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PRE-SERVICE SCIENCE TEACHER SENSE OF SELF IN DEVELOPING MULTICULTURAL PRACTICE

by

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DISSERTATION APPROVAL

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ABSTRACT

An abstract of the dissertation of Yuki Marie Monteith for the Doctor of Education in Educational Leadership: Curriculum and Instruction presented May 23, 2008.

Title: Pre-Service Science Teacher Sense of Self in Developing Multicultural Practice

The development of multicultural science teaching practices is becoming more crucial as the student population in public schools becomes more diverse. Multicultural teaching practices are even more important when disparities in science achievement can be delimited by racial, ethnic or cultural affiliation. Using a phenomenological perspective, this study explored science pre-service teachers' sense of self after a year of teacher education. Content analysis of themes arising from the study identified three areas specific to their sense of self: (a) the unconscious influence of beliefs about science culture, (b) the fundamental beliefs of the U.S. middle class, and (c) superficial beliefs about multicultural teaching practices. These themes illuminated the essence of the phenomenon: emerging internal contradictions challenging the sense of self.

DEDICATION

This dissertation is dedicated to my mother and father. From my mother comes my sense of responsibility and work ethic. From my father comes my appreciation for sciences and technology. From the dissimilar cultures of my Japanese mother and South Carolinian father come challenges of multiculturalism. From a life as a "Navy brat" comes exposure to diverse ways of seeing and living. From both my parents comes an appreciation for education, learning and teaching which has dominated my life.

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I owe thanks to my fellow graduate students whose support and insight helped sustain me through this sometimes painful process. Adnan, Steve, and Wanna were some of those who made this experience at Portland State University so much more enjoyable and relevant.

Finally, thanks to my family, who have cheered me on; celebrated with me when that was appropriate, and helped me manage the stresses of work, graduate school, and family crises.

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CHAPTER I

STUDY OVERVIEW

Introduction

Improving science education has been a continuous concern for over 350 years (Hurd, 2000). Just as the body of scientific knowledge increases and expands, science educators continue to learn more about their practice. In particular, researchers about science education have endeavored to gain understanding in how culture impacts the learning process in science education (Butcher & Valadez 2001; Ogawa, 1999; Slay, 2001; Stigler & Hiebert, 1998).

As Stigler and Hiebert (1998) stated, "If we want to improve teaching we must recognize and deal with both its systemic and its cultural aspects" (p.5). Teaching is a complex activity that is socially and culturally defined over many years. In particular, multicultural competency in teacher education calls for teachers' capacity for self-awareness as a foundation for developing knowledge of cultural influence (Gay, 1993; Vavrus, 2002). As a consequence, cultural competency has become an important research genre in multicultural education (C. Bennett, 2001).

Growing up as a Japanese-American in the United States, I can say that my own multicultural experience has influenced the lens through which I look at the cultural aspects of my own teaching practice in my seven years as a secondary

science teacher. My innate love of science combined with deeply held belief in the power of diversity motivated me to learn more about using multicultural teaching practices with rapidly changing demographics in student population. As I searched for materials to use in my classroom and became aware of the lack of understanding of the role of beliefs of science teachers in multicultural practices, I began to ask questions to help myself and other science teachers.

Many of the core beliefs in teaching are tacit and resist reform. Often, such tacit beliefs are not readily apparent to members of a culture. From a cultural studies perspective, one acknowledges the multiple subcultures within most urban classrooms and the unequal access to science knowledge within society. Science teachers serve as facilitators to a "cultural border crossing event" as students learn scientific ways of knowing (Aikenhead, 1997). However, pre-service teachers come to teacher education with limited experience with intercultural experience (Melnick & Zeichner, 1998). In addition, the ability of teacher education programs to promote an understanding of diversity and equity is problematic (Melnick & Zeichner, 1998; Vavrus, 2002).

Teachers' conceptions about teaching science are based on their own experiences as learners of science in the school setting (K12-University). A characteristic belief of traditional school experience is that science is a collection of facts and concepts (Munby, Cunningham, & Locke, 2000). Yerrick, Parke, and Nugent (1997) found in a study of science teachers, that the teachers equated collections of facts and concepts with emergent scientific knowledge. These beliefs

conflict with the development of effective science teaching practices; therefore successful implementation of equity pedagogy in science education requires the teachers to develop different beliefs about teaching science.

Although teaching strategies and knowledge about science may seem the most pertinent during student teaching, pre-service teachers must also develop an awareness of their own beliefs and attitudes toward diverse groups in society. In-depth work on the self over time may reveal deep-seated attitudes and behaviors toward different racial, ethnic, gender, and social groups. These beliefs influence their personal and professional life, many times unconsciously. Reflective self-analysis in combination with inquiry into various theories related to diversity (including key concepts such as oppression, cultural assimilation, stereotypes, prejudice, and institutionalized racism) is critical for teachers to be able to recognize and respond to diverse students in their classrooms (Banks & Banks, 1995). Self-understanding and a strong foundation in equity pedagogy goes beyond multicultural content integration to transform teachers into effective change agents for an equitable society.

