Abstract

SIMPSON, JAMILA RASHIDA. Science Educators' Concerns Regarding Ethnic/Racial Diversity Issues in Science Education. (Under the direction of Dr. Glenda Carter)

The purpose of this qualitative study was to determine the concerns science educators have about ethnic/racial diversity issues in science education. Three groups of educators, preservice teachers (n=12), inservice teachers (n=15), and informal educators (n=14) participated in the study. Participants' concerns were determined by using the Multicultural Teaching Concerns Survey (MTCS) by Marshall (1996b) and by examining transcripts of group discussions.

The MTCS results revealed that the science educators as a whole were most concerned about what strategies and techniques they should use with diverse students. The next area of greatest concern was "Familial/Group Knowledge". Finally, the areas of "Cross-Cultural Competence" and "School Bureaucracy" garnered similar levels of concern from science educators. Transcript data analysis revealed that the preservice science educators held two main concerns: a) Language as a barrier when communicating with ESL students and b) treating diverse students preferentially. Concerns were also more focused on "self" as Fuller (1969) suggested occurs with preservice teachers. The inservice science educators were found to hold five major concerns: a) diverse students' home life, b) students dealing with diversity, c) language as a barrier when interacting with ESL students, d) finding material on diverse scientists to present to students, and e) students' perceptions of the teacher. Most concerns raised by the inservice teachers were centered on the well-being of the student. Finally, informal science educators held three main concerns regarding: a) the lack of diverse people in the informal science setting, b)

language as a barrier when interacting with ESL audiences, and c) diverse students' home life. Most concerns were centered on the need to encourage diverse groups to participate in museum programs.

SCIENCE EDUCATORS' CONCERNS REGARDING ETHNIC/RACIAL DIVERSITY ISSUES IN SCIENCE EDUCATION

by

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Biography

Jamila Rashida Smith was born on November 22, 1977 to Clarence and Yvette Smith. Although she was supposed to have been born in February, she could not wait that long to enter into the world. She is the oldest of three children, with two younger brothers: Hakeem and Sean.

Jamila attended Iredell County Public Schools in Statesville, NC and graduated from West Iredell High School in 1995. Her love of weather brought her to North Carolina State University where she met her husband Clarence Simpson and earned her bachelor's degree in meteorology.

Because of her love for teaching and encouraging students, she knew that she wanted to do something more after college. She decided to enroll in the Master of Science degree program for science education. It turned out to be one of the best decisions of her life.

In August 2002 she married her soul mate, Clarence Simpson. Together they have both encouraged each other in their master's programs, with both finishing their theses in the fall of 2003.

Jamila plans to continue her education and earn a Ph.D. in science education.

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Introduction

According to the 2000 Census, the population of the United States is growing increasingly more racially/ethnically diverse. Also following in this trend is the diverse make up of students in US educational institutions. Currently 33% of the school population consists of minority students. However, it is believed that by the year 2035, minority students will make up approximately 50% of the US student population (U.S. Department of Commerce, 1996). Although a more diverse student population is predicted, the statistical trends are not predicted for educators. According to the National Center for Educational Statistics, in 1997, 87% of teachers were White and 40% of schools surveyed reported having no minority teachers at all. Therefore if these trends do not change, most ethnic/racial minority students will be taught by educators of European descent for most of their academic career. With this, research suggests that a cultural mismatch could exist between educators and their students (Ladson-Billings, 1995).

Peshkin (1992)defines culture as the 'learned and shared standards for ways of thinking, feeling, and acting…' (p.249). Cultural influences may not be easily recognized, but they have a great impact on the world-view of teachers, students, and the school curriculum. This curriculum is entrenched in culture and as such cannot be separated. Cultural influences found in curricula may include myths, customs, and history that are taken for granted by the dominant culture (Tobin, Tippins, & Gallard, 1994).

Understanding that curriculum is influenced by societal culture is very important. Our cultural backgrounds affect the way we view the world. As Mintzes and Wandersee (1997, p.44) state, "…Our perceptions of objects and events in the natural world are

strongly dependent on our store of prior knowledge. . . . we view the world through a pair of 'conceptual goggles'." Educators must understand that students may not view the world as they do, and may not construct knowledge in the same way as well.

The United States school system is based on Eurocentric cultural values (Banks, 1988). Anglo-European-American values include: rigid adherence to time, time as a valued commodity, emphasis on destiny control, and individual status linked to possessions. Other cultures have values that may differ from these. For example, African-American values include: expressive individualism, communalism, orality, movement, and social time perspective (Boykin, 1994). Native American values include: preference for cooperation over competition, ethical concern for the natural world, time orientation focused on the present and a view that human nature is basically good. Japanese values include: respect and obligation, group cooperation, avoidance of shame, indirect communication, modesty, and status distinction. Mexican values include: sensitivity to the environment, family concern, and diplomacy and tact in communication (Locke, 1998).

Although differing ethnic/racial groups have their own set of cultural values, Anglo-European-American values are expected of students when they are in the US public school system. Children whose cultural backgrounds differ from that of the dominant culture are placed at a disadvantage when dynamics such as emotional restraint and delay of gratification are seen as signs of 'social maturity' instead of the cultural values they are (Boykin, 1994).

In situations that may seem as if a student is exhibiting deviant behavior, an educator may need to examine whether a cultural mismatch in values may be occurring.

Students may be expected to quietly listen to a teacher talk and remain silent until they are given permission to speak. This however, is very different from the cultural norms of many ethnic minority groups, whose communicative styles value more active participation. Unfortunately, "uninformed and unappreciative teachers consider them rude, distractive, and inappropriate and take actions to squelch them" (Gay, 2000, p.53). "When children are ordered to do their work, arrive at their own individual answers, and work only with their own materials, they are being sent cultural messages. When children come to believe that getting up and moving about the classroom is inappropriate, they are being sent powerful cultural messages" (Boykin, 1994, p.125).

Purpose

Although many studies have examined the concerns of teachers and teacher attitude toward ethnically/racially diverse students, few studies have focused on professionals in the field of science education. Educational disparities regarding minority students in science education are well documented. Black, Hispanic, and Native American students exhibit lower average achievement test scores in science than White and Asian students, and are significantly underrepresented in science related fields (Ingels et al., 1990). Also, African American students continue to be overrepresented in lower track science and mathematics courses in high school and few are able to become scientists, mathematicians and engineers later in life (Atwater, 2000). These are unique concerns to science education.

It is evident that the role of the teacher is an essential part of inclusive science instruction. However, most preservice teachers state that they have limited exposure to diverse populations (Cockrell, Placier, Cockrell, & Middleton, 1999; Sparks III, Butt, &

Pahnos, 1996; Taylor & Sobel, 2001; Terrill & Mark, 2000) and when asked, most respond that they do not feel adequately prepared to work with diverse populations (Ladson-Billings, 1994). The cultural mismatch between teacher and student may cause potential concern for teachers. However, there is also the possibility that educators may not recognize that this cultural mismatch exists, therefore they may not be concerned about these issues. Knowing the concerns science educators have about teaching ethnically/racially diverse students may assist undergraduate science education institutions with ideas of what their students may wish to learn more about before entering the workplace. This information may also shed light on an area of science education that has not fully been examined, and may offer educators a look into their own concerns which may be affecting their interactions with diverse students in their academic settings. The purpose of this study is to identify and examine the concerns of science educators regarding ethnic/racial diversity issues in science.

This study examines preservice (e.g. science education student), informal (e.g. museum) and formal (e.g. classroom) science educators. These groups were examined to gain an extensive view of the experiences and possible unique concerns different types of science educators may have about diversity issues in science education.

Review of Literature

The increasing diversity of the American population has affected many educational institutions. Universities are examining the beliefs preservice teachers have about teaching ethnically/racially diverse students, the expectations they have for these students, and the experiences that will better prepare them to teach these students. Researchers are also examining inservice teachers' perspectives on culture as well as the

impact cross-cultural experiences have on their personal and professional lives. Informal educational institutions (museums) are looking at themselves and searching for ways to reflect their diverse audiences as well as enlighten others about diverse cultures.

The review of literature that follows begins with a summary of research that has examined the assumptions some preservice teachers have had about teaching ethnically/racially diverse students. The next section of research focuses on the concerns inservice teachers have had about teaching ethnically/racially diverse students. The last section describes methods some informal institutions have taken to reach out to diverse populations.

Preservice Teachers' Preconceptions about Teaching Diverse Students

Many studies have been done examining preservice teachers' preconceptions regarding teaching culturally different student populations. Terrill and Mark (2000) of Central Michigan University examined preservice teachers' expectations for their students of color and second-language learners. Data were collected using a questionnaire that was developed and distributed to 97 undergraduates (89% were White) who had been accepted into the teacher education program. The study results suggested that most participants would prefer to teach in a majority White, suburban school. These preservice teachers indicated that they felt less comfort working with African American students and English as a second-language students. Results also showed that the preservice teachers had different expectations for their students of color. Preservice educators expected that there would be higher incidences of child abuse in families of color, lower levels of motivation, and fewer gifted students of color as compared to White students in the suburban schools.

In another study (Shultz, Neyhart, & Reck, 1996) examining preservice teachers attitudes toward diverse student groups, 300 education students completed a questionnaire concerning their beliefs about diversity in urban classrooms. When preservice teachers were asked about urban students' behaviors and attitudes compared to their own, slightly over half of the participants perceived that students' attitudes would be very different. Words such as 'lackadaisical', 'unmotivated', and 'emotionally unstable' were used to describe urban students. Most participants responded that they believed a child's cultural background would have an effect on the child's education, but were unsure in what way.

Education coursework has also been a means of both identifying and altering a preservice teacher's attitude towards teaching culturally diverse students. In a study by (Weisman & Garza, 2002), preservice teachers were given a survey before and after a multicultural class in which they were enrolled. The results from the survey suggested that most preservice teachers began the multicultural course with the idea that minority students and their families were to blame for their lack of educational achievement rather than looking at factors such as school or society as possible sources of difficulty. Most of the White preservice teachers continued throughout the course to deny their own privileged positions of power in society. Results also indicated that ethnic majority preservice teachers may not be ready to embrace the ideals needed to effectively teach in a multicultural classroom.

In a study by Schmidt (1998), a multicultural literacy learning course was designed for education students that would use the ABC's (Autobiography, Biography, and Cross-Cultural analyses) model of Cultural Understanding and Communication to

foster multicultural understanding. Twenty educators (preservice and inservice) participated in the study. Assignments were given to students that required them to write their autobiographies, interview someone of a different cultural background, and compare and analyze the similarities and differences of their lives. Most educators expressed a positive experience of discovering their own culture and finding a realization of the impact their culture has had on their lives. Educators stated that they were able to examine and appreciate the differences and similarities they shared with others. They also reported that they believed the experience would help them better understand the lives of the children in their classrooms.

In an effort to teach educators about the impact of culture on education, some multicultural education courses have incorporated experiences that teacher educators hope will impact their students. In a study by Greenman and Kimmel (1995), school counselors, preservice teachers and inservice teachers were administered an instrument to examine their perceptions of cultural diversity, cultural pluralism, and multicultural education. School counselors and preservice teachers also took part in a simulated cultural event, in which they encountered people of a different culture. Inservice teachers participated in a week long multicultural education workshop but had no simulated cultural experience. Findings showed that most participants failed to gain a deeper understanding of the concept of culture from the mock cultural experience although most participants stated that the exercise was a positive experience for them. The group who had the most positive understanding of culture was school counselors, followed by preservice teachers. The most resistant group was inservice teachers. Inservice educators indicated that they did gain knowledge of multicultural activities they could use in class;

however, they also indicated they did not gain additional understanding of culture from their workshop.

Field experience was used as an intervention to impact attitudes and beliefs of secondary preservice teachers in a study by Deering and Stanutz (1995). Prior to a 10-week multicultural field experience, students completed a Cultural Diversity Awareness Inventory. The inventory was designed to measure the attitudes, beliefs, and behavior an individual may have toward culturally diverse children. Results revealed that after the multicultural field experience there was a decrease in the number of preservice teachers who preferred to work with students who were culturally like themselves. Prior to the field experience, many preservice teachers indicated they would be uncomfortable with people who spoke nonstandard English, but the number decreased after the experience. However, a finding that puzzled researchers was that the percentages of preservice teachers who stated they would sometimes accept nonstandard English spoken in their classroom increased after the field experience. Researchers could not determine whether this finding meant that preservice teachers gained more respect for the students' primary language, or whether preservice teachers had lower expectations for these students.

Student educators' perceptions of different techniques used to reach diverse populations were examined in a study by Carr and Klassen (1997). In this study, the attitudes White and minority preservice educators had about using antiracist education methods in Canadian public schools were examined. In the study, White preservice teachers were found to be less supportive of using antiracist teaching methods than minority preservice teachers.

A study conducted by Barry and Lechner (1995) examined preservice teachers' attitudes and awareness about multicultural teaching. Preservice teachers stated that they were undecided about how well their education programs had prepared them to teach culturally diverse student populations. Preservice teachers were unsure on how to effectively communicate with the families of their diverse students. They also indicated that they wanted more training in teaching and interacting with their culturally diverse students.

There are however, many instances of resistance from preservice educators regarding multicultural education. In a qualitative study by Jordan (1995), preservice teachers enrolled in a foundations course were required to participate in a field experience in which they would complete a clinical experience at an inner-city school. The preservice educators were predominantly White and female with most having little interaction with ethnically diverse people during their school careers. Because the field experience was the first cultural diversity encounter for some of the preservice teachers, some concerns arose. The area of most concern to the preservice teachers was how they would be perceived at the predominantly African American schools. Preservice teachers were also very concerned about life at an inner-city school. Some preservice teachers had very negative images of inner-city schools and students. Analysis of comments revealed that most images were acquired through what students had heard from others or seen through the media reports. However, some students later reflected their surprise when their negative images of the inner-city schools were not realized and most overcame their prior fears of the inner-city school culture.

