690	1,716	1,837	1,766
<i>White</i>	70.6%	72.6%	31.8%	55.5%	57.5%	83.1%	74.5%	81.3%	76.4%
<i>Hispanic</i>	16.9%	14.1%	35.6%	24.7%	13.6%	8.6%	9.1%	7.9%	10.9%
<i>African- American</i>	4.7%	4.9%	23.4%	11.4%	8.8%	2.2%	5.7%	1.6%	5.9%
<i>Asian</i>	2.3%	4.7%	4.7%	4.1%	15.4%	2.4%	7.6%	4.6%	2.3%
<i>American- Indian</i>	2.2%	1.7%	1.6%	1.5%	1.9%	2.0%	0.9%	2.2%	2.3%
<i>Filipino</i>	1.8%	1.8%	1.6%	1.5%	1.3%	0.9%	1.4%	1.9%	1.0%
<i>Pacific- Islander</i>	1.1%	1.1%	1.3%	1.3%	0.8%	0.6%	0.5%	0.4%	0.9%
<i>Multiple Responses or No Responses</i>	0.4%	0.2%	0.1%	0.0%	0.7%	0.2%	0.3%	0.1%	0.2%
<i>ELL</i>	2.3%	1.5%	20.8%	22.3%	9.8%	1.0%	0.9%	0.7%	0.7%
<i>Free/Reduced Price Meal</i>	32.9%	18.5%	83.4%	57.6%	35.0%	16.0%	13.3%	10.6%	20.4%
<i>EDI</i>	32.0	31.0	59.0	47.0	47.0	19.0	29.0	21.0	27.0

Source: California Department of Education (2009)

6.3. Sources of Data

The procedure chosen for this mixed-methods study was designed to use data collected through interviews, surveys, open-ended questions, and ELL students' performance on *CST* and *CAHSEE* as well as demographic data about ELL students. The data was collected from September 28 to October 30 of the 2009-2010 school year. The population selected to be part of this study was composed of 34 high school mathematics teachers who worked with ELL students in AUSD. However, after several contacts through emails and mails, only 26 teachers agreed to participate in the data collection process.

6.4. Instrumentation

The following instruments were developed in order to collect both qualitative and quantitative data for this study:

6.4.1. Semi-Structured Interview

In this study, the interview questions were designed to elicit a broad range of detailed responses, lending depth to the information that teachers furnished in their interview. In this approach, the interview questions were asked in an open-ended fashion to ensure neutrality, to avoid leading the participants, and to "minimize the imposition of predetermined responses when gathering data" (Patton, 1990, p. 295). A semi-structured interview guide with 24 open-ended questions was developed to collect qualitative data. This approach allowed for an efficient and comprehensive interviewing of the participants regarding specific issues concerning ELL students.

6.4.2. Survey

In this study, a survey was elaborated using 30 (thirty) four-point Likert scale questions (quantitative data) and 10 open-ended questions (qualitative data). The open-ended questions gave respondents an opportunity to add a detailed narrative regarding their perceptions of ELL students.

6.5. Data Collection

The qualitative data were collected by using face to face semi-structured interviews conducted with six teachers of the nine high schools at AUSD. These teachers were chosen at randomly. Each interview lasted 40-50 minutes and occurred once for each participant. Qualitative data were collected from 24 open-ended interview and 10 open-ended online survey questions. Responses to interview and survey open-ended questions were used to identify relevant themes that emerged from the answers and to identify patterns that existed across the responses of these high school teachers.

The quantitative data were collected by using a 4-point Likert scale format in which 26 teachers responded to 30 questions focusing on their perceptions in relation to ELL students. Quantitative data of the survey were obtained from these items. The survey was designed for participants to take between 15 and 20 minutes and surveying occurred only once for each participant. Data were collected on ELL students' performance in the mathematics portion of the CST and CAHSEE. School demographic data for ELL students were also collected from the California Department of Education website.