Research in teacher belief systems show that beliefs are well established by the time pre-service teachers get to a teacher education program (Bradford & Dana, 1998). People have commitments to prior beliefs; and efforts to change or adjust belief systems are difficult. Pajares (1992) reported that, "beliefs are unlikely to be replaced unless they are challenged and one is unable to assimilate them into existing conceptions" (p. 321).

Educational research has shown a renewed interest in the implications of psychoanalytic theory for educational studies (Pitt, Roberston, & Todd, 1998). Psychoanalytic learning theory, which analyzes the influence of the subconscious mind on behavior, is an essential theoretical component to humanist learning theories (Merriam & Caffarella, 1999) and may provide some new insight into multicultural education. The analysis of the subject, and of the learning, focuses on internal tensions (Britzman, 1998). New insights about deeply held beliefs surface when the subject or self attends to the internal tensions or inner conflicts. The psychocultural dimensions of self are less frequently the object of conscious analysis or reflection, at least among certain individuals and cultural groups (Hoffman, 1998). Psychoanalytic theory also helps open ways of approaching the realm of the unconscious, our resistance to knowledge, the desire for closure, mastery, and expertise that sometimes governs the educational impulse, and unenviable tensions between learner and new knowledge.

Increasing awareness of self can produce "interference" (Britzman, 1998). New knowledge of an unconscious belief held by the self may be inconsistent with current beliefs about self. Interference in this case takes the form of previously learned habitual behavior being disturbed by new learning. Since the self prefers continuity and sameness, and wishes to avoid unpleasant feelings, it resists this type of self knowledge (Britzman, 1998). Many beliefs and assumptions that have guided pedagogical practice and curriculum strategies in the United States are based on an understanding of largely white, middle-class students from the

dominant culture. Teachers could have difficulty tolerating the process working through resistance takes in developing multicultural practice because the new understandings may be in conflict with beliefs they currently hold.

Emotions and feelings that surface from the process of interference are often unpleasant. However, Kegan (1994) suggested that it is the process of subjecting the interferences to conscious deliberation and the endurance of the unpleasant that leads to changes in knowing and psychic growth. Kegan (1982) proposed that adults have the potential to developmentally progress through transformations in consciousness throughout the lifespan. I believe that a multicultural science teaching practice is a complex activity that is developmental in nature and evolves over time.

Background to the Problem

Science learning by minority students continues to lag behind students from the dominant culture (National Center for Educational Statistics, 2000). Multiculturalism acknowledges that societies are composed of multiple "micro-cultures." Culture plays an important role in the concept of self and others. Our belief systems are the totality of perceptions, attitudes, values, and identities (Singer, 1987). Thus, most of our core beliefs are affected by our cultural conditioning and are inventions of personal and group culture (Kelly, 1963). Many of these beliefs are tacit and unconscious (Singer, 1987). Why would students from particular micro-cultures learn science less well than students from the dominant culture? Studies in intercultural communication point to cultural differences in

beliefs, behavior patterns, and values that lead to different ways of understanding while similarities within culture allow people to predict the responses of others and more easily exchange meanings.

The majority of science teachers are not from minority cultural groups. More of these teachers than ever before have taken multicultural education courses in teacher education programs. However, multicultural education is still at the margins of the curriculum in schools (Banks & Banks, 1995). In particular, mathematics and science pre-service teachers often express doubts about the relevance of multicultural education for their content areas (Gay, 2000).

Studies have shown that students entering teacher education programs have already developed strong beliefs about teaching mathematics and sciences based on their own prior experience and resulting sense of themselves as mathematicians and scientists (Bramald, Hardman, & Leat, 1995; Carter & Doyle, 1995). These beliefs are likely to influence their teaching practice and could potentially be barriers to learning alternative ways of teaching science and mathematics

Current approaches are no longer adequate to foster the complex learning experience of developing multicultural practices.

Significance of Proposed Research

More effective multicultural science teaching requires a deeper understanding by science teachers of the role played by culture in establishing students' (and the science teacher's own) unique values, beliefs and perspectives. Effective science teaching practices are then able to communicate "through" those

different perspectives. However, research in multicultural science teacher education indicates that beliefs about the role of culture in science education are difficult to change (Bradford & Dana, 1998; Brand & Glasson, 1999; Jennings & Potter-Smith, 2002).