Preservice teachers' views about teaching in inner-city schools were also examined by Aaronsohn, Carter, and Howell (1995). In this qualitative study, the attitudes of 80, predominantly White, education students (undergraduate and graduate) from homogeneous suburban communities were examined. Prior to the intervention students revealed that they believed minority students to be 'disruptive', 'disrespectful', and 'worse behave[ed] than suburban students'. Most indicated that they believed minority students to be 'involved in drugs', 'in gangs', 'violent', 'delinquent' and 'wild – the standard stuff'. Education students also assumed that inner-city parents 'didn't finish school', 'aren't concerned' about their child's education and 'don't take education seriously' (1995, p.6). All but one student held the belief that inner-city parents do not care about their children or their children's education. All students indicated the media as a major source of ideas they held about inner-city schools. The undergraduate and graduate students underwent different interventions in the education courses taught by the researchers. Interventions for undergraduate students included: watching television programs that had instances of bias and discussing them in class, writing and reflecting on the first time they encountered difference in their lives, and required tutoring of diverse students. Graduate student interventions included: watching videos, examining readings and participating in class discussions on methods to better understand and teach diverse cultures. All students had to undergo the intervention of playing a card game with a stacked deck which allowed students to experience inequality and a field visit to an inner-city school Prior to visiting an inner-city school, preservice teachers described being 'fearful', 'nervous', and 'wary' of what they would encounter. Several indicated they were warned by family and friends of the harshness of inner-city schools. The

teachers reported however, being surprise at the schools being ‘clean’, ‘having good teachers’ and encountering ‘good kids’ (1995, p. 8). Half of the students indicated that after this experience they felt more comfortable being around minority children.

In another study examining preservice teachers’ perspectives on teaching diverse students, Ross & Smith (1992), interviewed six White preservice teachers before and after a field placement experience. Before the field placement, all of the preservice teachers saw student achievement as mainly affected by the individual. However, after the field placement experience, the preservice teachers began to see other potential influences on student achievement, such as curriculum or teacher attitude towards a student. In regards to the preservice teachers’ commitment to teach diverse students, opinions varied. The two preservice teachers with little previous experience with diverse populations stated that they wanted to teach in a middle-class school because that is where they felt the most comfortable. However, the preservice teachers who had had significant contact with diverse populations while in school were more eager to teach diverse populations.

Understanding teacher educators’ perspectives on multicultural education is imperative to reaching preservice teachers and preparing them to teach a diverse student population. Kitano (1996) examined the beliefs of 56 university faculty members regarding multicultural education. A fictional case was given to the faculty members in which an Anglo-American, newly certified teacher, was assigned to teach a class of ethnically diverse students. The new teacher in the fictional case asks the education professors what major points should be covered in her class so that her diverse students will be able to succeed. The majority of teacher educators suggested two types of

responses: that the first year teacher should vary her instructional method and that classroom climate should be more conducive for her students. Suggested less often were ideas about curriculum, having knowledge and sensitivity toward the culture of diverse students, interacting with the family and/or community of diverse students, finding and using professional resources and being aware of language or dialects of diverse students. Also, not all teacher educators in the study specialized in multicultural education. Using the National Council for Accreditation of Teacher Education (NCATE) vitae, faculty members were determined to be either novices or experts in multicultural education. The responses of the novices and the experts were examined and experts were found to give lengthier responses, more specific techniques, and also to connect the structure of school to the culture of society. Novices, on the other hand, focused more on classroom practices.

Beginning Teachers' Concerns about Teaching Diverse Students

Beginning teachers also have attitudes, preconceptions, and concerns about teaching students that are ethnically/racially different from themselves. In one study (Freeman, Brookhart, & Loadman, 1999), entry-level teachers who began their careers in moderate to high racially/ethnically diverse schools (schools in which 25% or more of the students were from racial/ethnic minority groups) were compared to their counterparts who taught at low diversity school settings (schools in which 10% or less of the students were from racial/ethnic minority groups). Teachers in the moderate to high diversity settings stated that they:

- Had lower job satisfaction
- Believed student motivation was low

- Attributed behavioral problems as out of the teachers' control
- Struggled to find meaningful relationships with their students

Birrell (1995) conducted a case study of a first year teacher who grew up in a middle-class, predominantly White community and had limited experiences with minority youth to examine his reaction to black students' ethnic behavior in school. The teacher reported that he knew a few black youths in high school and "considered himself to be a 'color blind' beginning teacher, entering a classroom filled with, as he put it, 'every color of the rainbow'" (1995, p.139). The transition to working with black students whose culture differed from his, however, was not a smooth one. By the end of the study he had given many of his black students failing grades and had arranged to be transferred to another school where the students shared his cultural behaviors. Based on the experiences of this first year teacher the author suggests that prospective teachers should explore:

- Their own ethnic heritages so that they may be less threatened by those of their culturally different students.
- The school and how it is used as a socialization tool in our society.
- Their life experiences, as they can be most important influences on their cultural sensitivity toward their students.

Unfortunately, being physically present in a setting does not necessarily result in an understanding or an appreciation of the cultural norms of the community. Sometimes negative responses arise from a lack of understanding of cultural differences and not from a lack of pedagogical knowledge (Wiggins & Follow, 1999).

Inservice Teachers' Concerns about Teaching Diverse Students

Interestingly enough, most research about multicultural education and teachers beliefs about teaching diverse students is focused on preservice educators, and not inservice educators. It is as if inservice educators are believed to have no needs or concerns about teaching ethnically/racially diverse students. Research, however, suggests that like the preservice educators, teacher educators may also have concerns about teaching diverse student populations.

In a qualitative study by Abt-Perkins and Gomez (1993), inservice teachers were enrolled in a class in which they could examine their own beliefs and classroom practices toward diverse students. Goals for the class included offering teachers a place they could talk candidly about their teaching experiences and how their own cultural perspectives influenced them. During the class teachers began to realize how their beliefs and consequent reactions affected themselves and their students. One teacher realized how she had had a major role in maintaining a minority student's silence in her class. She later discovered that although she had not believed she was treating the minority student different, that she in fact, had. Further self-analysis led the teacher to realize that she had been unknowingly intimated by her student because he was different than her. After the course the teacher initiated dialogue with her student, altered some teaching practices, and subsequently her student became more actively involved in class. The study suggested that critical self-evaluation should be done by teachers to see what perspectives they are bringing to the classroom and what effect this may have on student learning.

A qualitative study by (Johnson & Kean, 1992) examined the effect of different intervention techniques to improve science teachers' teaching practices, curriculum and

communication with their female and diverse students. Inservice teachers and administrators participated in a 17-day workshop that offered intervention activities to: "promote cultural awareness" through presenter exercises, "confront belief systems" through stories of teaching experiences and metaphors, and "change the norms of schooling" by examining alternate teaching methods, such as the learning cycle and cooperative learning (1992, p.278). Researchers later visited and observed teachers' classrooms, provided the teachers with "nonjudgmental feedback" and held meetings to be a place of support as well as encourage teachers to try new techniques in their classes. Teachers and administrators reported having less discipline problems in their classes, friendlier teacher and student interaction, more understanding for students and their different cultural values, and more student-centered teaching techniques.

A study by Mahan and Rains (1990) also examined the effect of a cultural immersion experience on inservice teachers' professional and personal lives. At Indiana University's School of Education, a cultural field placement experience was offered to interested inservice teachers. These teachers were placed on an American Indian Reservation in the Southwest and their attitudes and cross-cultural experiences were examined before and after the experience. Prior to the immersion experience, a survey was administered to the 45 inservice teachers about their cross-cultural friendships and prior cross-cultural immersion experiences. Few inservice teachers reported having Mexican American or American Indian friends prior to the immersion experience. Most inservice teachers also reported having had a cross-cultural immersion experience. Although most did report living in a foreign country as their cross-cultural immersion experience, many listed their cross-cultural experiences as working with diverse people,

being a house guest of a diverse person, going to an integrated school, or taking a class about different cultures. After the experience, inservice teachers indicated having more Mexican American and American Indian friends. They stated that they had become more aware of their own culture and had learned more about themselves. Most teachers also reported that they would use the experience to either create new courses or revise existing courses to share what they had learned during their experience.

Informal Education

Although there has been a wide variety of research on diversity issues in formal education, little has been done to examine this issue in the realm of informal education. Literature does reveal that some informal education institutions have reacted to societal changes and are addressing the need for multicultural understanding.

An article by Santos (1980) described an informal educational institution in Dallas, Texas known as the Cultural Crossroads Educational Center. This institution was founded in the wake of desegregation to act as a means of leading students to understand and celebrate the cultural heritage of themselves and others. Through the center, students were introduced to different cultural artifacts, music, clothing, etc. Teachers were hosted to inservice teacher workshops; and multicultural materials were given to teachers to assign to their students. All of this was done to accomplish the center's goals of:

- Providing experiences to help students live in harmony in a pluralistic society.
- Developing a positive self-concept in all students
- Developing and disseminating multicultural curriculum

More recent articles also illustrate museums changing for a changing society and reaching out to more diverse populations. Kramer (1994) explained the obstacle

the Brooklyn Museum had of being thought of as a 'cultural elitist' institution by some and the steps it was taking to move toward cultural diversity. The Brooklyn Museum was founded in 1823 by the populace who lived in the Village of Brooklyn. The goal of the museum was to educate the 'young men' to become "useful members of society". Therefore, the collections which were displayed reflected the culture and interests of the community and financial donors of that time. However, many of those donors moved away as time progressed and the cultural demographic of the area changed to encompass African American, Hispanic, and West Indian ethnic groups. In an effort to reach the new diverse demographic community, The Brooklyn Museum began outreach efforts that included reinterpreting collections that were at the museum and finding diverse artists' works to display. The museum hoped that their efforts would not only bring in patrons from the diverse community, but that it would also foster cultural understanding for other patrons.

Other museums have also felt the need to tell the story of their diverse communities. Kahn (1994) examined the Museum of London and their approach to incorporate the diversity of the city with their exhibits. Although the museum had a diverse community in the area, few of the patrons who visited the museum were from these diverse populations. In an effort to discover why this might be the case, the museum came upon the realization that the diverse community and their stories were not represented in the museum. Therefore, the museum began a new commitment to include these populations in the exhibits and to start a new project entitled "Peopling". The "Peopling" project had museum staff talking to citizens to let them know of the project,

recruiting older people of diverse populations to tell their stories, and collecting artifacts to be used in exhibits. The project hoped "to validate the experiences of [diverse groups] while hopefully enlightening others" (1994, p. 244). Although there had been no formal study on the visitation to the museum, staff believed that not only was visitation higher than the year prior, but that more diverse patrons were visiting the museum.

Teaching Concerns

The limited interaction with and the cultural mismatch that exists between many educators and their diverse students may cause educators concerns about teaching ethnically/racially diverse students. A critical study conducted by Frances Fuller (1969) suggests that teachers' concerns move through three sequential phases. The first is the pre-teaching phase, during which educators seem to have no solidified concerns about teaching. Next is the early teaching phase during which educators begin to grow more concerned about their own adequacy as a teacher. Finally, during the experienced teacher phase, educators are more concerned about their impact on their pupils than their own adequacy to complete teaching tasks. Fuller and Borich (1974) later labeled these stages as self-concern, task concern, and impact concern. These stages have been used by researchers to approach teaching concerns based on the position of the educators' phase of teaching.

A study by Marshall (1996a) explored teacher concerns regarding working with culturally different students. Preservice education majors and inservice teachers responded to a four-item open-ended questionnaire to identify specific areas of concern they held about teaching ethnically diverse students. The responses were then analyzed

to identify common concerns and to organize them into themes. Teachers expressed concerns about the following:

- Their ability to judge students fairly without regard to cultural background and to be judged fairly by students without regard to cultural background.
- Selecting and incorporating the most appropriate teaching resources to positively influence the learning outcomes of diverse students.
- The extent to which the cultural structure of school impedes their ability to effectively meet the needs of diverse students.
- The extent to which they perceive gaps in their knowledge about the family or cultural group background of their students.

From the educators' concerns, questions were constructed, and subsequently, a 64-item Multicultural Teaching Concern Survey was developed. The survey was designed to measure the intensity of concerns participants may have regarding working with culturally different students. Marshall (1996a) stated that teachers' concerns about their work have the possibility to influence their actions in schools.

Summary

Although the numbers of diverse peoples are increasing, most preservice teachers have had few personal encounters with diverse people. This may greatly affect their beliefs about ethnically/racially diverse students. Preservice teachers have been found to have different expectations for their ethnically/racially diverse students. Studies indicated preservice teachers feel less comfort working with these students and they believe these students to be unmotivated. They do not understand the effect society has on a student's educational opportunity, and they believe their families to be unsupportive

and uncaring. Preservice teachers also indicated that most of their conceptions are not due to personal experience, but are based on hearsay or the media. Preservice teachers have also been found to be resistant to multicultural education concepts. It is not until their preconceived ideas of their students are tested in actual educational settings that some students have truly begun to view diverse students differently.

Inservice teachers are also affected by increasing diversity. Inservice teachers can be role models for incoming teachers and their response to a growing diverse student population is very important for preservice teacher education, not to mention their diverse students. Like preservice teachers, inservice teachers may not have much prior experience or personal relationships with ethnically/racially diverse people. This may greatly affect how they teach their students and their comfort in the classroom. Some inservice teachers may think of themselves as novices and may not feel equipped to offer preservice or new teachers much advice on how to teach diverse students. The advice they do give may also be vague. Research has found that some inservice teachers have reacted positively to having a support group to discuss what is taking place in the classroom and have incorporated techniques learned in order to help their diverse students. And just like preservice teachers, inservice teachers have been found to benefit from cross-cultural field experiences.

Informal education institutions are also impacted by our society's changing ethnic demographic. Some informal education institutions are realizing this change and altering their programs in order to better reflect their diverse constituents.

Although there have been articles outlining the steps museums have taken to reach diverse communities, little research has been done in the area of museum outreach

to diverse communities, or how museum educators view diversity issues in education. Research studies are also few in the area of formal science education and how science educators are impacted by ethnically/racially diverse students. This study examines the concerns of preservice, inservice and informal science educators about ethnic/racial diversity issues in science education.