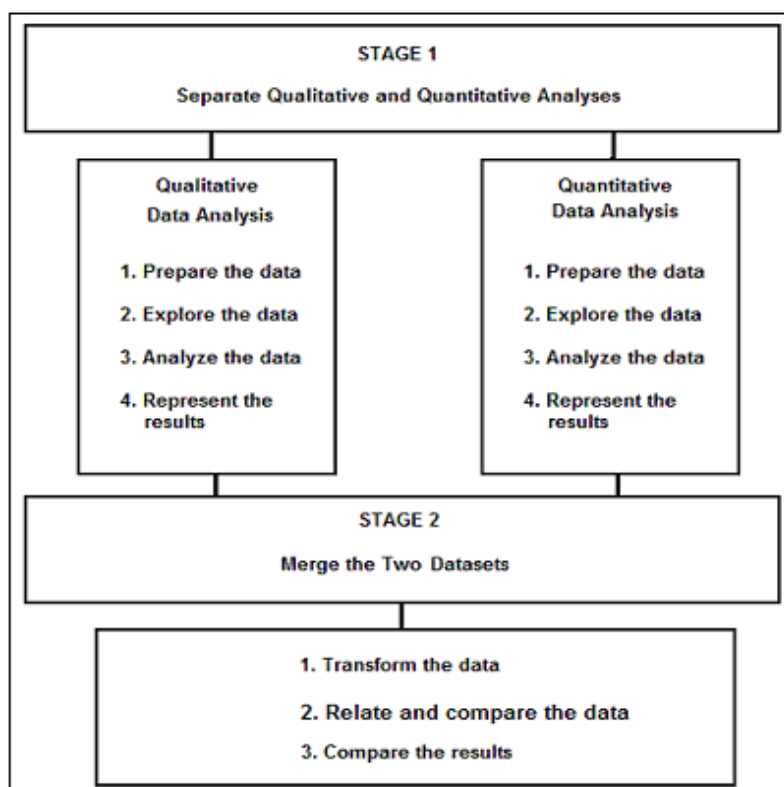
On September 29, 2009; an online survey was sent electronically to 34 teachers in the nine high schools in the AUSD through their school district email addresses. By the end date for completing the survey, October 12, 2009, a combined total of 26 teachers had completed and returned the survey for a total response rate of 76.47%, which fell within the guidelines suggested by the literature related to survey response rate that considers a response rate of 70% recommended and acceptable (Gay & Airasian, 2003).

6.6. Data Analysis

In this study, qualitative data analysis consisted of an examination of 6 high school teachers' answers to open-ended interview questions as well as 26 teachers' responses to open-ended survey questions. Quantitative data analysis consisted of examining the high school teachers' answers to the 4-point Likert scale survey

questions. It also included ELL students' performance data and demographic data on ELL students. In order to analyze the data, the researcher used "concurrent data analysis" (Cresswell & Plano Clark, 2007, p. 136) in which both qualitative and quantitative data merged after they were analyzed separately in order to provide a comprehensive analysis of the research questions.

Figure 1: Concurrent Data Analysis



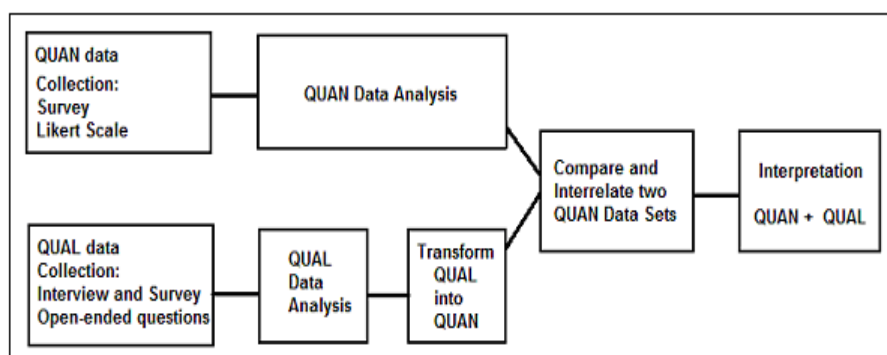
Source: Diagram Adapted from Cresswell and Plano Clark (2007, p. 127)

According to the concurrent analysis, in Stage 1, the researcher conducted separate initial data analysis for each of the qualitative and the quantitative databases, which included coding, theme development, and the interrelationship of analysis of qualitative data and descriptive analysis of quantitative data. Next, in Stage 2, the researcher merged the two sets of data and used the triangulation design for a complete picture of the study. Triangulation design is one of the approaches used for concurrent data analysis, and it was used for the data analysis in this study because it gave equal priority to quantitative and qualitative data analysis.