Gay (1993), in describing abilities needed by teachers to provide an equitable education to students in the classroom, listed four significant prerequisites:

- Knowledge of one's own beliefs and biases
- A familiarity with the cultural values and behavioral codes of the community
- A thorough knowledge of multiple learning and teaching styles
- Well-developed cross-cultural communication skills and styles of interaction

Change in science teacher practice inevitably involves change in teacher beliefs. Evans (1996) stated that the most effective change management approach identifies the changeable values and beliefs people hold and seeks to change them through a combination of an understanding of the psychology of individuals and a focus on the role of culture. Gorski (2000) in describing the goal of multicultural education as affecting social change stated that the pathway toward this goal included the transformation of self as one of three stands of transformations needed (self, schools and schooling and society). Gorski further described the

transformation of self as the continual and critical process of examining prejudices, biases, and assumptions.

The purpose of this study is to describe the essence of the experience of self for a cohort of pre-service science/math teachers using a phenomenological approach, resulting in a phenomenological description of a sense of self for this group. At this stage in the research, "sense of self" is defined generally as the experience of self in relationship to others.

Key Definitions

The first part of this section covers the key definition of self. The second part includes a brief description of a multiculturally effective science teacher that can be applied in science education. An abbreviated discussion of culture and some key points related to the pervasive and varied roles culture plays when culture is applied within a developing sense of self framework is featured in the third section. In the fourth section the concept of culture is elaborated upon.

Sense of Self

By "sense of self" is meant "one's own inner assessment or concept of one's person and one's singular or multiple roles as delineation of self "(Goldberg, 1979, p. 6), located by both evolutionary and cultural influences (Benson, 2001).

Science teachers who are to be most multiculturally effective will:

- *Be Aware of their Own Cultural Bias*
  Understand that their own national or ethnic culture shapes their own sense of what is "correct" or "valuable" and that this might in fact bias

their ability to acknowledge the validity or value of a student's perspective/behavior.

- *Empathize with Different Cultural Perspectives*
  Understand that the culture of their students affects the way in which the student interprets what is said, and that the ability to empathize with the student's cultural perspective is key to effective communication and teaching.

- *Have a Deep Sense of Self, Independent of Culture*
  Will be less "vested" in a particular set of culturally biased values and beliefs and will be secure in themselves and their value at a deeper level.

Kegan (1982) presented a framework for understanding the evolution of sense of self in terms of growth of subject-object perspective. Subject-object is discussed further in the literature review section.

Role of Culture as Backdrop

Culture plays pervasive and varied roles in the developing sense of self of the science educator:

- Teacher's ethnic culture – affects the deeply held, sometimes tacit, values and beliefs of the science educator. This also includes role expectations of what it means to be a teacher and student.

- Student's ethnic culture – affects the deeply held, sometimes tacit, values and beliefs of students, as well as role expectations for what it means to be teacher and student. Needless to say, those values, beliefs and role expectations may often not match those of the teacher for the minority student.

- Teacher / school culture – Pre-service science educators transition from an academic setting, where they learn educational theory, to a heavily constrained and stylized school setting with its own strong cultural elements. The teacher / school culture can "condition" the new science educator, sometimes subconsciously.
- Science / math culture – In general, the subject area may have its own cultural elements. In particular the "rigor" of science and math sometimes give it an absolutist flavor which interacts with the science educator's sense of self in subtle ways.

Culture in the literature is defined in many ways. Ethnologist Spradley (1979) defined culture in a general way as shared knowledge that people use to "interpret experience and generate social behavior" (p. 5). Hall (1998) stated that culture is primarily a system for creating, sending, storing, and processing information and communication underlies everything. For the purposes of this study, I am using Singer's (1998) definition of culture. Singer described culture as "a pattern of learned, group-related perceptions - including both verbal and nonverbal language, attitudes, values, belief systems, and behaviors – that is accepted and expected by an identity group" (p. 30).

Statement of the Problem

In the large, I believe that multicultural science education can improve significantly to the degree educators can better mentally organize multiple perspectives, concepts, and dilemmas. This is closely tied to the adult developmental stage of the educator. At this time, we know very little about the

adult developmental stage of pre-service science educators and how they experience a sense of self in the context of the development of practice. If we understood the developmental profile of the pre-service teacher population, we could better facilitate programs for personal and professional development in multicultural science education practices. The first step in this (longer) program of improvement is in this understanding of how pre-service science teachers experience a sense of self. That is the subject and purpose of this proposed study. Kegan's (1982) (subject-object) developmental model in terms of subject-object provides a psychoanalytic learning theoretic foundation for this work.

Research Questions

Central Question

- What is the essence of the experience of self (sense of self) for pre-service science teachers who are developing multicultural practice? In particular:
    - How aware are they of their own cultural bias?
    - How do they empathize with different cultural perspectives?
    - How independent of particular cultures is their sense of self?