Science Educators' Concerns Regarding Ethnic/Racial Diversity Issues In Science Education

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Science Educators' Concerns Regarding Ethnic/Racial Diversity Issues In Science Education

Introduction

As the minority population in the United States increases, so does the enrollment of different racial/ethnic groups in schools and other educational institutions. In 1996, about 33% of public school students were members of racial/ethnic minority groups. It is predicted that by the year 2035 racial/ethnic minorities will constitute 50% of the U.S. student population (U.S. Department of Commerce, 1996). However, the statistics for minority teachers do not mirror these values. In 1997, only 13.4% of teachers were members of racial/ethnic minority groups, and 40% of schools reported having no minority teachers at all (National Center for Educational Statistics, 1997). This indicates that most ethnic minority students will be taught by ethnic majority (European descent) educators for nearly their entire academic career.

The concerns teachers have or do not have about teaching diverse students may influence the way they interact with these students. When educators are not aware of the factors that influence their students' lives, they may not be concerned about the issues that affect their students and subsequently, they may not be sensitive to their needs. Concerns, however, may also pose a problem. For instance, concerns teachers have about interacting with diverse students and their families may act as a barrier between student/teacher communication and student learning. Dealing with teacher concerns may allow teachers to focus more on the needs of their students (Fuller, 1969). Therefore, it is very important to understand the nature of teachers' concerns, or lack thereof.

Literature Review

Cultural backgrounds have an effect on how we view the world and are pervasive in school curricula. Culture can be defined as the 'learned and shared standards for ways of thinking, feeling, and acting…' (Peshkin, 1992, p.249). Curriculum is embedded in culture and cannot be separated; it may even include myths, customs, and history that are taken for granted by the dominant culture (Tobin et al., 1994). In the United States, the dominant culture is Anglo-European-American, whose values are evident throughout the schooling process. For example, Anglo-European-American culture values rigid adherence to time, time is valued as a commodity, an emphasis is placed on destiny control, and an individual's status is linked to possessions. However, values may differ depending on an individual's culture. For instance, African American culture values expressive individualism, communalism, orality, movement, and social time perspective (Boykin, 1994). Puerto Rican culture values dignity, cooperation, respect of persons and extended time orientation. And Mexican culture values family, the environment and tact in communication (Locke, 1998).

Anglo-European-American values are expected throughout American culture, and problems arise when individuals are not aware of the cultural roots of the expectations. "When children are ordered to do their work, arrive at their own individual answers, and work only with their own materials, they are being sent cultural messages. When children come to believe that getting up and moving about the classroom is inappropriate, they are being sent powerful cultural messages" (Boykin, 1994, p. 125). Children of cultural backgrounds different from the dominant culture are placed at a disadvantage when factors like emotional containment and delay of gratification are not seen as

culturally valued expressions, but rather signs of 'social maturity' (Boykin, 1994). How can our society change if we are not aware of these differences?

Students from other cultures face a cross-cultural experience when they study Western science. When students move from their cultural lives into the culture of school science, the move is called "cultural border crossing" (Aikenhead & Otsuji, 2000). "If science teachers are not aware of the cultural aspects of Western science, and are not aware of the differences between scientific and other cultures (those of their students), then teachers will not make good culture brokers and the science curriculum will be less accessible to their students" (Aikenhead & Otsuji, 2000, p.277). However, research suggests that teachers do not view science as a cultural phenomenon and tend not to see the culture difficulties their students may experience in their classes (Aikenhead & Otsuji, 2000).

Research has found that many ethnic minority students demonstrate different cultural behaviors than the majority of educators (Vasquez, 1990). But most preservice educators are limited in their interactions with diverse populations (Cockrell et al., 1999; Sparks III et al., 1996; Taylor & Sobel, 2001; Terrill & Mark, 2000) and most educators report that their preservice programs did little to prepare them for working with diverse populations (Ladson-Billings, 1994). Because preservice teachers may be unfamiliar with diverse populations, they may harbor misconceptions about these populations. Therefore, it is plausible that teachers who are unfamiliar with their students' behaviors may develop concerns about interacting with them (Marshall, 1996a). However, another possible outcome is that teachers who are unfamiliar with diverse students are not concerned about problems diverse students face because they do not experience these

problems. In order for educators to address the problems their students face, educators must be aware the problems exist. This may not be the case for many educators.

Since the landmark study by Fuller (1969), "Concerns of Teachers: A Developmental Conceptualization", identifying a hierarchy of teacher concerns, many studies have explored preservice and inservice teachers' concerns regarding teaching experience (Reeves & Kazelskis, 1985), teacher efficacy (Ghaith & Shaaban, 1999), and teacher preparation (Pigge & Marso, 1997). However, few studies have been done examining teacher concerns about ethnic/racial diversity issues in science education. This study will address this gap in the literature by focusing on concerns of preservice and inservice teachers as well as science educators in an informal science education setting.

Methods

The following study examines and describes the concerns science educators have about ethnic/racial diversity issues in science education. In this study the concerns of three groups of science educators about ethnic/racial diversity issues were examined through the use of the "Multicultural Teaching Concerns Survey" (Marshall, 1996a) and group interviews. The survey provided information about the level of intensity of concerns educators have about teaching ethnically/racially diverse students. The interviews provided the opportunity to further elucidate and explore the beliefs and experiences of these educators about issues related to multicultural teaching.

Participants

The groups of science educators (N=41) who participated in this study were from formal (preservice and inservice educators) and informal (museum educators) science

education settings. The demographic makeup of the participants was predominantly White with only two ethnic minority participants. This was not due to a lack of ethnic minority volunteers, but rather a lack of minority presence in these selected locations.

One group of participants consisted of twelve preservice science educators enrolled in an undergraduate science education course at a large southeastern university. The second group consisted of fifteen inservice science educators enrolled in a graduate-level science education course at the same university. The third group consisted of fourteen informal science educators from a science museum located near the university. The decision to survey these three groups of science educators was made so that both differences and similarities in concerns of these three groups could be identified. This was done to elucidate patterns of concerns across groups as well as to identify concerns specific to one particular group of educators.

The preservice and inservice participants were accessed with the cooperation of a science education professor at the university. The researcher was given permission to visit the professors' undergraduate and graduate classes to explain the study, to ask for volunteers to participate, and to conduct the research during class time.

An educator on staff at a local science museum provided access to informal science educators. The museum contact sent a group e-mail to the science education staff at the science museum to find participants for the study. Those who were interested gave contact times they were available for the study. To accommodate volunteers' schedules, data were collected on two separate occasions at the museum.

Instruments

The Multicultural Teaching Concerns Survey (Marshall, 1996b) is designed to assess the level of concern educators have about working with diverse student populations across four categories: Familial/Group knowledge (17 questions), Strategies and Techniques (20 questions), Cross-Cultural Competence (21 questions), and School Bureaucracy (6 questions). The Familial/Group Knowledge category deals with concerns educators have about their knowledge of their students' familial/group culture and background. The Strategies and Techniques category includes the concerns educators have about utilizing the appropriate techniques and "diverse" content in curriculum. The Cross-Cultural Competence category focuses on the concerns educators have regarding the impact of personal attitudes, actions, and/or beliefs on interactions with diverse student populations. The School Bureaucracy category deals with concerns educators have about whether the structure of schools and the actions of other school personnel impacts efforts to implement multicultural education in schools (Marshall, 1996a). The original 64-item MTCS instrument was administered to the science educators in the study. However, Marshall (1996a) conducted a factor analysis, which led to the elimination of items that did not load high for the categories. The following analysis of the MTCS is based on the 31-item questionnaire that was a result of the factor analysis. This questionnaire consisted of eleven questions in the Familial/Group knowledge category, four questions in the Strategies and Techniques category, eleven questions in the Cross-Cultural Competence category, and five questions in the School Bureaucracy category.

In response to each question on the instrument, respondents are asked to rate their level of concern on a five-point Likert-type scale ranging from 1 (an extremely unimportant concern for me at this time) to 5 (an extremely important concern for me at this time). The mean scores are obtained for each participant, item, and category. A higher mean score represents a more intense level of concern. The calculated reliability coefficient for the instrument in this study was 0.80.

Procedure

Due to the sensitive topic of the study, participants' anonymity was an important consideration. To provide anonymity, each survey was numbered and randomly distributed to participants (face down) so that their identity would be unknown. Participants were instructed to remember the number they received on the survey, complete the survey, and place their surveys in an envelope. While participants were completing the surveys, the researcher set up stations around the room.

After the surveys were completed, the researcher explained to participants that they were going to transition into the group discussion portion of the research. The researcher asked the participants to arrange themselves into discussion groups by their numbers after the researcher left the room. They were also told that specific directions to help facilitate the discussions were at each station.

Stations were set up around the room with signs informing participants what groups they belonged to based on their assigned number. Although the numbers were randomly distributed to individuals, groups were assigned in sequence. For example, Participants 1-4 were assigned to station 1, participants 5-8 were assigned to station 2, etc.

Typically four people were assigned to each group, although this was not always the case. Group distribution was based on the number of participants who had volunteered to take part in the study. The researcher's goal was to have an equal number of participants distributed among the groups.

There were a set of instructions for the proctor (see Appendix A) and the group (see Appendix B), as well as a tape recorder, located at each station. One participant was assigned the duty of proctor by virtue of his/her assigned number. The proctor was responsible for recording the discussion using the tape recorder and moderating the talk. The proctors were furnished with written instructions for guiding the discussion. The group was allowed approximately 15 minutes for their discussion. Before making a comment, participants identified themselves by number. This was done to enable the researcher the opportunity to later correlate survey and transcript results during the study. Each group was encouraged to discuss with one another issues about teaching culturally diverse students they believed to be important to them or any concerns they may have about cultural diversity in science education. After the time allotted, the researcher returned and collected the tapes from the stations.

Data Analysis

The tapes were later transcribed verbatim by an individual who had no contact with participants. Afterwards, the transcripts were analyzed by the researcher for any themes that may have surfaced from group discussions. As suggested by Creswell (1998), notes were taken in the margins of the transcripts during the preliminary process of exploring the text. This step was repeated several times to minimize the possibility of

concerns being overlooked by the researcher. Participant responses were identified as a concern if:

- A participant explicitly identified an issue as a concern.
- A participant agreed that another participant's concern was also his/her concern.
- A participant asked an original question (a question not given on the proctor's instruction sheet) to the group.

As suggested by Miles and Huberman (1994), counts were taken of concerns to determine their frequency among the participants. Themes were then identified and used to sort the data into more concise groupings. Finally, themes were examined and placed into the concern categories (developed for the Multicultural Teaching Concerns Survey) to which they corresponded.

For reliability, a doctoral student also in the field of science education, independently matched concerns to appropriate identified themes. During the matching process, no new themes emerged. Only participant concerns that were identified by both the researcher and the doctoral student and placed in the same concern theme were used to calculate concern percentages.

Results

Preservice Educators

Multicultural Teaching Concerns Survey Results

To assess participants' levels of concern, individual mean scores as well as group mean scores were calculated for each subcategory and are illustrated on Figure 1. Across the four categories of concern, preservice science educators had a group mean score of

approximately three (see Figure 1). However, on an individual basis, mean scores varied greatly among the four categories with no clear pattern of the concern discernable for the preservice group as a whole. Differences among categories are statistically significant. This suggests that overall the preservice science educators do not share common concern intensity about teaching diverse students.

Data indicated that as a group preservice science teachers were most concerned about the category of Strategies /Techniques as can be seen by the slightly higher group mean score and also by the range of individual scores clustered more toward the upper end. Although this category received the highest average score among the other categories, only four of the preservice educators had more than moderate concern about what strategies and techniques they should use with their diverse students. Interestingly, the preservice teachers' responses tended to cluster around three different levels of concern for this category. One group of preservice teachers was very concerned about what strategies and techniques they should use with diverse students; another group had only a little concern about this issue, while the other group indicated no concern at all.

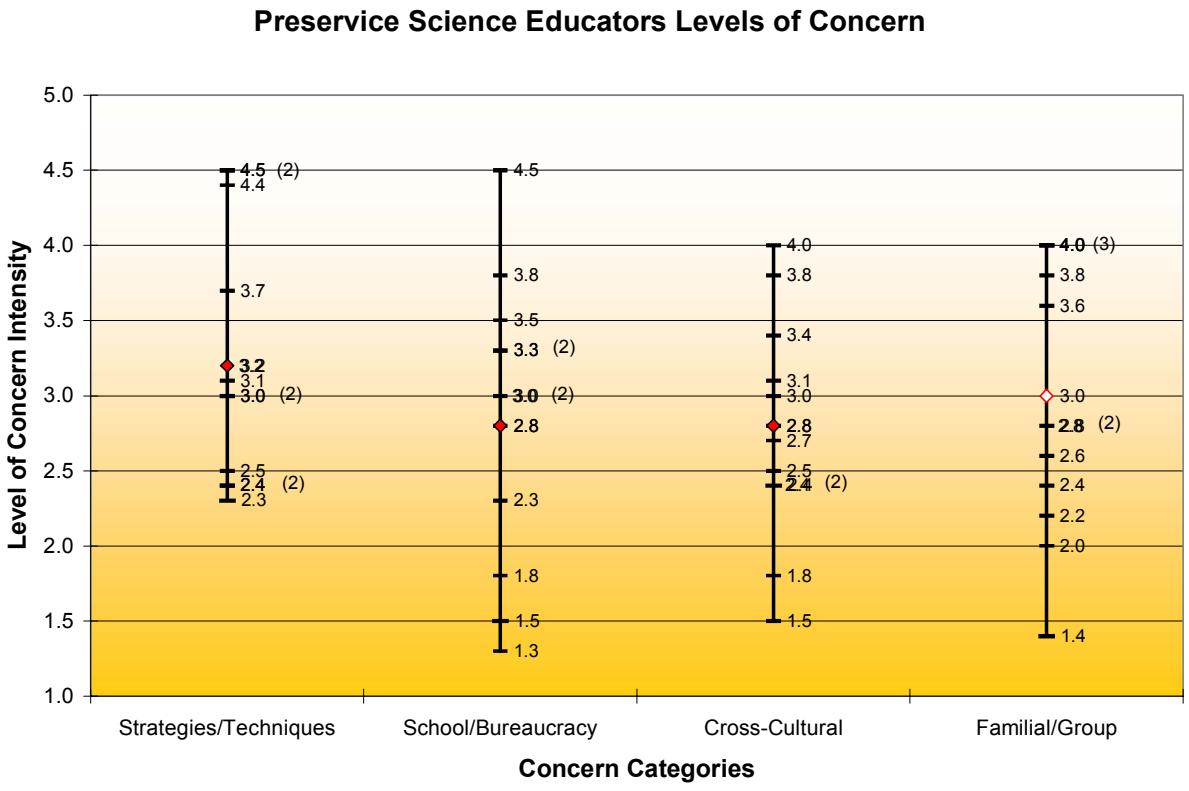

Figure 1. Range of concerns of preservice science educators

However, note the lowest individual mean score for this category was higher than the lowest individual mean scores in the three remaining categories.