Patton (2002) advocated for the use of triangulation by stating that

triangulation strengthens a study by combining different methods, which includes both quantitative and qualitative research approaches. In this study, both quantitative and qualitative data were collected and given equal emphasis, which allowed the researcher to combine the strengths of each form of data. In so doing, data were merged and the results of analyses were used simultaneously to understand the research questions through the comparison of findings from the quantitative and qualitative analyses in order to elaborate valid and well-substantiated conclusions about the problem under study.

Figure 2: Data Transformation Model of the Triangulation Design



Source: Triangulation Design (Creswell & Plato, 2007, p. 63)

On the other hand, the researcher transformed qualitative data into quantitative data, which allowed him to mix data during the analysis stage in order to facilitate the comparison, interrelation, and further analysis of the two sets of data. The transformation of data included counting codes and counting themes by using the procedure described by Creswell and Plano Clark (2007, p. 138):

1. Qualitative data were analyzed for themes.
2. The number of occurrences of themes was counted and computed.
3. These numbers were entered into SPSS (Statistical Package of the Social Sciences) to generate data reports.
4. A table, which is a matrix with data transformation, was generated to portray the results in order to compare *quantitized* qualitative data with the quantitative data.

The analysis of interview transcripts and survey was based on an inductive approach geared to identifying patterns in the data by means of thematic codes.

According to Patton (1990), inductive analysis means that the patterns, themes, and categories of analysis come from the data; they emerge out of the data rather than being imposed on them prior to data collection and analysis. Data were analyzed using the constant comparative method whereby line, sentence, and paragraph segments of the transcribed interviews and surveys were reviewed to decide what codes fit the concepts suggested by the data. Each code was constantly compared to all other codes to identify similarities, differences, and general patterns.

In sum, data were reduced and analyzed by means of thematic codes and concepts in a three-level process. Themes gradually emerged as a result of the combined process of becoming intimate with the data, making logical associations with the interview questions, and considering what was learned during the initial review of the literature. At successive stages, themes moved from a low level of abstraction to become major, overarching themes rooted in the concrete evidence provided by the data.

7. Results and Discussions

In this study, the analysis of the data revealed that quantitative and qualitative findings complemented each other when the research questions were addressed and analyzed.

7.1. Research Question 1

What are the general perceptions of high school teachers in relation to their ELL population?

If high school teachers know about their students' languages and cultural backgrounds, the better they are able to interpret their behavior and attempts at communication (Scheurich & Skrla, 2003). The data revealed that high school teachers in AUSD possess some knowledge about the diversity of their students. However, they need to learn more about the linguistic and cultural backgrounds of their ELL students in order to value the cultural perspectives and languages these

students bring to schools. The data analysis showed that 25 (96.15%) high school teachers believe that ELL students need to maintain their cultural background while becoming acclimated to the mainstream culture (Correlation is significant at 0.01 level (2 tailed) - Spearman's rho coefficient = 0.928, $p = 0.000$, $N = 26$). In this perspective, one high school teacher affirmed that "teachers need to encourage ELL students to enter mainstream culture without losing their own identity." Knowledge of students' linguistic and cultural backgrounds may help high school teachers to examine their own pedagogical practices and become more sensitive in providing diverse learning experiences by improving instructional pedagogies and methodologies for students that result in improving instruction for all students, especially for ELL students (Scheurich & Skrla, 2003). The qualitative open-ended interview questions and open-ended survey questions showed that high school teachers expressed an interest in knowing and embracing students' cultural differences in order to provide better instruction to this school population. One high school teacher stated that "teachers acquire knowledge about ELL students' cultural backgrounds through experience, observations, academic readings, and professional development opportunities".