Related Questions

Questions illuminating the phenomenon of "sense of self" include:

- How do pre-service science teachers resolve the dilemmas of conflicting beliefs/actions and negotiate the many messages they experience while developing their science teaching practice?

- What cross-cultural conflicts (intrapersonal and interpersonal) do the pre-service teachers experience?
- How do the pre-service teachers describe self-other relationships?

CHAPTER II

REVIEW OF RELEVANT LITERATURE

This chapter features a review of the theoretical, methodological, and practical evidence that relates to the problem as well as the literature from fields where solutions might be found. The key issues, challenges, and problems are highlighted through this discussion of the literature. The transdisciplinary review includes relevant findings from three domains: education, anthropology and the behavioral sciences.

The review of the literature for this chapter is organized into five sections. The first section focuses on multiculturalism, equity pedagogy, and science education with relevant definitions. An overview of cultural competency literature as it relates to teacher education is presented in the second section. Section three features a discussion of theories of self. The fourth section is a review of the literature that is related to developmental psychology. A summary of the literature is presented in the final section

Multiculturalism and Science Education

Multiculturalism acknowledges that the body of knowledge of an entire society is composed of multiple "micro-cultures." Banks (cited in Grant, 1997) described multiculturalism as "a philosophical position and movement that assumes that gender, ethnic, racial, and cultural diversity of a pluralistic society should be

reflected in all its institutionalized structures but especially in educational institutions, including the staff, norms, values, curriculum and student body" (p. 16). Multiculturalism in education is not a separate, isolated, once-a-year activity, but an integrated part of the regular curriculum which includes a range of cultural perspectives (Ladson-Billings, 1994). Banks and Banks (1995) conceptualized multicultural education into five dimensions: content integration, the knowledge construction process, prejudice reduction, an empowering school culture and social structure, and equity pedagogy.

Science itself can be considered a unique culture (Ogawa, 1999). Aikenhead and Jegede (1999) suggested that "crossing cultural borders" in science teaching involves the development of curriculum that helps pupils move between their life-world culture and the culture of science. Features of culturally sensitive curriculum include:

- contextualizing the science curriculum in the students' daily lives,
- employing culturally sensitive instructional strategies,
- acknowledging the contributions of non-Western scientists,
- comparing and bridging the worldviews of science and the worldviews of students.

Because of the complexity of acculturation, these authors (Slay, 2001) encourage the science teacher to take the role of "culture broker" who makes the border crossing explicit rather than implicit.

According to Ladson-Billings (1994) culturally relevant pedagogy is an approach that uses cultural referents to help students develop knowledge, skills, and attitudes. Furthermore, culturally responsive teaching in Gay's (2000) view includes the following characteristics:

- Acknowledges the legitimacy of different cultures and approaches to learning.
- Builds bridges of meaningfulness between home and school experiences.
- Incorporates multicultural information, resources, and materials in all subjects and skills taught in schools.
- Uses a variety of instructional strategies that are connected to different learning styles.
- Teaches students to praise their own and each others' cultural heritages.

Weld (2000) links effective multicultural curricular inclusion in science to the inquiry approach advocated by the National Science Education Standards (National Research Council, 1996):

- Students are actively engaged in doing science.
- The real world is brought into the classroom.
- Diverse learning styles are accommodated through various strategies such as hands-on labs, research, dialogue, and reflection.
- Topics are connected to other school subjects.

Many studies in the literature have addressed the importance of multicultural curricular inclusion to science education. Factors such as multiculturalism as a

philosophical position, the role of teacher as culture broker, culturally relevant pedagogy and linking effective curricular inclusion in the National Science Education Standards, have been mentioned as reasons why teacher education programs should be concerned with the development of multiculturalism in science teaching practice.

Equity Pedagogy in Science Education

Teachers who successfully implement equity pedagogy in science education draw upon a sophisticated belief and knowledge base in multiculturalism and science content. Banks and Banks (1995) has said, "Equity pedagogy is a dynamic process that not only focuses on the identification and use of effective instructional techniques and methods but also on the context in which they are used" (p.153). Research in science education has shown that teachers' belief systems are not representative of current thinking about science, equity, and learning science in that most were content-focused and teacher-centered (Dana, McLoughlin, & Freeman, 1998; Munby et al., 2000; Yerrick et al., 1997). The beliefs that teachers hold influence their perceptions and judgments as well as their teacher behaviors.