According to group mean scores, the next area of greatest concern was familial/group knowledge, with a mean score of 3.0. Again, individual mean scores showed a wide spread with five participants indicating a high level of concern and the remaining participants indicating little to no concern. Although some preservice science educators were concerned about the family and home life of the diverse students they may teach, the majority (67%) did not believe this category to be an important concern. Therefore, the group mean alone does not truly convey the range of concern intensity levels the preservice teachers hold in this category.

The areas that appeared to be of lesser concern were cross-cultural competence and School Bureaucracy concerns. These categories both had an average score of 2.8 for the group mean. Although their mean scores suggested preservice teachers had the same level of concern for both categories, individual mean scores indicated a different situation.

When individual School Bureaucracy mean scores were examined, data revealed that preservice educator concerns varied greatly regarding school bureaucracy. Preservice educator concern intensity was across the spectrum, with some participants very concerned about the impact of school on diverse students, and others indicating that school bureaucracy was not an important concern for them. For the preservice teachers, the school bureaucracy category, compared to the other categories, had the greatest range of individual concern.

Cross-cultural competence was also an area of little concerns for the preservice science educators when individual mean scores were examined. Although some participants felt that cross-cultural competence was an area of concern, most preservice teachers did not have concern about this category.

Group Discussion Results

During the discussion part of the study, preservice science teachers shared the concerns they had about different diversity issues they believe they will face in science education. When the group transcripts were examined two major areas of concern came to light. The first concern centered on language acting as a barrier between teachers and their ESL students. The second was the concern that as teachers they may treat diverse

students preferentially so as to not be labeled as prejudiced or in an effort to show they are not prejudiced.

Because the gender of participants was unknown in most cases (unless they indicated their gender in their discussions), the researcher assigned gender to identify participants. Also, to help facilitate ease in following a conversation among group members, participants are identified by an assigned group letter and an individual identification number. For example, A1 represents group A and person 1 from that group.

Language as a barrier. After quantifying the areas of concern that emerged in the discussion it became apparent that working with English as a Second language (ESL) students was viewed by the greatest number of preservice teachers as a potentially problematic area. In fact, half of the preservice teachers in the study spoke about interacting with ESL students and their concerns about communication difficulties and student achievement. While some only mentioned their concerns, others were quite explicit about their fears. Interestingly, the more specific concerns about communicating with ESL students came from preservice teachers with prior experience with or prior knowledge of ESL students' academic situations. One preservice teacher (B1) felt that there were not enough questions on the MTCS about language concerns as compared to other questions about culture .She personally believed that the language difference between a teacher and student should be more of a concern than culture:

> *Language. . .is something that I think that's gonna be a bigger issue than making, applying coursework to the different cultures…Because I know right now*

> *language can be a barrier if you don't know it, because you have no way of communicating with that student.*

Another preservice teacher (B2) immediately responded to this comment drawing on his own prior experience. This preservice teacher had observed first hand the difficulty a teacher might experience when trying to communicate with ESL students who do not share a common language with the teacher. The preservice teacher went on to share with the group his experience of observing an ESL class. The teacher of this ESL class had been directed by administrators to communicate with ESL students without speaking Spanish:

> *I'm working with the class right now that . . . It's an ESL class, and the teacher is not allowed to speak Spanish. She's told not to speak Spanish and like only to communicate English with them. It's interesting.*

The idea of the teacher being discouraged from communicating with the ESL students by using the students' native language seemed to solidify the preservice teacher's idea that language could be a barrier to teaching some populations of students. He had observed the language difference as an obstacle when trying to communicate with students, and was therefore concerned that s/he might encounter this same obstacle as an inservice teacher.

Another preservice teacher (C3) who was working towards obtaining an ESL license described some research that enlightened him about some of the obstacles ESL students face in school. As a result of reading the research, he wanted to use teaching techniques that would help their ESL students be academically successful. *"Some concerns that I have . . . is how to provide content area instruction at a high enough*

cognitive level for students with limited English proficiency . . . that's my primary concern because that's what I'm most aware of".

In the same group, the moderator began the discussion by asking the preservice teachers what some of their concerns were about diversity issues in science education. One participant (C1) immediately shared that a major concern was to find ways to motivate the ESL students he would teach:

> *The only concern I really have . . . is just finding a way to motivate students who may not be as familiar with the English language as some of the other students. Just trying to find a way that I can relate more of the information to them.*

While some preservice teachers mentioned ways they individually could help ESL students, such as providing high cognitive level instruction and motivating their students to do well in school, another preservice teacher (C2) described how teachers could take leadership in working towards more far reaching solutions:

> *We need to take the responsibility and take the lead in designing curriculums that will allow [ESL] students an equal opportunity. . . I think a large portion of that has to do with instructing teachers how to teach as well as the tests. . . I know there is some effort to make Spanish versions of those tests which would solve part of the problem. . . .*

Treating Diverse Students Preferentially. The other major concern, brought up by approximately one-third of the preservice teachers, was the possibility that as teachers they may treat diverse students more favorably than White students. Some of these preservice teachers expressed the belief that by actively trying not to be prejudiced against diverse students they would actually be treating them preferentially. The survey

questions about treating diverse students preferentially obviously made an impression on one preservice teacher. The group's moderator asked if there was anything that stuck out from the survey, the preservice teacher (A2) shared this concern:

> *Well I think one thing that I noticed from the survey was that it asked if you thought you would treat ethnic children differently but in a favorable way, which I find myself trying not to do a lot of times. Because I'm so afraid to say anything wrong that I feel like I treat them special, but beneficially special. . . . I've had teachers…that are afraid to discipline a child because of his ethnicity, because of the way they might react and say that you're prejudiced. . .*

Another preservice teacher (A1) in the same group also shared this concern. This preservice teacher had worked previously in another job field and had many experiences working with diverse people. Because of this prior work experience, the preservice teacher was sensitive to how, in an effort to be "colorblind" and not prejudiced, he may have treated diverse people preferentially. This preservice teacher was worried that he might carry over this favorable treatment to the classroom as an inservice teacher:

> *I used to be a magistrate. . .I've come from a fairly conservative viewpoint, and my friend, who's the other magistrate there, he comes from a fairly liberal viewpoint. . . . I think sometimes I probably bent over backward because I knew I was coming from a conservative viewpoint, but I didn't appear that I was acting prejudice towards blacks or other minorities. And often I would discuss my cases with the other magistrate. And you know, one time, I had found in favor of this gentleman, and I asked my coworker, I said you know, 'What do you think? This was hard for me, what do you think?' He said, 'I think you were really trying to*

find for a black person.' And I really hadn't thought about it that way. Maybe I was, maybe I was, you know, so conscious of trying to do the right thing by someone and thinking I was trying to be colorblind and maybe then going the other way. So, in terms of discipline, I wonder if I'll have that problem as a teacher.

Diverse Students' Home Life. The MTCS included questions that assessed the level of concern educators had about diverse student's home life including questions about diverse student family, culture, and parental support. These preservice educators indicated little concern for diverse students' home life. Many of the preservice teachers seemed to believe that knowing about a students' home life could interfere with their ability to treat all students fairly. When asked what stuck out in the survey, one participant (A4) explained that she did not want to know about her students' home life and that she did not see a connection between home life and school:

I really think that home and school are so separate that I don't, I don't know because. . .if I start thinking about children's home lives, then I might start forming prejudice that just don't need to be there that I shouldn't even think about. Like where they live . . . they have two parents, stuff that shouldn't concern me. I should just teach no matter what.

Another preservice teacher (C3) in another group was posed with the same question about what "stuck out" from the survey and she also spoke about students' home life. However, this preservice teacher seemed to understand the significance home life has on shaping a child's future. Even though the preservice teacher understood the

connection between home life and student, the preservice teacher explained that she felt limited on what she could do to help their diverse students in the future:

> *One thing I did notice about the survey was there were a lot of questions regarding the home situations of the children. I know this is a very important part of how a child approaches education, um, what kind of focus they have toward life. . .and toward their future, but as far as a teacher, I don't know how much of that we can really get into. I think it's important to be aware of it, but we're only, we're limited…*

Discussion

For preservice science educators, language was an area of extensive concern. Most preservice teachers understood that a language difference between student and teacher does act as a barrier between communication and student learning. The preservice educators were very concerned about their future ESL students' academic success and some had already devised goals and plans to help their students have an "equal opportunity".

Although the preservice educators seem very concerned and empathetic toward their future ESL students, the same empathy did not seem available to other diverse groups. While preservice educators gave examples of how they would assist their ESL students through the use of different instructional methods, few discussed strategies or techniques for helping other diverse student groups succeed. Preservice educators also seemed to view strategies for assisting diverse groups in school as "preferential treatment" and their method to make sure they did not engage in this practice would be to act as if diversity does not exist. As one participant (A5) stated:

-My concern is that [diversity issues] exist at all. . . . I don't think it's possible at all to get everybody together living in peace. . . . I just mainly think it's not going to be settled. You almost have to act as if it doesn't exist in order for . . . to get along, especially in children. It doesn't exist in children until they watch it in the adults.

However, whether preservice educators choose to acknowledge ethnic/racial diversity, it exists, and will impact their teaching. One participant (A1) who said he would ignore ethnicity was still impacted by ethnic/racial difference in a class they were observing:

One of the kids [in the class] is part Palestinian and he was doing his current event during science class. . . I didn't realize he was Palestinian, I was just asking him because [of] his name. . . . I just asked him if he had ever been to the Middle East because I was assuming that his nationality was probably Middle Eastern. And was trying to see if . . . how much information he had because he was doing this current event and I saw the title of the headline and it had to do with the Israeli-Palestinian conflict. And a long story made short, he told me he had been to the Middle East and had been there a couple of times and another child said something about the conflict that was going on and how terrible the suicide bombers were. And he said, 'Well, my dad says that's the only thing they have.' And you know, a very pro-Palestinian viewpoint, obviously you'd probably expect that. But, I found myself really having to bite my tongue, and not say anything to necessarily contradict that statement. You know, regardless to how I might have felt. . . . so I think that it can be real touchy and you do have to

sometimes just pretend it doesn't exist. Because that's not what education is about I don't think.

The home life of diverse students was also viewed by preservice educators as a source of potential problems. Like their treatment of ethnicity, the method preservice educators indicated they would deal with a students' home life by ignoring it. Because this is a part of diverse students' lives that occurs outside the classroom, preservice teachers seem to have a limited view of the impact it would have on their teaching and diverse students' academic success. The preservice educators did not seem to understand the connection between culture and home life, home life and school, or school and student achievement.

When all of the concern statements were examined, 60% of those focused on "self" rather than the students. Overall, preservice teachers showed more concern for themselves than for their diverse students. Most preservice educators spoke of diversity as an area that would pose a problem for them and something that would have to be overcome in their classrooms. This supports Fuller (1969) who found that the concerns of preservice teachers were more likely to be about self. As novices, these teachers are concerned about their survival in the classroom and view diversity as a possible threat to that survival. If concerns were focused on student well being, preservice concerns were mostly based on hearsay or were vague. Fuller (1969) states that most preservice teachers have little concern for their students because they do not know what to be concerned about. Fuller (1969) found students to be more likely to think of teaching in terms of what they experienced as pupils. This may limit the concerns most preservice students have for their diverse students, especially if their cultural values, worldview, and

school experiences are different from these students. Of the three major themes that emerged from the discussions of the preservice teachers, two were focused on the future obstacles diversity would create and the other was viewed as being out of the control of teachers, therefore not an area of concern.

Inservice Educators

Multicultural Teaching Concerns Survey Results

The inservice science educators who participated in this study had an average of nine years of teaching experience and were all involved in pursuing advanced degrees. Although most were very experienced teachers, the data suggest they were still very concerned about teaching racially/ethnically diverse students. The average level of concern across all categories was close to four (see Figure 2), suggesting that many of the educators felt these categories were "important to them" at the time. However, looking at individual mean scores it was clear that teachers' individual intensity levels ran across nearly the entire range of values for most categories. Differences among categories are significantly different. Also, there was a very pronounced trend in one category of concern expressed by this group of teachers.

Looking at the results of the MTCS showed inservice science teachers were most concerned with what strategies and techniques they should use with their diverse students. In fact, all but one teacher was highly concerned about this category which seems to be an outlier for this category.

The area that the inservice teachers showed the second greatest concern for was familial/group knowledge. Again, all but one participant showed at least some concern

for this category. Looking at the spread of the individual mean concern scores showed that most teachers were very concerned about the impacts of home life on their students.

According to the MTCS, these teachers were, on average, equally concerned about the effect School /Bureaucracy has on diverse students and their cross-cultural competence which reflects their concern about how they might interact with diverse students without bias from themselves or the students. Although both categories had the same average score, the range of teacher concern indicates differences.

Although the average concern level for School /Bureaucracy suggested that the inservice teachers were very concerned about the impact school structure has on diverse students, individual concern scores tell a different story. When the range of scores was examined, it revealed that although some were very concerned about School /Bureaucracy most had little concern about this area.