High expectations are critical for students' achievement and should permeate the school and classroom climates regardless of the students' cultural, linguistic, or socioeconomic backgrounds (Haberman, 1994). Agreeing with this perspective, Minicucci and Olsen (1992) stated that culturally relevant school teachers advocate for higher expectations for ELL students. In this study, the common theme among participants was that they recognize the need to hold the same high expectations and standards for their ELL students as for the other student subgroups in their classrooms. In so doing, the quantitative data revealed that 25 (95.15%) high school teachers believe that ELL students are able to achieve high academic standards in mathematics. The qualitative data support this belief by showing that these teachers have high expectations for ELL students and that their expectations are not limited by ELL students' cultural orientations. In this regard, one high school teacher stated that "teachers believe that students, independent of their cultural background, can be

successful in mathematics”.

On the other hand, professional development is one highly effective systemic approach to supporting ELL students because it can fuse knowledge of cultural differences, standard-based instruction, instructional strategies, and curriculum knowledge providing teachers with culturally relevant pedagogy (Zepeda, 2008). The quantitative data revealed that 18 (69.23%) out of 26 high school teachers believe that they need to make sure that ELL students are provided with a challenging mathematics curriculum that is equivalent to that of native-English speakers. In their opinion, ELL students can reach this goal by following the school district curriculum and by using adopted standards-based textbooks. In this regard, one high school teacher stated “ELL students are provided with materials that are the same difficulty but easier to understand”. Another high school teacher affirmed that:

ELL students should be scheduled in mathematics classes based on their achievement. Unfortunately, many ELL students are usually starting in mathematics classes that are of the lower level based on their achievement in middle school.

In other words, these high school teachers believe that since ELL students receive the same amount of instruction and have access to the same instructional materials and curriculum, they are not disadvantaged in their learning process. In these high school teachers’ point of view, the mathematical learning of ELL students is adequate to their educational needs.

7.2. Research Question 2

What are the perceptions of high school teachers about ELL students’ cultural backgrounds as challenges to their academic performance on mathematics standardized high-stakes tests?

Even though culture is embedded in mathematics (D’Ambrosio, 1990), 20 (76.92%) out of 26 high school teachers were not aware of its influence in the learning of this subject. As a result, they may fail to see culture explicitly as it relates to the teaching of the mathematics curriculum. This finding is supported by the

qualitative data from open-ended interview questions and open-ended survey questions, which revealed that 21 (80.77%) high school teachers believe that the cultural background of ELL students does not influence their performance on standardized assessments. In so doing, the data also revealed that these teachers do not seem to be aware of the impact of ELL students' cultural backgrounds on their performance on standardized tests.

The quantitative data showed that 16 (61.54%) high school teachers believe that culture does not play an important role in the academic success of ELL students in mathematics. The qualitative data helped the researcher to understand the context of this result. For example, one high school teacher stated that "the performance of ELL students in standardized assessments is more about their attitude towards mathematics than the influence that their cultural background has on the mathematics teaching-learning process" while another teacher affirmed that "the majority of mathematics teachers do not really have a sense of what the cultural connection would be to mathematics". The data revealed that 21 (80.77%) high school teachers in this study do not believe that it is important to use culturally specific contexts in teaching and learning mathematics, which is the opposite of including relevant examples from students' own culture and exposing them to a variety of cultural contexts (Pease-Alvarez, Espinoza, & Garcia, 1991). Precisely because culture is what people take for granted, the majority of the high school teachers at AUSD may often be unaware of the norms and expectations that govern their behavior until those norms are not followed by someone who is unfamiliar with their culture (D'Ambrosio, 1990).

The review of literature suggests that mathematics is learned differently in other cultures. The appropriate use of mathematical activities related to the culture of ELL students is an important tool for extending understanding and providing real-world associations for the learning mathematical content (Rosa, 2010). In this regard, it is necessary that high school teachers in the nine high schools at AUSD develop an understanding of the influence of culture in the process of teaching and learning mathematics as related to the achievement of ELL students on standardized

assessments in mathematics. The reflection on their understanding of ELL students' culture and the comprehension of these influences might help them restructure their teaching styles.