Equity pedagogy in relation to the teacher can be defined as "teaching strategies and classroom environments that help students from diverse racial, ethnic, and cultural groups attain the knowledge, skills and attitudes needed to function effectively within, and help create and perpetuate, a just, humane and democratic society" (Banks & Banks, 1995, p. 152). These strategies also mirror those from a constructivist view of learning; emphasizing the role of the learner in

the construction of knowledge. Practices that enable students to create new knowledge and make connection from their own experiences are indicative of student-centered practices, instead of teacher-centered practices that focus on the memorizing of facts determined by the teacher. Encouraging students to explore and inquire, generating multiple solutions and perspectives is closer to comprehending the true nature of science.

Pre-service science teachers further develop existing knowledge base and conceptions of diversity and inclusion from teacher education programs so that they can apply them in schools. The National Council for Accreditation of Teacher Education (2002) standards includes the ability of pre-service teachers to develop awareness of different teaching and learning styles shaped by cultural influences and ability to adapt instruction and services for all students. In addition, the standards encourage pre-service teachers' to design a plan to improve their practice in knowledge, skills, and dispositions related to diversity.

The National Academy of Sciences in the National Science Education Standards (National Research Council, 1996) called for emphasis on "a new way of teaching and learning about science that reflects how science itself is done, emphasizing inquiry as a way of achieving knowledge and understanding about the world" (p. ix). In the vision of science education portrayed by the *Standards*, effective teachers of science create an environment in which they and students work together as active learners. In order to achieve this goal, science teaching

methods have to evolve from a teacher-centered approach to a more student-centered approach.

Paramount to the student centered approach is the knowledge that student learning and understanding is actively constructed through individual and social processes (Wink & Putney, 2002). The practice of the teacher is deeply influenced by their understanding of and relationship with students. These relationships are grounded in knowledge and awareness of the similarities and differences in students' backgrounds, experiences, and current views of science. The learning that is required of teachers involves changing their beliefs.

Cultural Competency

The need to understand cultural differences has become increasingly important in teacher education. To effectively communicate, teachers and students have to share meanings. Individuals from two different cultures bring with them different value assumptions, expectations, verbal and nonverbal habits, and interaction scripts that influence communication (Ting-Toomey, 1997). Intercultural researchers describe general differences in patterns of thinking and behaving between cultures such as high context (where information is implicitly coded) and low context (where information is explicitly coded) communication (M. Bennett, 1998; Hall, 1998; Weaver, 1998). Teachers need to understand cultural differences and share cultural information in order to effectively teach in a diverse student population.

Defining what cross-cultural competence is can be difficult. Since 1982, counseling education in particular has made steady progress in identifying and defining multicultural competencies (Fuertes, Bartolomeo, & Nichols, 2001) while acknowledging a need for a more complex picture of multicultural competencies (Toporek & Reza, 2001). Sue et al. (1982) characterized competency as awareness and sensitivity to cultural and institutional influences with a willingness to work with the existing diversity. Cross, Bazron, Dennis, and Isaacs (1989) described cross-cultural competence in terms of behaviors, attitudes, and policies that are congruent, converge, and result in effectiveness in cross-cultural situations. In their definition, the notion of cross-cultural competence can be applied to individuals, agencies, and systems.

Although teacher education programs acknowledge the importance of (inter or cross) cultural competency, the assessment of pre-service teachers remains vague. In 2001, the Oregon University System conducted a study of the teacher certification requirements in 24 states to ascertain their cultural competence requirements for teacher licensure (Zanville & Duncan, 2001) in response to Oregon Senate Bill 782 which called for increased cultural competence in Oregon schools. Results of this study showed that a small number of states have specific requirements for "cultural competence." Most of these states included cultural competence as part of a set of performance or outcome-based standards.

Oregon (TSPC) Teacher Standards and Practices Commission, Division 17 Standards (2002), have "outcomes" expected of pre-service teachers completing

approved teacher preparation programs. TSPC currently requires teachers to have the following outcomes. They must:

- affirm the dignity and worth of all students, and provide the positive support students need to be effective learners;
- respect cultural patterns and expectations that operate within a school;
- interact thoughtfully and courteously with students and their parents, and resolve conflicts in a professional manner, respecting the cultural context of the community;
- use a variety of research-based educational practices that reflect how students learn, are sensitive to individual differences, and diverse cultures, and encourage parent participation.

One model of cultural competency from intercultural communication literature relates levels of competency to adult developmental stages. M. Bennett (1993) described a developmental model of intercultural sensitivity that identifies stages of how cultural differences are comprehended and the factors that impede that comprehension.

It is M. Bennett's (1993) contention that cultural differences can be experienced at different levels that he describes as six stages of development:

- Denial – very unaware of cultural differences
- Defense – cultural differences are perceived, however differences from ourselves or the norms of our group are labeled very negatively.
- Minimization – avoidance of stereotypes and appreciation of some differences, however, our group values are seen as universal.