Looking at the range for the cross-cultural competence category also revealed some interesting things. Many of the inservice teachers held different levels of concern about interacting with diverse students in a fair and just way. The different levels of concern were so spread out that no generalizations about the inservice teachers as a group could be made. Although most of the teachers believed that relating to their students cross-culturally was an area of concern, there were still some teachers who felt this area was of only some or little importance to them.

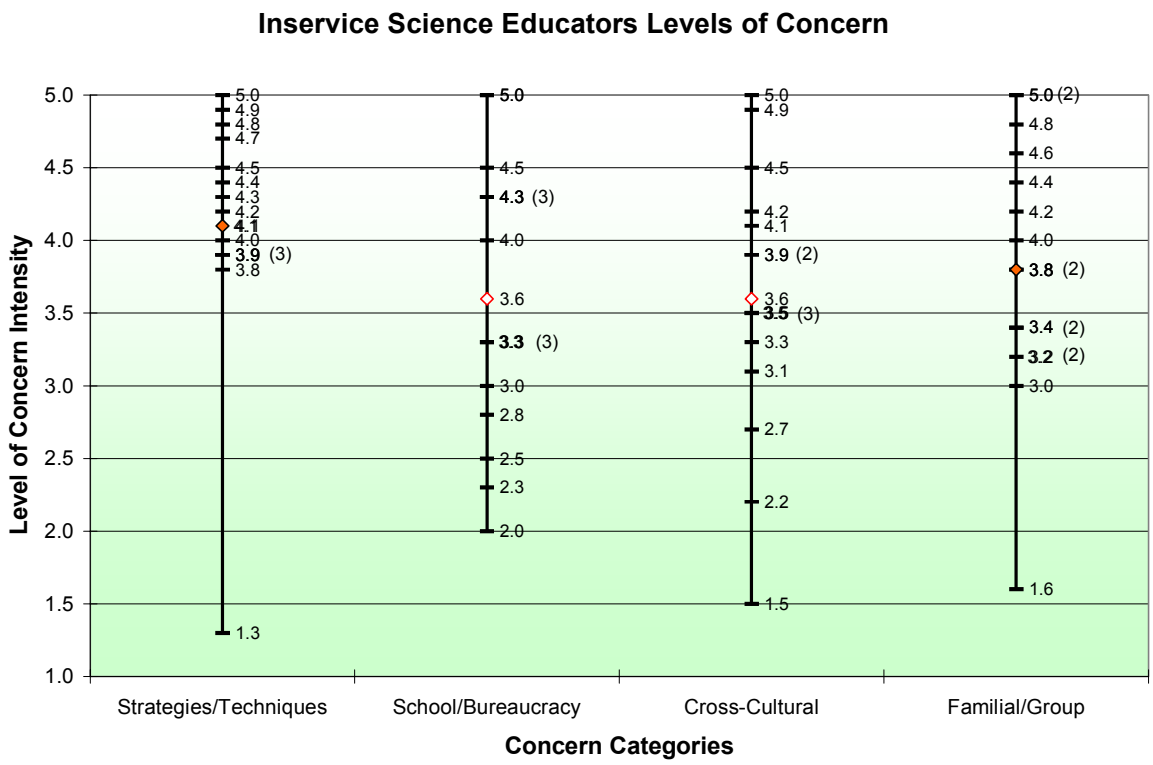

Figure 2. Range of concerns of inservice science educators

Group Discussion Results

During group discussions, inservice science educators spoke about many of the concerns they held about different issues related to diversity in science education. Five main concerns were brought up during group discussions. Most of the inservice teachers stated having concerns about: 1) the home life of their diverse students, 2) helping students deal with diversity, 3) communicating with ESL (English as a second language) students, 4) students' perceptions of them as teachers, and 5) finding diverse scientists to present to their students.

The two concerns that were the most talked about were diverse students' home lives and students encountering diversity in school. Both concerns were mentioned by approximately 47% of the inservice teachers in the study.

Diverse students' home life. Most inservice teachers were cognizant of how a student's home life may affect how well that student performs in school. Although most teachers shared this concern, one participant (G2) explained that she had never considered the home life of diverse students as having an impact on their learning. However, after completing the MTCS, she began to think about how home life might affect a student and shared coming to understand the category:

> *. . . Something I didn't really think about before is actually, the um . . . the family situation and how families viewed learning and education and how when even if you bring home something or even if the student brings [something] home, the family is not going to be able to, maybe help them out . . . because it might be a whole different means of how they're learning. . . .*

In contrast, another participant (F2) was troubled by the fact that home life questions were included in the survey. As a college instructor, the teacher believed that home life was an issue that did not affect her because she had little contact with diverse students' parents. Therefore, she felt this category did not pertain to her.

> *My biggest concern with the survey was, I teach at a college. And all the questions were about parents. I don't see any of the parents and the parents don't see me. So, I put that didn't concern me a whole lot because I don't really care much about what the parents think because I've not had any interactions with them. So that explains my response to that.*

Upon hearing this comment a group member (F3) immediately challenged her statement. This group member believed that regardless of the interaction between teacher and parent, teachers should care about the home lives of their students, because the students

are ultimately affected by their lives outside of school: *"You have to care about what the parents think because that's where the attitudes are coming from, from home, and from their peer group."*

Inservice teachers also talked about how much support diverse students receive from their parents. One teacher (D1) shared her belief that diverse students and their parents, especially African Americans, are more likely than other groups to be apathetic toward education:

> *I think one of the things that stuck out for me in the survey were the questions about how their home life affects their education. And to me I have noticed that most likely the children who were most apathetic and whose parents were most apathetic towards education were diverse students . . . namely African American students. And so I think that their home life does greatly affect how they view education and the importance of education.*

However, not all teachers believed that diverse parents are more apathetic towards their children's education. In one group, a teacher (F2) posed a question about the amount of support minority students get from their parents. Another teacher in the group (F4) responded with an example of a minority student in her class who was not doing well academically but whose parent was very concerned about the child's academics.

> *Our parents at the school are very involved with every aspect of the school. And so I do see a lot of the parents' support of the kids that are signed up in my classes. . . . . I mean [there's] one student I have that's not doing so well. His parent is calling me every week going, 'Okay, what can we do, what can we do to fix this, what can we do to push him and get him to succeed?' So, he's not doing*

very well, but I don't think it's parental support that's lacking in that particular part.

In a different group, a member asked if there were any teachers who felt they had had experiences to share that could be "teachable moments" in terms of dealing with diverse students. In response, one teacher (E4) shared his experience of working with diverse students' parents. He said that the diverse parents he encountered cared about their children and gave an example of a Hispanic mother who had high expectations for her child:

I don't know if this is a teachable moment, but I know I taught a Hispanic American who could not speak English very well, and we had to have an interpreter come in to speak with his mother. . . . The mother had very high values for her son and expected him to make good grades in the classroom. . . . Most of the parents wanted to see their children succeed in the classroom. I did not have any parents that . . . didn't really care about their children.

The importance of parents being supportive of their children was also echoed by a participant in another group (F3). He shared with his group that it was important for parents to be concerned about their child's academics. However, this teacher observed that some of the children at his school who were not doing well academically were not supported by their parents: *"we have parental support that is sadly lacking in some of the worst cases. And I would say the parental support is a huge indicator of how successful that student is going to be."*

In responding to this comment another participant (F1) pointed out that although diverse students were the focus of this study, a student's home life affects him/her no

matter what the student's race or ethnicity: *"Just add to that, no matter what color though, it doesn't matter what background you have, that parental support is important for all races."*

Students Dealing with Diversity. Another topic for which teachers expressed a high level of concern was students' ability to deal in school with people who are ethnically/racially different from themselves. Even though most of their schools were racially integrated, teachers were finding that their students were having trouble interacting with racially/ethnically different students. Some teachers described how past personal experiences had had an effect on current diverse relationships. Participant D2 shared how comfortable he was working with diverse people because of his prior work experience. This sparked another teacher (D3) to share her concern that her students were not being equipped in school to handle diversity. She believed that schools are pivotal in preparing students to work with others who are different from themselves. She also explained that students who are not equipped to handle people of diverse backgrounds in school will not be equipped to handle diverse people in the workplace:

> *I want to comment something on what [D2] just said. I feel like a lot of our kids are not getting an education on dealing with students of different races. Like just by the way to act. And when they get out into the work force, like [D2] was just saying, they are not going to be able to deal with other people as well. And something needs to be done about that . . . and just incorporating that into every classroom including science would probably help a lot with that.*

In another group, the moderator's question about concerns about racial/ethnic diversity issues in science education sparked an interesting response. One of the

participants (F4) remarked that there was little diversity at the private school where she taught. She wondered how she could discuss an issue when she doesn't encounter it at school:

> *I get concerned when. . . I teach in a private school, and I really have no ethnic and racial diversity. It's kind of a frightening experience. It's really difficult to enter into this conversation when I don't see it. And I think that's part of the biggest problem that I've come across.*

This statement, however, prompted another participant (F2) to ask if she believed her students were prepared to interact with diverse people outside of school. The participant also questioned how the private school students' ideas about science education would be affected by the lack of diversity in the student body:

> *How do you think your students will handle ethnic diversity since they're in such a homogeneous setting? How do you think it's going to affect them and their beliefs about science education when they go out into the real world?*

The private school teacher (F4) admitted that the topic of diversity had been the focus of many discussions at her school. She explained that the school had been creating ways to introduce students to diverse environments and prepare students to interact in a diverse world:

> *That has been a conversation we've had at the school for quite some time. It's definitely come into the forefront this year. And I think our students do understand that they are a homogeneous group and that they don't get a lot of exposure to other cultures and they tried, as far as doing things in the community,*

to expose our students to other cultures. . . . it's becoming a bigger issue at our school. I'm kind of in this conversation a lot lately.

In another group, a story was shared about a dilemma one of the teachers (G1) had faced during the school year when two groups of students did not get along. The conflict was based on racial identities. This posed a problem for the teacher who found it a challenge to get the two groups to work together:

...this year was a challenging year because I did have racial diversity in my room. We had one group that considered themselves and outspokenly called themselves the "redneck" group. And then we had another group that was um . . . that was a group of black girls, and the two were constantly at each other. . . . I tried to stay neutral and get these two groups to come together to see each other's strong points instead of looking at the color of each other's skin. So, that was . . . it was a challenge, but by the end they could at least sit in the classroom together and work on a lesson.

Concern for students to be educated about different ethnic/racial groups was also discussed by teacher G2. He believed that his students held perceptions of different racial/ethnic groups that were based on stereotypes. He explained that sometimes students made comments that hurt other students and that as an educator he felt he should work toward educating his students to rid them of these stereotypes:

I think that a lot of my kids perceive . . . they have incorrect perceptions of other ethnicities. And it's very, very important for me. . .as well, it should be for all educators. . .that they. . .get rid of these prior misconceptions through education and not, not just, helping one student think and learn to the best of their abilities. .

. . Like some sort of . . . diversity type training workshop…so they can realize the negative effects that their comments, without even realizing it, affect other people in my class.

Educator E1 shared the idea that education can be a tool to change the attitudes and beliefs of students. He explained to his group the different strategies he had incorporated into his teaching to help his students become more understanding of others.

Over the past couple of years, being exposed to more diverse educational strategies, I've tried to include more rhythmic and social climates and cooperative learning type atmospheres in my classroom so that it does teach students to be more tolerant of other people's opinions and values and attitudes. And I've seen that it helps students, not only in learning of their basic knowledge, but to become better citizens.

In the following discussion excerpt, a teacher (E3) conveyed to his group the strategy he used with his class to encourage interaction between his students:

I think having that social time in [class] is important, especially for the kids, because, you know, a lot of that's so important to them, [and] as a result of interacting with one another, they can, you know, learn some things about it rather than just having, you know, self-segregated little tables here and there.

Language as a barrier. The next area that prompted a great deal of discussion for the inservice teachers (approximately 40% of inservice teachers stated this was a concern) was language acting as a barrier between teacher/student communication. For many of the teachers, trying to communicate with students who do not share English as their native language had been a struggle. One teacher (D1) expressed how difficult it

can be for the teacher who is trying to introduce a student to a concept when a common language is not shared*:*

> *One of my concerns is with Hispanic students that come into our classroom that are not proficient in English . . .If you've got kids who cannot speak the language then trying to teach them biology with all the concepts and the vocabulary terms is going to be extremely difficult.*

Group member D2 responded to this comment with her experience of teaching a foreign exchange student. She indicated that overcoming the difficulty of communicating and introducing science concepts was a lot of work for both teacher and student. The student eventually passed the course with a lot of help, but the teacher identified language as the biggest obstacle for this bright student:

> *I, one year, had a foreign exchange student from China, and this young lady had a lot of trouble understanding classical spoken English. I had to work with her one-on-one quite a bit to get her through an Honor physics class. But we eventually managed to get her through . . . the sad part about it, she was a very smart young lady, but the language barrier really hurt in this particular case.*

For one group, the concern of language as a barrier to communicating with ESL students led to lengthy conversation. A member of the group posed the question of how schools treat ESL students. One teacher responded (E1) with a story of how ESL students in his school are separated from the regular classes. He questioned how long ESL students are expected to be separate from the regular classroom:

> *Our school district has a school that ESL students can attend. And so they have their own education system and a school separate from an integrated classroom*

where they might be in with the other students that don't speak the same language. I don't know at what point those students move from that school into regular classrooms and that might be something we need to look at.

A similar story of working with ESL students was also shared. At school, this teacher's (E3) ESL students were separated from "regular" classrooms for some subjects, but were integrated into "regular" classes for P.E., math and science. The teacher was concerned about students being placed in a "sink or swim" model of learning and that students are not truly being prepared to operate in society:

I know at my school, what they do a lot is they'll have a separate classroom, ESL classroom, but then for things like P.E. and science and math, they'll send them right in there. Often times. . .very little English instruction and you kind of expect that the immersion will help them pick it up and to me sometimes it seems like it's just a sink or swim kind of thing and maybe they're not getting as much support in the language. You know because speaking it is one thing and learning it is a completely different level. And so it's a issue I'm concerned about, with, you know, how are we really preparing these kids for our society in terms of, you know, speaking language basic things that you, we use to function in here.