7.3. Research Question 3

What are the perceptions of high school teachers in relation to the association between mathematics and culture?

Dossey (1992) asserted that mathematicians do not agree on the nature of mathematics, debating whether or not it is bound by culture (internalists) or culture-free (externalists). Internalists such as D'Ambrosio (1990) believe mathematics is a cultural product, developed as a result of various activities such as counting, locating, measuring, designing, and playing. Other mathematicians such as Kline (1980) are externalists because they believe mathematics activity is culture free. Thus, they do not believe in the connection between mathematics and culture.

The data showed that 20 (76.92%) high school teachers in this study possess an externalist view of mathematics, which means they perceive mathematics as culture-free and 6 (23.08%) of them possessed an internalist view of mathematics because they perceive mathematics as a cultural product. In so doing, the data also revealed that 25 (91.15%) of the high school teachers have had limited school and professional experiences concerning the relationship between mathematics and culture.

The quantitative data revealed that 16 (61.54%) high school teachers do not believe that there is a relationship between mathematics and culture. Even though 10 (38.46%) school leaders believe that there is a relationship between mathematics and culture, they are not really sure how it occurs. For example, one high school teacher stated that "teachers have limited experiences with how culture ties with the mathematics curriculum". This means that the majority of these high school teachers have the perception that students see numbers differently and believe that mathematical symbols and signs are slightly different in other cultures. For example, one high school teacher affirmed that "mathematics has different importance and

historical background in different cultures”. However, it is necessary to emphasize that the data analysis showed that high school teachers in this study believe that an emphasis needs to be placed on the cultural and linguistic backgrounds of ELL students as a resource for curricular activities in their learning of mathematics.

7.4. Research Question 4

What are the perceptions of high school teachers about ELL students’ linguistic background as challenges to their academic mathematical achievement?

According to the high school teachers in this study, language is an important factor that influences the performance of ELL students in mathematics. In the context of this finding, the review of the literature confirms this perception (Perkins & Flores, 2002; Rosa & Orey, 2009). For example, Valverde (1984) noted that differences in English and Spanish contributed to Hispanic students’ poor performance and involvement in mathematics. In so doing, the results of this study revealed that 22 (84.61%) of the high school teachers believe that the gaps in the performance of ELL students were partly due to the influence of language, as opposed to cultural factors, on standardized mathematics assessments. The qualitative data from open-ended interview questions and open-ended survey questions showed that high school teachers also believe that English proficiency plays an important role in the learning of mathematics for ELL students. In their point of view, most mathematics classes rely heavily on English language as the base for instruction. In the high school teachers’ opinion, ELL students need to understand the academic language of mathematics as well as its terminology and vocabulary. For example, one high school teacher stated that:

As ELL students move to higher level mathematics classes, they start to deal with more abstract concepts, which deal with terminology. If they do not understand the terminology, they cannot understand what is being taught.

In this regard, 23 (88.46%) high school teachers in this study perceived language as an important factor that influences ELL students’ performance in

mathematics instruction and assessments. In their opinion, some of the language factors that influence mathematics performance are difficult vocabulary and words with mathematical meanings different from their everyday meanings (Perkins & Flores, 2002; Rosa & Orey, 2007). For example, in relation to word problems, the quantitative and qualitative data show that the school leaders believe that one of the difficulties associated with the above problems is that they are either set in artificial contexts or lack context altogether (Rosa & Orey, 2007), which in these teachers' opinion, may create confusion, even for native English speakers. This means that, high school teachers believe that ELL students are unable to demonstrate their content knowledge in mathematics high-stakes tests. They believe that these students need a modified curriculum to improve their achievement in mathematics due to the influence of their linguistic background on these tests (Correlation is significant at 0.01 level (2 tailed) - Spearman's rho coefficient = 0.909, $p = 0.000$, $N = 25$). They also believe that preparation of lessons and curriculum modification are factors that help ELL students to learn to succeed on standardized tests. In so doing, these high school teachers stated that these students need more language support than modified curriculum. One school teacher stated that teachers "believe that adjusting teaching language strategies and styles would be more effective and maintain universality and equality of instruction".