- Acceptance – cultural difference is both acknowledged and respected while maintaining your own commitment to values.
- Adaptation – proactive effort to use one's own knowledge about cultural differences to improve relationships with people who are culturally different.
- Integration – ability to communicate effectively with many cultural groups.

Cultural competency enables a teacher to effectively communicate and function within a school culture that is composed of a diversity of individuals. This competency entails an awareness and sensitivity to cultural influences. Currently the assessment of cultural competence is complex and researchers are calling for more understanding of how, when, and by what process one becomes multiculturally competent (Fuertes et al., 2001).

Multicultural Teacher Education

In order to prepare pre-service teachers to work in more culturally diverse school settings, critical reflection is one technique being used to increase awareness of tacitly held beliefs with the goal of becoming more culturally competent. Brand and Glasson (1999) discussed the relationships between belief systems and crossing cultural borders in examining science pre-service teachers' beliefs about diversity. An example from their study illustrates resistance to change in beliefs. Kyle, a Caucasian male from a rural community, maintained that focus issues related to cultural diversity are simply unnecessary distractions which interfere with the teaching of science. In his experience of teacher education, the challenge to his

belief was listening to culturally diverse students discuss their learning in science classrooms. Although he acknowledged the students' shared perspectives were of the type he wasn't accustomed to seeing, he maintained that multicultural education is just being more considerate of different cultures. This superficial level of understanding of multiculturalism lacks awareness of the role of cultural norms and values.

In developing new beliefs, adults may report changes in their beliefs that are not evident in practice. They may "talk the talk but not walk the walk." Jennings and Potter-Smith's (2002) study of a multicultural teacher education course showed how using critical inquiry, reflection, and action influenced the pre-service teachers' understandings and beliefs through developing action plans that reflected the language of knowledge construction. The plans, however, did not articulate the meanings that would be an indication that change had taken place in their beliefs. There was a shift in the pre-service teachers' concepts of multicultural education that included talk of a transformational approach without accurately illustrating meaning and full understanding. The pre-service teachers could use multicultural language but could not articulate how they could meaningfully practice multicultural education. Changes in practice as in contextualizing the science curriculum in the students' daily lives were not included in the plans.

In discussing teaching based on conceptual change approach, Bradford and Dana (1998) came to the conclusion that experience alone does not change a teacher's belief. In their study, a science pre-service teacher, when faced with using

a current textbook sanctioned by the science teaching community to include societal relevance, spent additional time to prepare lessons that made up for the lack of conceptual depth she perceived in the textbook. Although her expectation did not agree with her experience, her conceptions about teaching remained stable by blaming the textbook rather than re-examining her assumptions and beliefs about teaching science. Along those lines, Bradford and Dana highlighted the need for outside challenges and support that might prompt adults into clarifying, rethinking, and re-evaluating their pedagogical conceptions and practices.

Some researchers have created aspects within their courses that deliberately set out to create cognitive dissonance in order to support conceptual development through critical inquiry in action research (Dana et al., 1998). Science pre-service teachers were asked to make explicit their thinking about science teaching and learning over a period of time. In addition, two plan-teach-assess-reflect cycles were included to enact and test their beliefs with "real results." Their interactions with students in the classrooms, combined with assessment from those students about their instruction and what the students learned, made some of their implicit beliefs and conceptions explicit. Stress was placed on the idea that dissonance alone did not suffice in changing the pre-service teachers' beliefs. Once the need to know was created, a replacement construct (as in knowledge and skills that are more effective in fostering student learning) needed to be provided. The dissonance experienced by the pre-service teachers was pointed to as the key motivator for change experienced by the pre-service teachers. However, this study also noted that

some of the pre-service teachers selectively reconstructed their conceptions of science teaching without confronting some of the inconsistencies in their own beliefs.

Some research techniques have the goal of uncovering implicit assumptions and surfacing beliefs to a person's awareness through critical incidents. A person is instructed to recall a key incident or moment from their recent experience, write it down, and critique it. Christie (2000) found in a study of critical incidents in college teaching in Australia that 90% of the incidents described as memorable when simply asked to remember an "event" or "moment" from their recent teaching could be categorized as "negative." Coleman (2002) used critical incident technique to examine the experiences of counseling psychology graduate students during their multicultural training with the intent of assessing the efficacy of multicultural training programs. The researcher found that the trainees experienced a number of affective and cognitive responses to particular processes during their training. The teachers tended to remember a moment when they felt challenged or the incident was thought provoking. In a study by Wasson and Jackson (2002), the researchers examined diversity attitudes and beliefs among 25 senior level health education students with the goal of using the information to enhance program and curricular experiences. The data indicated that the students were moderately aware of diverse attitudes and perspectives and were only minimally to moderately empowered to take responsibility or action. In all the studies, when the participants

described and examined the incidents, they uncovered assumptions and beliefs they did not realize they held.