Translating work for ESL students was a similar experience for participant E4. This teacher explained that she had to translate tests and other instructional material in order for the student to pass the class:

I know a couple of years ago, I had a Spanish speaking student in the classroom. . .we had to. . .translate the tests into Spanish…so she could take a science test…we

were doing that a couple of years ago so she could pass the class or understand what we were doing in the classroom. Everything was interpreted for her.

After this story was shared, group member E1 disclosed an experience he had teaching an ESL student. The teacher stated that he, like the previous group member, had needed to provide instructional material in Spanish for the ESL student. As time progressed, the student began to learn English words and other students in the class encouraged the ESL student's learning with words of praise. The teacher, however, shared that he did not feel he had done an adequate job that had truly helped the ESL student:

> *About six years ago, I had a student that was totally Spanish speaking in my classroom and we provided a Spanish edition of the science text for him…we provided tests in his language and other supplementary materials in Spanish, but I don't feel like I served the child. . . . As we saw him, you know, pick up a few English words, the children that spoke English would, you know, praise [him] and you know, give him all kinds of "hurrahs" for you know, learning to say "hamster" and things like that. But in terms of his learning and developing science concepts, I don't think I served him.*

Several inservice educators also discussed the role school can play in the academic success of ESL students. One educator (G1) stated frustration with her school that placed several ESL students in her AIG class which she felt may not have been suitable for their academic level. This teacher was concerned that schools were placing ESL students into classes because schools did not know where else to put them:

I have three non-speaking Spanish students in an AIG class, and they were placed there just simply because there was nowhere else to put them on their schedule. And I think had the schedule been looked at a little more closely we could have found a better place for those. Where they could have received better. . .one-on-one [instruction] instead of being put with a high level group that bypassed them. . .when these kids couldn't even understand English. So, I think not only should we look at multicultural we should also look at their academic levels and place them in the correct locations.

Diverse Scientists. Inservice science teachers also felt that it was important to introduce students to the contributions that diverse people have made in science. Some teachers stated they believed introducing students to diverse scientists would benefit all students. Teachers explained their hope that by exposing students to diverse scientists, diverse students would be encouraged to participate in science. Teachers also hoped that White students would learn how other ethnic/racial groups have contributed to science which would hopefully help rid students of negative stereotypes about diverse people. One participant (D3) shared her frustration in trying to find African American scientists to present to her African American students. The teacher hoped that by exposing African American students to scientists of their ethnic/racial background, students may be encouraged to participate more in science:

I've had problems finding information specifically on African-American scientists and specifically in my field of earth science. . . I don't think they exist. (laughing) And so it's difficult to get students, sometimes, involved in the work when they're upset about learning about all these old White males. (laughing)

Being able to find diverse scientists to present to students had also proven frustrating for another teacher (D1). This teacher shared the difficulty she has had finding diverse scientists. She hoped that finding diverse scientists would allow her to show diverse students people of their backgrounds who have made contributions to science. She also stated that it would be helpful if someone compiled information about diverse scientists and made it available for teachers:

> *I think that there is a problem with being able to find scientists and the work of scientists to study who aren't White males. . . . So I know that it's hard to show these students that people of their race are also involved in the research and the work that science is based upon. So it would be nice if somebody would actually put together more information for us to use to show that there are scientists of their race that are involved.*

Another group of teachers discussed teaching in predominantly White schools where students are not exposed to much diversity. A teacher in the group (G2) shared that she believed her White students held some negative stereotypes about diverse people. She believed that education is the way to change these preconceptions. A group member (G3) responded to this comment with a suggestion of introducing White students to diverse scientists. He explained that he hoped introducing White students to diverse scientists would foster understanding:

> *I think maybe one of the things that could happen and I think one of the things that would be helpful, uh, for me, teaching in a non-diverse school, is to present the kids with um. . . just contributions in the field that have been made from, you know, women, minorities, in general. Um, and maybe, if, I learned more about*

that, I could help my students . . . predominantly White students, um, more so in that realm.

G2 immediately responded to this comment. She believed that it is the responsibility of teachers to find diverse scientists to introduce to their students. She stated that although the information has not been presented to teachers, it is available, but teachers have to make an effort to find it and incorporate it into their lesson plans:

Along with [my fellow group member], I also think that it's up to me to actually research some of this stuff, because I don't think that in the end it's really actually been given to us. And what we need to make a conscientious effort whether having an in-service day about it or whatever so that we can have the material available to us so that we can research it and look at it and develop lesson plans integrating multicultural disciplines. . . .

Students' Perceptions of Teacher. Another area that caused teachers concern (~26% stated this as a concern) is how students perceive teachers. Teachers seemed particularly concerned that diverse students might judge them unfairly based on their race. One educator (D2) expressed hope that he would continue to be perceived by his class as fair to all students. He related that there had been one instance in which he was accused of being prejudiced, but that another teacher explained to the student that that was not the case:

Since I've been teaching nine years, I've been somewhat sensitive to wanting the whole class to perceive that I was treating the whole class evenly . . . not picking on the black students or picking on the White students or picking on Hispanics or anybody else. I wanted the whole class to perceive that we were one body, we

were there, you know, I was there to facilitate their learning. You know, I was as much involved in how well they did as they were. And once they realized this, I've had very few problems racially in any one of my classrooms. I think one time in nine years, I had a student accuse me of discrimination . . . and one of the older black teachers got that student aside, and she had heard about the comment, and set them straight that I particularly was not that way. So, yeah, it is a concern, but I feel like I, hopefully have it under control.

Others shared their concern about students judging them based on their race. A teacher (E1) who had been teaching for 19 years explained her concern that students would judge her without knowing her, *". . . a concern of mine is how students perceive me before they even know who I am and where I come from. You know, because of preconceived notions about race."*

E4 responded that she had been teaching for 12 years and was worried that students perceive her to be prejudiced just because she is a White female. She explained that diverse students think that she believes they will misbehave in her class, but she stressed that this belief is not true:

I understand they come into the classroom; I'm a White female teacher and they already think that, that I have views about them, um . . . of racial, African American students who might think that I think that they're gonna cause trouble in the classroom . . . which isn't the case at all.

Also shared was how a group member believed students' preconceived ideas about teachers may ultimately affect the student. He (E2) offered that a student's

perception of the teacher may actually act as a barrier to a student understanding the material the teacher is teaching:

> *But, um . . . like some of my peers said . . . some of them come to class having preconceived notions about the teachers, so that could affect the way they perceive you or understand, try and understand what you're trying to present to them. . . .*

Discussion

Most teachers acknowledged the impact of home life on a student's academic success. However, some educators tended to hold the belief that if a student was not doing well academically then they were not being encouraged at home. A few also believed that diverse parents were less supportive of their children as compared to other parents. It is unclear how the inservice teachers who made these comments view parental support. They may view parental support from their cultural worldview which may lead to their expectation that a parent of a child will talk to the teacher when a student is not doing well academically. However, this may not be in line with the cultural values of their diverse students' parents. So instead of this cultural difference being recognized, diverse parents may be labeled as unsupportive and uncaring.

Also interesting was the desire inservice science teachers had to find diverse scientists to present to their students. Many inservice educators hoped to enlighten their students about the contributions of diverse scientists. However, it also seems apparent that the teachers are themselves unaware of these contributions. One teacher (D3) showed how unaware she is of diverse scientists' contributions: "*I've had problems*

finding information specifically on African-American scientists and specifically in my field of earth science. . . I don't think they exist. (laughing) . . .”

Inservice teachers were also very concerned for their diverse students’ academic success. However, more specific concerns seemed to be available for ESL students whose cultural barriers seemed more apparent. Inservice teachers shared how school structure such as placement in certain classes can affect their ESL students. However, most inservice teachers did not show concern about how diverse students are affected by their placement in certain classes, or how other aspects of school culture affect them.

Many educators also expressed concern about how students perceived them. Even teachers who had taught for many years continued to be concerned about this topic. It is interesting how teachers explained that minority students may have preconceived notions about them, but they insisted they do not have preconceived notions about their diverse students.

According to Borich and Fuller (1974), inservice teachers’ concerns should gradually move from being concerned about “self” to being concerned about the “impact” they will have on their students’ learning. The concern for students was demonstrated throughout many themes the inservice educators discussed. However, for the theme of “cross-cultural competence”, Marshall (1996a) states that concerns in this category, which include concerns about students’ perceptions of the teacher are primarily focused on “self”.

In contrast to the findings of Borich and Fuller (1974) there may be some concerns that do not move from “self” concern toward “impact” concern simply because a teacher has had many years of teaching experience. In fact, most of the teachers who

stated concern about how students perceived them had taught for many years. This prompts the question: Is the movement Borich and Fuller (1974) suggested, of teachers moving from "self" concern to "impact" concerns, necessarily the case for inservice teachers when they are dealing with issues of diversity? Also, does this category only reveal self-concern? Although the statements teachers made, do give the impression they are focused on the teacher, closer inspection of one inservice teacher's comments revealed that she was worried about her students' academics: *". . . some of them come to class having preconceived notions about the teachers, so that could affect the way they perceive you or understand, try and understand what you're trying to present to them. . . ."* It is a possibility that the theme of "Student Perception of Teacher" may not only represent a teacher's concern for self, but also for student.

Informal Educators

Multicultural Teaching Concerns Survey Results

The concern the informal educators had about teaching diverse students was initially assessed by examining the group and individual scores from the MTCS (see Figure 3). Differences in mean scores were found to be significantly different. Survey results showed that as a group, the informal science educators were most concerned about issues in the Strategies /Techniques category. When individual mean scores were examined they revealed that the majority (approximately 79%) of the informal science educators were concerned about using appropriate strategies and techniques with diverse students.

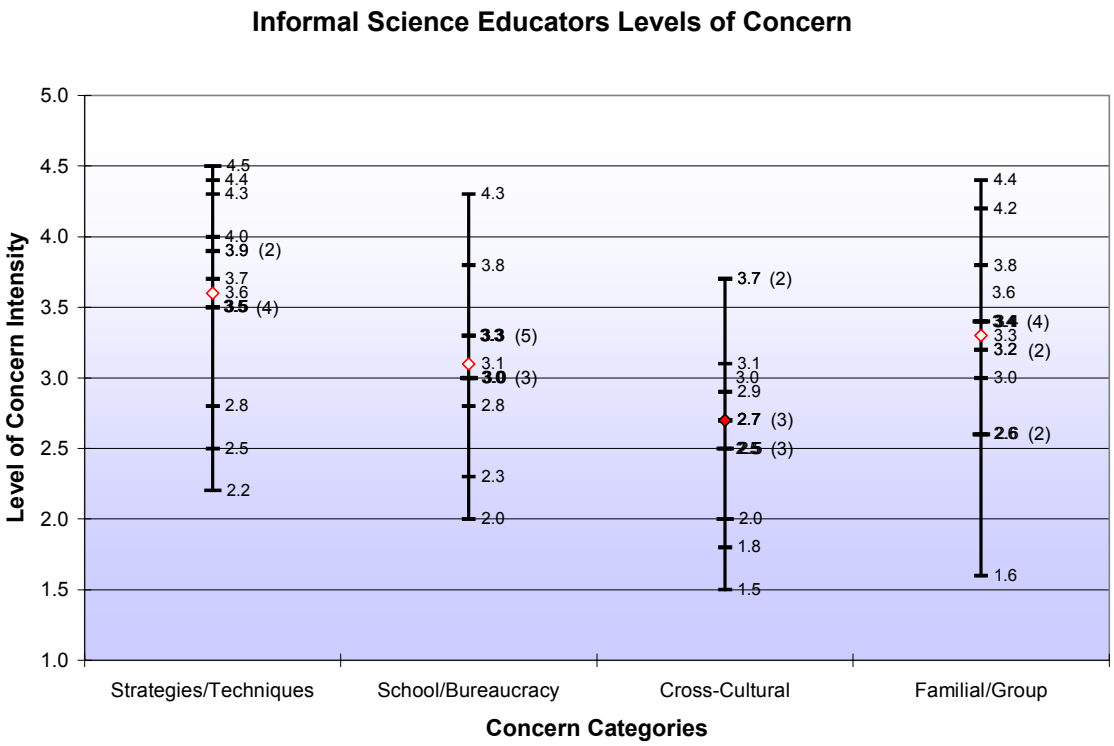

Figure 3. Range of concerns of informal science educators.

The next area of greatest concern was the familial/group category. The majority of the informal science educators felt this was an area of some concern for them; all but one participant had a concern intensity average score above 2.5. However, only a few had very strong feelings about this category.

School Bureaucracy concerns had a group mean score of 3.1 and individual mean scores revealed that the informal science educators had mixed views on how concerned they are about this category. Most of the educators did not have strong feelings about how School Bureaucracy affects their diverse students. In fact, most of the participants' scores clustered around 3.0 indicating this category was only of some concern to them.

The area of least concern for the informal science educators was Cross-Cultural Competence. The mean score for this category suggests that as a group, the informal teachers held little if any concern at all. While there were a few individuals who were not

concerned about this issue, most participants indicated some, although minimal concerns, around this category.

Group Discussion Results

During group discussions, informal educators shared concerns they had about ethnic/racial diversity issues in science education. An examination of group transcripts revealed three main areas of concern for this group. Informal science educators expressed most concern about: 1) the lack of diversity in informal education, 2) language as a barrier between educator and audience, and 3) the home life of diverse students.

Lack of Diverse Individuals in Science. The concern mentioned most often by the informal educators was the lack of diversity they encountered at the museum and other informal science settings. Sixty-four percent of the informal science educators stated a lack of diversity, in one facet or another, as an area of concern for them. These educators indicated they were concerned about the lack of diverse personnel, the lack of diverse volunteers, and the lack of diverse populations enrolling in museum programs. When asked, *"What are some of the concerns that you have about ethnic/racial diversity issues in science education?"* one educator (I3) explained that although she had worked in informal education for many years, she had still seen little improvement in the participation of diverse populations:

> *My concern is that there isn't any [diversity] . . . particularly African Americans…they are underrepresented in any of the professional meetings that we go to. They're certainly underrepresented on our staff, particularly given the fact that . . . the school groups represent the population and they represent the*

proportion, whereas our staff does not, and that's of great concern. . . . I've been here twenty-five years and I have seen very little change.