In this context, both qualitative and quantitative data showed that high school teachers believe that linguistic background of ELL students can act as a barrier to their performance on mathematics assessments. In their point of view, one of the challenges faced by ELL students with regard to performance on standardized mathematics assessments is related to the ability to understand the questions as well as the ability to comprehend the abstract mathematical concepts they have to learn. According to these high school teachers, it is necessary to enhance standards-based curriculum to address these mathematical issues.

7.5. Research Question 5

What are the high school teacher's perceptions of ELL students' performance

on standardized high-stakes tests in mathematics?

The No Child Left Behind (NCLB) Act of 2001 requires that all students, including ELL students, reach high standards by demonstrating proficiency in English language arts and mathematics by 2014. School districts, schools, and teachers must help ELL students and other student subgroups make continuous progress toward this goal. Through the mandates, NCLB establishes high expectations for all students and seeks to reduce the achievement gap between advantaged and disadvantaged students. In this context, high school teachers in the nine high schools at AUSD are also facing such challenges.

According to Abedi and Dietel (2004), the above are worthy goals because they require extraordinary improvement in students' learning. However, the researchers also stated that the challenges for ELL students are especially difficult, involving both educational and technical issues. The results of this study showed that 22 (84.61%) out of 26 high school teachers agree with the premise that standardized tests are difficult for ELL students. They believe that most of ELL students try harder academically than their non-ELL students' counterparts and put extraordinary effort into trying to do their best in high-stakes standardized assessments. One high school teacher affirmed that teachers "find several ELL students who work hard, if not even harder, yet they are far behind so it is a challenge for them to keep up to the standards the state has set." Along these lines, another high school teacher stated that "teachers have seen ELL kids work harder because they know there is a language barrier to overcome".

According to the quantitative data, 15 high school teachers (57.69%) do not feel that they are prepared to address the specific needs of their ELLs. The qualitative data showed that, in this study, high school teachers face challenges in their roles as teachers in meeting the needs of their ELL students as well as in promoting their success. One school leader affirmed that:

Teachers are not well prepared to deal with the challenges faced by ELL students such as the need to provide time, resources, funding, and growth opportunities that help them to be well

prepared to assist their ELL students to perform and achieve in mathematics.

The qualitative data also revealed that these high school teachers believe that they must participate in professional development opportunities in order to help them to better understand how ELL students learn.

8. Implications of the study

This study has important implications for schools with ELL students. These implications both incorporate and integrate diverse ways of knowing, understanding, and representing information for teachers and students. This is especially important when instruction and learning take place in an environment that both encourages multicultural viewpoints and allows for the inclusion of knowledge that is relevant to students. If teachers are provided with professional development that helps them to develop a learning environment that is relevant to and reflective of students' social, cultural, and linguistic experiences, then they are able to act as guiders, mediators, facilitators, consultants, instructors, and advocates for students; helping to effectively connect their community-based knowledge to classroom learning experiences.

According to this context, two of these implications are:

- 1) *The need for consistency in the implementation of culturally and linguistically relevant mathematics curriculum and instruction*

Not all participants in this study viewed themselves as well prepared in pedagogical strategies and methodologies that effectively help them to serve ELL students in their classrooms. To make a decision about how to modify pedagogies in response to the needs of these students, equal support must be given to teachers so they gain increased and effective research-based instructional practices to ELL students in their mathematical curricular activities. The consensus and research related to best practices has stated that curriculum, assessments, and instruction need to be meaningful and relevant to all students as well as appropriate to individual language

and cultural backgrounds (D'Ambrosio, 1993).

These best practices and strategies range from the simple use of visual representations such as a vocabulary wall activity (Orey, 2009), scaffolding, graphic organizers, and differentiating instruction to the Sheltered Instruction Observation Protocol (SIOP) model. An implementation of these pedagogical practices aims mainly to help ELL students in developing their cultural identity and encourages them to strive for academic excellence and outstanding participation. Although high school teachers in this study believe that professional development helps them to improve their pedagogical skills and teaching practices, the lack of consistency in the implementation of the teaching and learning strategies in their schools does not contribute to an effective outcome of those strategies.