How do people react to opportunities to struggle with new and confusing ideas or ideas perceived as threatening? The literature indicates the results are mixed. Other literature also points out the tenacity and pervasive power of people's beliefs (Ethell & McMeniman, 2001). In the educational system, the enduring nature of teachers' beliefs, even in the light of new pedagogical theories and principles, raises significant concerns for teacher educators (Ethell & McMeniman, 2001).

According to Hewson (1996), conceptual change occurs when the status of inappropriate conceptions is lowered, while the status of a more appropriate one is raised. There must be dissatisfaction with one concept and then exchange with a concept that is more meaningful and useful in prediction than the previous one. The consensus does seem to be that the outcomes depend on the nature of the interactions.

Theories of Self

One possible explanation for the tenacity of beliefs may be linked to self-concept. Aronson's (1999) theory of self-concept extends Festinger's theory by attributing the arousal of dissonance to the high level of personal involvement. Reduction of dissonance would entail some form of self-justification. At the core of cognitive dissonance is the person's self-concept. Therefore, the negotiation of

conflict involves balance in stability of self and tolerance of uncomfortable dissonance.

New or different ideas can be perceived as threatening to some individuals (Chevalier & Houser, 1995) since these new or different ideas could imply that something is wrong with the original beliefs. The "normal" response to this perceived threat to the beliefs is blatant resistance (Brand & Glasson, 1999), and as a result mechanisms that defend the self often come into play. Most people focus "on either reproducing images in which they perpetuated their own self-identity or they focused on restructuring the environment in a way that prevented the reproduction of the images in an attempt to preclude negative experiences" (Brand & Glasson, 1999, p. 15).

Who is the individual self that is experiencing? Spindler and Spindler (2000), in studying anthropology, culture and schools for over 50 years, have dealt with the ambiguity of the concept of self by treating the self-concept in three dimensions: the enduring, situated, and endangered self. The enduring self that the Spindlers describe has continuity over time and provides an integrating process (p. 375). This concept of self contains idealized, romanticized beliefs as contrasted with the situated self. The situated self copes with the pragmatic everyday details and reacts to the changing experiences within social contexts. While the endangered self, as an adaptive response to conflicts arising when the enduring self is violated too strongly or too often by the situated self.

Within modern object relations theory, the self system is developed out of our relationship with objects (significant people and things other than people). The term object-relations refer to the self-structure we internalize in early childhood, functioning as a blueprint for future relationships. In this focus on self and others, object relations theorists emphasize attachment, interpersonal conflict, and other issues related to human relationships (Pine, 1990).

Self-concept is also defined as the totality of a complex, organized, and dynamic system of learned beliefs, attitudes and opinions that each person holds to be true about his or her personal existence (Purkey, 1988). The concept of self in this study is grounded in this psychoanalytic perspective. Following Goldberg (1979), Hoffman (1998) has defined self as "a culturally patterned way of relating to others; to the material, natural, and spiritual worlds; and to time and space, including notions of agency, mind, person, being and spirit" (p. 325). Viewing self from this frame allows for a definition based on analytically derived data (Goldberg, 1979). The data of analysis deals with the inner life of the person, complex mental states, and the negotiation of meaning. In the self psychoanalytic model, the self's construction of meaning extends beyond the confines of the individual to include others who function as part of that individual and his mind, the self-object model.

Some recent teacher education literature refers to "teaching selves" (Danielewicz, 2001) or "teaching identities" (Mayer, 1999). I feel it is important to make a distinction for the purposes of this study between self and identity.

Identities are categories that are conditional; multiple ways people name and describe roles in given times and places (Danielewicz, 2001) like gender and race. The use of self in this study is not identity although the self of the participants sometimes occupies the identity role of science teacher which in turn is influenced by the culture of science and schools. The conception of self here is the continuous, enduring, organizing self system that encompasses the multiple identities and transcends body and mind. Self in this case is self as that delineated sense of intrapsychic continuity.

Developmental Psychology

Adult developmental stage theories indicate that people progress through different developmental stages or phases, just as do children and adolescents; and that learning continues throughout the life span. Merriam and Caffarella (1999) define psychological development as "development that occurs within the individual, whether development is primarily an internal process or results from interactions within the environment" (p. 99). Brookfield (1995) made a strong case that as "we examine learning across the lifespan the variables of culture, ethnicity, personality and political ethos assume far greater significance in explaining how learning occurs and is experienced than does the variable of chronological age" (p. 1).

Piaget's well known theory of development acknowledges the role of cognitive dissonance and self in learning and growth. This theory states that a major challenge to the process of development and learning is being able to

maintain an inner sense of balance or equilibrium while integrating new information (Hicks, 2001). New knowledge is constructed by the individual in response to a "decentering" event in the external environment (von Glasersfeld, 1997).