The informal science educators explained that their programs, which include some that are geared toward students and some for formal teachers, have had problems getting diverse populations to participate. One participant (I1) explained that she works with a program in the museum that has tried to recruit diverse students, but has found this to be a struggle. She disclosed to the group some of the feelings expressed by diverse parents who did not feel comfortable sending their children to a program they perceive to be "all White"

. . . we do have programs where targeting these groups has been a goal. . . We have found difficulty recruiting African American girls for this program. . . . I would like to understand that issue better, so that we can be more successful when we go out and try to recruit. . . . I don't always know why it is that we have the trouble, getting girls to participate. I know that some African American mothers have expressed, who have had girls who participated have expressed concern about sending their girls to an experience that may seem to them as all-White. But that's the puzzle that I wish I understood better and could change our whatever we're doing to make it work.

This concern about lack of diversity at the museum led another group member (I2) to share his experience of trying to get diverse groups to volunteer at the museum. He explained that although there have been many opportunities for diverse populations to work as volunteers at the museum, getting diverse people to remain has been an issue:

From my perspective it concerns me that we do not have more ethnic/racial diversity in volunteers. . . .It's starting to come around a little bit, but,. . .for some reason, . . .they see [the museum] as this place that, . . .you've got to be like, a circus trainer or something to, . . .handle animals and whatever, even though we have a wide diversity of opportunities. . .at times, we might get them interested, but keeping them here has been a big problem.

One informal educator (I3) that had been involved with a program that takes teachers out of the country for educational fieldtrips expressed a similar concern. Her program has had trouble recruiting diverse educators, and over the many years she had been involved with the program she has not seen much change in diverse enrollment.

I would like to add. . .that we also have a program for teacher education that's. . .been going on since 1987 and we have. . .tried very hard to recruit minority. . .educators to apply for that program. And we have found great difficulty in the years getting applicants, and the few applicants and participants we've had. . .usually there's a group of 12 every year. . .and I would say over the 15 years we have had no more than 4 African American participants. And of those 4, they have not remained involved in the program, whereas the other participants have. And as far as, cause I have asked many times, you know, what the issue is. And one of the issues in this is that it involves travel. It involves travel out of the country and it also involves swimming. And some of them, some African American colleagues have expressed a fear, and actually a belief, that a lot of African Americans are not comfortable with water activities and swimming. . . . And also, not as comfortable with the traveling issue . . . many of them seem to

have obligations in their communities and their extended family, which made it more difficult for them to travel during the summer. But. . . I have no idea from any kind of controlled analysis, whether, you know, how much, or how many people these factors have influenced.

Language as a barrier. Language issues also caused concern for informal science educators. Roughly 33% of the participants mentioned that language can act as a barrier when trying to communicate with diverse populations. Although many educators expressed concern about this topic, opinions on what to do to communicate to diverse audiences differed.

An educator (J1) shared her frustration that diverse groups were not attending museum programs. She wondered if language was acting as a barrier for the Hispanic community and deterring them from coming to the museum:

. . . My question is how to get more culturally diverse populations to come to the museum or to join in the programs. Why are they not? And I guess one population to work with too, are Spanish speakers. . . . We do all this stuff to say, 'come in, come to the museum, but come interested.' And what is the barrier? And I know language is a barrier for that population, but . . . how do we motivate an interest. . . .

Some insight into this topic can be found by listening to the comments of one museum educator. Apparently, the museum has considered using to certain strategies to reach out to the Hispanic community. However, as participant K2 explained, not all people agree with these methods:

A real hot button right now is languages other than English in the classroom because of the large Hispanic community. . . . whether we should be providing interpreters and providing. . . Hispanic documents and literature and everything for them to use. Or you know, the attitude of, well, they're here, and they need to learn, and you know, that kind of thing. . . . You hear it. So it's hard.

Many informal educators also gave examples of ways they were trying to reach diverse audiences for whom language is a barrier. Several explained that they liked to incorporate words or phrases into their presentations that the audience might understand. One (L1) explained that some of her colleagues were using Spanish in their presentations to connect with their audience:

If your audience is looking at you blankly because they can't understand your language, . . . we've talked about that and, you know, people are trying to learn a little bit of Spanish for instance just to be able to connect in a really minor way with the audience. But, yeah, that's something that we've been concerned about and not quite sure how to attack. You know, if you get an audience that's not speaking English.

An educator (J3) in another group also indicated that he used Spanish in his presentations to connect with Hispanic audiences. He shared that although he did not know Spanish well, he would ask the audience for help in naming different items. He also expressed that working in an informal setting allowed him to work with different groups of people and that was a rewarding experience for him:

In this setting . . . people come here to this setting of all ages and so we have a lot of experience with different groups. And generally I think most of us find that, or

certainly I do. . . I find it rewarding, I get something back from interacting with different groups. . . . I'm not fluent in Spanish . . . but I try with Spanish. . . . And it's fun for me. I'll often ask the Spanish-speaking groups to give me the words. You know, I'll point to something and ask them 'Como se dice en Español'. . . . And that's fun, that's a nice interaction. It's a good interaction.

Diverse Students' Home Life. Although informal science educators do not have their students for long periods of time, they stated their concern that home life does have a great impact on the attitudes of their audience. Thirty-three percent of the informal science educators mentioned their concern regarding home life impacting certain racial/ethnic groups' interests in natural science.

The survey prompted one educator (L1) to think about the home life of diverse audiences. When the educator began the survey she said she was not concerned about this aspect of a diverse student's life. However, as the survey progressed, her concern for this topic grew:

There were several questions asking about . . . a diverse student's home life. . . . Initially when I started answering I said, 'no, I don't care about their home life.' ...And then as I was going through I'm thinking, well, maybe I do because that's all about the culture of that family, or that group or whatever. And it does affect [them] in a museum. And so maybe the home life does matter. . . . Is it my, is it something I need to be concerned with, that child's home life, or not?

In response to this statement, a group member (L2) shared his belief that unlike formal education, informal educators do not have significant time with students to gauge someone's home condition. He believed that culture can affect the way information is

perceived by students. However, he felt that because of the short amount of time informal educators have with students, they were limited in what they could do about a student's home life:

> *I think if we were in a, had a formal classroom, that would be, we can pick up on that and work on it. But I think it does affect how [diverse students] accept information, you know, what is important. I mean, especially at a science museum, you know there's a bunch of different ways that information presented here can be taken. And some cultural beliefs may not coincide with what our information is. And so that could affect how they perceive us . . . perceive what we're saying. . . . but there's nothing that I think we could do about it.*

J3 also shared with his group the time constraints informal educators have to deal with when teaching students. However, this participant believed that although time limits the impact informal educators can have on their students, he is still personally concerned about students' lives at home.

> *We don't have a lot of time with any of the students we have. Unless it's a recurring program. So the impact we have is pretty minimal to what we can do in the lives of students. So I answered some questions, I know, from my personal interest and feeling. You know, am I concerned about the . . . households and that sort of stuff, yes I am.*

Discussion

The world of informal education is similar to that of formal education, but also significantly different. For informal science educators, in a museum setting, all visitors are potential students. This means that the ages of audience may vary significantly,

ranging from older adults to very young children. Another difference is that the informal setting offers only limited time for interaction between the instructor and the student which limits what science educators may accomplish with their students. Also, unlike most of formal education, attendance is voluntary. This means that most participants who take part in museum programs are there by choice. Knowing these characteristics of informal education allows for new perspective on seemingly similar, nevertheless different concerns, than those given by formal science educators.

Informal educators overwhelmingly voiced concern about the lack of diversity present in informal science. Participants revealed the long term struggle of their science museum to encourage diverse populations to participate in programs. With little participation from diverse populations, informal educators wonder if culture is a factor. Subsequently, most concerns informal educators discussed seemed to be rooted in the objective of getting diverse populations to participate in museum programs. Because many of the museum patrons are not from diverse groups, many educators spoke about the possible barriers that exist that may deter diverse groups from participating. Many informal educators seemed to believe the answer to increasing diverse participation is recruitment. However, other than reaching out to Spanish speaking visitors, little was mentioned about how to appeal to diverse groups once they take part in museum programs. When cultural influence was mentioned as a possible factor why diverse groups did not readily visit the museum, the culture of the diverse student was usually stated as the deterrent. Many of the cultural values associated with diverse communities, such as African Americans not wanting to swim or being uninterested in natural science, seemed to be based on preconceptions and hearsay. The culture of the museum or of the

museum educator was rarely mentioned as a factor contributing to the lack of interest from diverse populations.

Conclusion

With all three groups of science educators, the intersection of and experiences of culture have clearly impacted the concerns they have about ethnic/racial diversity issues in science education. A common pattern across the three groups was apparent from the results of the MTCS. All three groups rated "strategies and techniques" as the general area of most concern. Second was "familial/group knowledge", and last, with very similar concern scores, were "cross-cultural competence" and "school bureaucracy".

When assessing the areas of concern, most educators may have identified areas they felt knowledgeable about or felt they could concretely affect. The educators' intensity of concern seemed to be based on the following: 1) perceived impact they can have on diverse students, 2) prior knowledge of diverse students' educational situations, 3) prior experience with diverse students.

Strategies and techniques is an area most educators felt they could personally address for diverse students. The discussion portion supports this as many educators spoke of techniques they used with diverse students, such as cooperative learning activities, finding diverse scientists to present to students or speaking Spanish to interact with Hispanic students.

Many science educators also understood the impact home life can have on the academic success of a child. However, of those who did not have much concern for home life, most stated that they did not think they could have much impact on this part of

a child's life. This is very likely the reasoning behind their responses to the MTCS that indicated little concern.

Few educators mentioned the impact school structure has on diverse students, with the exception of ESL students. This may be a result of most participants not understanding how school affects their diverse students. It is also possible that the effects school structure has on ESL students are simply more visible to most educators. Barriers diverse students in general face due to school bureaucracy, such as African American students being proportionally overrepresented in lower track science classes, school curriculum being focused on Eurocentric cultural values, or standardized testing being used as a means of advancing students through grade levels may not be as apparent to science educators. Because most of the educators who participated in this study were White, they may be viewing the obstacles their students face from their own perspective, their own experiences, and the opportunities they were given.

However, many of the participants did not face the same societal barriers their diverse students face, and as such are unaware of the challenges. They may believe that their diverse students have the same opportunities and experiences they had in education and do not see the societal factors that influence their diverse students' lives. Many of the educators may not be aware of the "Invisible Knapsack" they carry which affords them a privilege their diverse students may not have (McIntosh, 1989).

As McIntosh noted, White educators may have been taught to mainly "recognize racism only in individual acts of meanness by members of [their] group, never in invisible systems conferring unsought racial dominance on [their] group from birth" (1989, p.12). This is similar to other studies that have found that many preservice

teachers are not aware of the impacts of society on their diverse students (Goodwin, 1997; Weisman & Garza, 2002).

Also, few educators discussed how prejudice or racism may be affecting their diverse students. When the term prejudice was mentioned, which occurred on numerous occasions, it was solely focused on the concern educators had about practicing "reverse prejudice" against White students. In response to this concern, many educators stated that they treat all students the same and try to ignore race. However, ignoring the ethnicity/racial identity of a student is actually ignoring an integral part of who the student is and illustrates educators' "lack of awareness" and that they are evaluating their students based on Eurocentric cultural values (Bollin & Finkel, 1995). Educators also worried that diverse groups would perceive them fairly, but in contrast, did not worry if they would perceive diverse groups fairly. This may explain why educators did not hold much concern for the cross-cultural competence category. If educators believed themselves to be free of any bias toward diverse students, this would prompt them to rate these questions of little concern.

While some participants were aware of the role culture plays in teaching science, many were not. Educators seemed to view culture by very tangible standards, such as language, diverse students' races and their home life. Educators did not show an awareness of their own cultural values and ways of thinking and behaving. They also did not seem to take their ethnic/racial identity into account in how they view these concerns. With many of the science educators completely unaware of how they and their diverse students' worldview is affected by culture, many of their concerns or lack thereof will continue to be perpetuated by their classroom behavior.

However, for some preservice teachers who had high concern scores on the survey, it was difficult to assess if the scores truly reflected their concern because they did not talk much during the discussion portion of the study. The sensitive issue of this study may have inhibited some participants from sharing many of their concerns. While some participants shared their concerns, others remained silent during most of their group discussion. It is unclear whether quiet participants simply did not have concerns about diversity issues in science education, did not want to possibly be rejected by group members, or if they were offended by the topic itself.

It is clear however, that not all participants held the same concerns they indicated they felt on the surveys. One example that stands out is participant A5. He consistently had a score of approximately four in every category except for cross-cultural competence. When the discussion contributions of this teacher were examined however, they seemed to contradict the findings of the survey. He repeatedly expressed frustration with diversity and the way diverse students behave. He made statements such as, *"You almost have to act as if [diversity] doesn't exist in order . . . to get along. . . ."* When another preservice teacher (A4) in the group shared her concern about what to say to diverse students in certain situations where she is not knowledgeable about a possible controversial topic, A5 responded, *"Well, it's almost like people are looking for a fight."* When another teacher mentions he is concerned about treating diverse students preferentially and not disciplining them, A5 says, *". . . I think the kids know this, and they use it as a power play against us."*

In studies such as this, especially about a topic as sensitive as race and ethnicity, it is difficult to be sure that the participants' remarks fully reflect their feelings. There is

the possibility that the discussion influenced participant ideas, changed their beliefs, or even made them fear disappointment of their peers. It may also be hard for participants to examine themselves and their beliefs to know if they are giving candid answers. No matter the case, survey and discussion results can tell a more complete story about the diversity concerns science educators have in science education.