One of the most important implications of this study is that professional developments of teachers who serve ELL students need to be seriously addressed in order to improve their education and reduce the academic gap among other student subgroups. The results of this study show that high schools teachers want more information and educational experiences related to ELL students, time for training and planning, and opportunities to collaborate and learn from different sources. Research has also shown that professional development is more successful when it aims to enhance and expand the repertoire of teaching skills and instructional strategies of teachers rather than radically alter them (Richardson, 1990; Zepeda, 2008).

2) The need to make connections between culture and mathematics

Reflection on the social, cultural, and political dimensions of mathematics offers an important perspective for a dynamic and globalized modern society, which recognizes that all cultures and all people develop unique methods and explanations that allow them to understand, act, model, and transform their own reality. In this regard, ethnomathematics is the study of mathematical ideas developed by different sociocultural groups and offers a contextualization of the curriculum that contributes to the elaboration of pedagogical practices in multicultural classrooms (Rosa & Orey, 2007b).

Another important implication is that ethnomathematics as pedagogical action demonstrates that mathematics is contextualized and grounded in the needs and expectations of the community that utilizes it. Along this line, the goal of ethnomathematics is to contribute both to the understanding of culture and the understanding of mathematics but mainly to the relationship between the two. Educating students mathematically consists of much more than just teaching them mathematical concepts. Instead, this kind of teaching is much more difficult to do, and the problems and issues are much more challenging because it requires a fundamental awareness of the values that underlie mathematics and recognition of the complexity of educating students about these values.

The main implication for high school teachers in this study is that they have to consider student linguistic and cultural backgrounds in designing and selecting classroom activities by incorporating ethnomathematics into mathematics curriculum. With the increased growth of a diverse student population in the nine high schools at AUSD, the mathematics curriculum needs to reflect on the intrinsic and cultural learning of all students. In other words, it is important that teachers are well prepared to address students' linguistic and cultural backgrounds in their mathematics classrooms. According to D'Ambrosio and Rosa (2008), this inclusion improves students' academic achievement, helps move classrooms towards an equitable learning environment, helps students to form positive beliefs about mathematics, integrates mathematics with other disciplines, and promotes mathematical understanding.

9. Final Considerations

The challenges of the new century and the increased accountability it demands requires a different kind of teaching strategies that enables teachers to serve their students more effectively. Therefore, mathematics teachers need to develop their educational platform and engage in reflection, both of which are essential to their teaching practices. Similarly, researchers have recognized that reflecting on or

pondering an ideal, issue, perception, belief, or problem leads teachers to an enhanced educational practice (Airasian & Gullickson, 1997). Since professional reflection constitutes a valued strategy for enhancing professional practice, it is paramount that teachers create opportunities to reflect upon their own teaching practices in order to understand, critique, and modify it.

In addition, a deep understanding of both culture and its connection to mathematics is an important source of knowledge for leaders to reflect upon in order to modify and transform their teaching practices. In this regard, if high school teachers in this study are to facilitate successful learning opportunities for all students, they must know their students, their cultural roots, linguistic backgrounds, previous experiences, and their students' perceptions about the world. This also includes knowing ELL students' linguistic backgrounds and cultural values that may influence performance on standardized high-stakes assessments.

For ELL students to reach their full mathematical potential, instruction should be provided in ways that promote the acquisition of increasingly complex mathematical knowledge and language skills in a social climate that fosters collaboration and positive interactions among students and teachers. Important features of such settings include high expectations and exposure to academically rich mathematics curriculum, materials, resources, and approaches that are culturally and linguistically relevant to the ELL students' needs in order to enhance mathematical learning and achievement in addition to using effective methods and materials.

In conclusion, teachers who understand students' linguistic and cultural differences strive for intentional variety in instruction, curriculum, and assessments that lead to an improvement in the learning of mathematics. Teachers play a key role in encouraging and supporting best pedagogical practices for themselves and students in their classrooms. It is the researcher's hope that this study adds to the existing body of the literature in relation to the perceptions of high school teachers concerning ELLs and provides useful information for decision-makers in the field of teaching English and mathematics to speakers of other languages.

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