Implications

The findings for this study offer many implications for the science education field. In previous years, various teacher education programs offered multicultural education courses that lacked clear definitions of "multicultural education" (Phuntsog, 1995). Goodwin (1997) asserted that because of the fragmented nature of multicultural education in teacher education programs, a message preservice teachers may receive is that multicultural education is an inconsequential concern to their learning. Preservice teachers may also hold this belief if they are unaware of the impact culture has on diverse student learning. However, the concerns educators have or do not have about teaching diverse students may impact their teaching practices whether or not they are aware of it.

This study also suggests that concerns about diversity issues in science education may not decrease with teaching experience, but may actually increase. This may be the case because the more experiences inservice teachers have with diverse students, the more they become aware of the obstacles these students face. Whereas a novice teacher may not be aware of the different issues their diverse students face because they have not had to deal with them. In this study, the preservice teachers who shared the most specific concerns had had prior experience with or had prior knowledge about certain issues. Those who did not, had vague concerns and concerns based on hearsay.

Because of the small number of participants in this study, broad generalizations cannot be made about the concerns science educators have about diversity issues in science education. However, because this study examined predominantly White science educators' concerns, it may be interesting to also examine the concerns of diverse science educators who may have different perspectives and concerns. Further research may also examine the concerns students have about teaching diverse students and examine if this has any effect on the way teachers interact with diverse students in their classes.

With 33% of the US school population being minority students, and this percentage projected to increase through the upcoming years, it is very likely that today's generation of teachers will have direct contact with diverse students. Therefore, because educators may not be used to interacting with diverse populations prior to their teaching experience, universities have the responsibility to prepare them to teach these groups. Teacher education programs should require all students to take classes on teaching diverse groups to prepare them for an increasingly diverse student population. However, these classes should not be separated from the regular science education curriculum, but integrated throughout. The importance of preparing teachers to educate a diverse student population should be recognized throughout their educational classes. Preservice educators in an education degree program are a captive audience, whereas educators who are already in the workforce are not. Teachers should be made aware of the cultural influences that are a part of society and that impact diverse students. Universities should also offer the same opportunities to lateral entry and graduate education students who are entering beginning their studies in the education field. These students should also be introduced to culturally relevant pedagogy.

Finally, schools, museums, and teacher education programs need to collaborate to access inservice and informal teachers and aid them in reaching out and understanding their diverse students, reshaping curriculum, and reshaping the structure of schools. Universities and informal science institutions should also introduce preservice, inservice, and informal science educators to cross-cultural experiences. Like previous cited studies (Aaronsohn et al., 1995; Deering & Stanutz, 1995; Mahan & Rains, 1990; Ross & Smith, 1992), a cultural immersion experience may cause educators to be aware of their own cultural identities and encourage them to be sensitive and understanding of others. Hopefully this research will encourage all educational institutions to open an honest dialogue with educators and find out what concerns they have about diversity issues in science education and then take the steps necessary to address these concerns.

References

Aaronsohn, E. A., Carter, C. J., & Howell, M. (1995). Preparing monocultural teachers for a multicultural world: Attitudes toward inner-city schools. *Equity & Excellence in Education, 28*(1), 5-8.

Abt-Perkins, D., & Gomez, M. L. (1993). A Good Place to Begin - Examining Our Personal Perspectives. *Language Arts, 70*, 193-202.

Aikenhead, G. S., & Otsuji, H. (2000). Japanese and Canadian Science Teachers' Views on Science and Culture. *Journal of Science Teacher Education, 11*(4), 277-299.

Atwater, M. M. (2000). Equity for Black Americans in Precollege Science. *Science Education, 84*, 154-179.

Banks, J. A. (1988). *Multi-ethnic education: Theory & Practice*. Boston: Allyn & Bacon.

Barry, N. H., & Lechner, J. V. (1995). Preservice Teachers' Attitudes about and Awareness of Multicultural Teaching and Learning. *Teaching and Teacher Education, 11*(2), 149-161.

Birrell, J. R. (1995). "Learning How the Game Is Played": An Ethnically Encapsulated Beginning Teacher's Struggle to Prepare Black Youth for a White World. *Teaching and Teacher Education, 11*(2), 137-147.

Bollin, G. G., & Finkel, J. (1995). White Racial Identity as a Barrier to Understanding Diversity: A Study of Preservice Teachers. *Equity & Excellence in Education, 28*(1), 25-30.

Borich, & Fuller, F. F. (1974). *Teacher Concerns Checklist: An Instrument for Measuring Concerns for Self, Task, and Impact.* Austin, TX: University of Texas Research & Development Center for Teacher Education.

Boykin, W. (1994). Harvesting talent and culture: African American children and education reform. In R. J. Rossi (Ed.), *Schools and students at risk: Context and framework for positive change* (pp. 116-138). New York: Teachers College Press.

Carr, P. D., & Klassen, T. R. (1997). Different Perceptions of Race in Education: Racial Minority and White Teachers. *Canadian Journal of Education, 22*(1), 67-81.

Cockrell, K. S., Placier, P. L., Cockrell, D. H., & Middleton, J. N. (1999). Coming to terms with "diversity" and "multiculturalism" in teacher education: Learning about out students, changing our practice. *Teaching and Teacher Education, 15*, 351-366.

Creswell, J. W. (1998). *Qualitative inquiry and research design : choosing among five traditions*. Thousand Oaks, California: Sage Publications.

Deering, T. E., & Stanutz, A. (1995). Preservice Field Experience as a Multicultural Component of a Teacher Education Porgram. *journal of Teacher Education, 46*(5), 390-394.

Freeman, D. J., Brookhart, S. M., & Loadman, W. E. (1999). Realities of Teaching In Racially/Ethnically Diverse Schools: Feedback From Entry-Level Teachers. *Urban Education, 34*(1), 89-114.

Fuller, F. F. (1969). Concerns of Teachers: A Developmental Conceptualization. *American Educational Research Journal, 6*(2), 207-226.

Gay, G. (2000). *Culturally Responsive Teaching: Theory, Research, and Practice*. New York: Teachers College Press.

Ghaith, G., & Shaaban, K. (1999). The relationship between perceptions of teaching concerns, teacher efficacy, and selected teacher characteristics. *Teaching and Teacher Education, 15*, 487-496.

Goodwin, A. L. (1997). Multicultural Stories: Preservice Teachers' Conceptions of and Responses to Issues of Diversity. *Urban Education, 32*(1), 117-145.

Greenman, N. P., & Kimmel, E. B. (1995). The Road to Multicultural Education. *journal of Teacher Education, 46*(5), 360-368.

Ingels, S. J., Abraham, S. Y., Karr, R., Spencer, B. D., Frankel, M., & Owings, J. A. (1990). *National educational longitudinal study of 1988, data file user's manual*. Washington, D.C.: National Center for Educational Statistics, U.S. Department of Education.

Johnson, J., & Kean, E. (1992). Improving Science Teaching in Multicultural Settings: A Qualitative Study. *Journal of Science Edcuation and Technology, 1*(2), 275-287.

Jordan, M. L. R. (1995). Reflections on the Challenges, Possibilities, and Perplexities of Preparing Preservice Teachers for Culturally Diverse Classrooms. *Journal of Teacher Education, 46*(5), 369-374.

Kahn, D. M. (1994). Diversity and the Museum of London. *Curator, 37*(4), 240-250.

Kitano, M. K., Lewis, R. B., Lynch, E. W., & Graves, A. W. (1996). Teaching in a Multicultural Classroom: Teacher Educators' Perspectives. *Equity & Excellence in Education, 29*(3), 70-77.

Kramer, L. K. (1994). Cultural Elitism vs. Cultural Diversity in the Art Museum of the Nineties. *Curator, 37*(3), 155-160.

Ladson-Billings, G. (1994). Who will teach our children? Preparing teachers to teach African American learners. In W. C. Hayman (Ed.), *Teaching diverse learners: Formulating a knowledge base for teaching diverse populations* (pp. 129-158). Albany, N.Y.: State University of New York Press.

Ladson-Billings, G. (1995). But That's Just Good Teaching! The Case for Culturally Relevant Pedagogy. *Theory into Practice, 34*(3), 159-165.

Locke, D. C. (1998). *Increasing Multicultural Understanding: A Comprehensive Model* (2 ed. Vol. 1). London: SAGE Publications Ltd.

Mahan, J. M., & Rains, F. V. (1990). Inservice Teachers Expand Their Cultural Knowledge and Approaches through Practica in American Indian Communities. *Journal of American Indian Education, 29*(2), 11-24.

Marshall, P. L. (1996a). Multicultural Teaching Concerns: New Dimensions in the Area of Teacher Concerns Research. *The Journal of Educational Research, 89*(6), 371-379.

Marshall, P. L. (1996b). Teaching concerns revisited: The multicultural dimension. In F. A. Rios (Ed.), *Teacher thinking in cultural contexts*. Albany, NY: State University of New York Press.

McIntosh, P. (1989). White Privilege: Unpacking the Invisible Knapsack. *Peace and Freedom*, 10-12.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis : an expanded sourcebook* (2nd ed.). Thousand Oaks: Sage Publications.

Mintzes, J., & Wandersee, J. (1997). Reform and innovation in science teaching: A human constructivist view. In J. Mintzes, J. Wandersee & J. Novak (Eds.), *Teaching science for understanding: A human constructivist view* (pp. 41-58). New York: Academic Press.

National Center for Educational Statistics. (1997). *America's teachers: Profile of a profession*. Washington, D.C.: U.S. Department of Education, Office of Educational Research and Improvement.

Peshkin, A. (1992). The relationship between culture and curriculum: A many fitting thing. In P. Jackson (Ed.), *Handbook of research on curriculum: A project of the American Educational Research Association* (pp. 248-267). New York: MacMillian Publishing Company.

Phuntsog, N. (1995). Teacher Educators' Perceptions of the Importance of Multicultural Education in the Preparation of Elementary Teachers. *Equity & Excellence in Education, 28*(1), 10-14.

Pigge, F. L., & Marso, R. N. (1997). A Seven Year Longitudinal Multi-Factor Assessment of Teaching Concerns Development Through Preparation and Early Years of Teaching. *Teaching and Teacher Education, 13*(2), 225-235.

Reeves, C. K., & Kazelskis, R. (1985). Concerns of Preservice and Inservice Teachers. *Journal of Educational Research, 78*(5), 267-271.

Ross, D. D., & Smith, W. (1992). Understanding Preservice Teachers' Perspectives on Diversity. *journal of Teacher Education, 43*(2), 94-103.

Santos, S. L. (1980). Cultural Crossroads Center Helps Dallas Students Celebrate Cultural Diversity. *Phi Delta Kappan, 62*(3), 211-212.

Schmidt, P. R. (1998). The ABCs of Cultural Understanding and Communication. *Equity & Excellence in Education, 31*(2), 28-38.

Shultz, E. L., Neyhart, T. K., & Reck, U. M. (1996). Uphill All the Way: An Investigation of Attitudinal Predispositions of Preservice Teachers Toward Diversity in Urban Classrooms. *Teacher Educator, 32*(1), 22-36.

Sparks III, W. G., Butt, K. L., & Pahnos, M. (1996). Multicultural Education in Physical Education: A Study of Knowledges, Attitudes, and Experiences. *Physical Educator, 53*(2), 73-86.

Taylor, S. V., & Sobel, D. M. (2001). Addressing the discontinuity of students' and teachers' diversity: a preliminary study of preservice teachers' beliefs and perceived skills. *Teaching and Teacher Education, 17*, 487-503.

Terrill, M. M., & Mark, D. L. H. (2000). Preservice Teachers' Expectations for Schools With Children of Color and Second-Language Learners. *Journal of Teacher Education, 51*(2), 149-155.

Tobin, K., Tippins, D., & Gallard, A. J. (1994). Research on instructional strategies for teaching science. In D. Gabel (Ed.), *Handbook of research on science teaching and learning: A project of the National Science Teachers Association* (pp. 45-92). New York: MacMillan Publishing Company.

U.S. Department of Commerce. (1996). *Current population reports: Population projections of the United States by age, sex, race, and Hispanic Origin, 1995 to 2050*. Washington, D.C.: U.S. Department of Commerce.

Vasquez, J. A. (1990). Teaching to the distinctive traits of minority students. *The Clearing House, 63*(7), 299-304.

Weisman, E. M., & Garza, S. A. (2002). Preservice Teacher Attitudes Toward Diversity: Can One Class Make a Difference? *Equity & Excellence in Education, 35*(1), 28-34.

Wiggins, R. A., & Follow, E. J. (1999). Development of Knowledge, Attitudes, and Commitment to Teach Diverse Student Populations. *Journal of Teacher Education, 50*(2), 94-105.

Appendices

Appendix A – Proctor Instructions

Dear Proctor,

You have been randomly chosen as the proctor of your group for this part of the study. The proctor's duties are:

- Please read the included instructions to your group.
- Please have yourself, or someone else in your group keep the time (remember, this is a 15 minute discussion).
- Please begin and end the recording of the group discussion with the tape recorder provided.
- Please start the discussion with the question below.
- If group members forget, please remind them of the instructions.
- After the discussion, please put the tape recorder in the box provided.

Begin discussion with:

- What are some concerns that you have (the group) about ethnic/racial diversity issues in science education?

Other questions you may prompt discussion with:

- Was there anything that stuck out from the survey?
- Is there anything you are concerned about that may not have been covered in the survey?

Appendix B – Group Discussion Instructions

Dear Participants,

In this portion of the study there will be a 15 minute group discussion of your teaching concerns regarding racial/ethnic diversity issues in science education.

The purpose of the discussion is to allow educators to freely share their thoughts, concerns, or questions about this topic, which may or may not have been covered in the survey. Please discuss what you feel comfortable sharing.

Things to remember:

- Please introduce yourself by your identifying number (which was located on the survey) before you make a comment. – **DO NOT USE YOUR NAME**
- Please speak clearly and loud enough for the tape recorder to record your comments.
- In the survey, the terms students of color, culturally different students, and diverse students were used interchangeably to refer to African American, Asian American, Hispanic American, and native American students.
- Please examine this topic in relation to science education when possible.