Many studies have indicated that a period of destabilization and dissonance is necessary for successful long lasting change to occur (Huberman & Miles, 1984). Cognitive dissonance theory states that the incongruence of two relevant but different constructs or beliefs causes psychologically uncomfortable dissonance. How those facing cognitive dissonance reduce the dissonance becomes more complex.

The discomfort motivates the person to reduce the dissonance. Dissonance can be reduced by removing dissonant cognitions, adding new consonant cognitions, reducing the importance of dissonant cognitions or increasing the importance of consonant cognitions (Festinger, 1957). Most people become aware of their cognitive dissonance through interaction with others, whether it is through reading the thoughts of others or through face-to-face interaction. The interpersonal and intrapersonal processes are linked together. Hall (1998) asserted that "dissonance in interpersonal and intercultural relations is inevitably traced to perturbations in the perceptual-communicative process in one or both of the tacit or explicit levels of culture" (p. 59).

The transformation occurs when a construct is restructured as in removing the dissonant cognitions and replacing them with new consonant cognitions. One

way of viewing transformation of beliefs is to look for a shift in a learner's "repertoires of meanings, language and actions" (Jennings & Pattenaude, 1998, p. 325). However, the more important a belief, the more resistant it is to change (Rokeach, 1960). Important beliefs are those which are connected to other beliefs, influencing their ramifications and repercussions (Brand & Glasson, 1999). Beliefs tend to maintain their suppositions unless there is a "conversion" or "gestalt shift" (Nespor, 1987).

Transformation and cognitive dissonance theory can be applied to adult learning. Mezirow's (1991) theory of transformative learning includes phases of change initiated by a "disorienting dilemma." Our meaning making of our experiences lead to the actions we take. In particular, we want to make sense out of disorienting experiences. For learners to change their "meaning schemes (specific beliefs, attitudes, and emotional reactions)" (Mezirow 1991, p. 167), they must engage in critical reflection on their experiences, which in turn leads to a perspective transformation. As described by Mezirow (1997), transformative learning occurs when individuals change their frames of reference by critically reflecting on their assumptions and beliefs and consciously making and implementing plans that bring about new ways of defining their worlds.

Increasingly researchers are also acknowledging the integral part emotions and feelings have in learning. Dirkx (2001) argued that "emotionally charged images, evoked through the contexts of adult learning, provide the opportunity for a more profound access to the world by inviting a deeper understanding of ourselves

in relationship with it" (p. 64). Powerful feelings, emotions, and affect that arise within our learning experiences draw attention and energies to unconscious issues (Boyd, 1991).

Intrapersonal conflict in the form of cognitive dissonance can be explicitly used as a form of pedagogical practice for teachers of adult learners. Cognitive dissonance has been targeted as a strategy or tactic for change to produce learning. However, different terminology is used to describe the process depending on the area from which the research originates. Literature from education uses the terms critical reflection, critical incident, critical analysis, critical inquiry, conceptual change, knowledge deconstruction, or critical pedagogy - all incorporating the use of cognitive dissonance.

An alternative approach in understanding adult learning is the possibility that cognitive development is fixed to physiological or maturation stages. Kagan (1992) suggested that some adults are not developmentally ready for critical reflection. Adult developmental stage theories indicate that people progress through phases. Perry's model reflects the critical intertwining of cognitive and affective domains of the journey towards complex thought (Moore, 2002). His work underscores the notion that powerful learning involves significant changes in the way learners approach diversity and uncertainty leading to the ability to create meaning from multiple perspectives and define identity from multiple associations.

Some theorists have drawn attention to the role of the "constructive-developmental" (Kegan, 1994, p .4) and organization of meaning in the

developmental process. Kegan underscored the importance of context in understanding adult psychological development and proposes a way of seeing ourselves in relation to the demands of our environment. The central issue is "the way in which the person is settling the issues of what is 'self' and what is 'other' essentially defines the underlying logic (or 'psychologic') of the person's meanings" (p. 12). He referred to his perspective of psychological development as an "activity" (p. 7) where human beings are in "an ever progressive motion engaged in giving itself new form" (p. 9).

Kegan's (1994) theory allows for the "personal unfolding of ways of organizing experience that are not simply replaced as we grow but subsumed into more complex systems of mind" (p. 9). Consisting of five increasingly complex orders of mental organization, his developmental perspective accords particular attention to the adulthood stage of life where its "mental demands [call for a] qualitatively more complex order of consciousness" (p. 92). The emergence of fourth-order consciousness is signaled by the capacity for tasks such as setting limits, maintaining boundaries, and preserving roles--tasks that require the creation of a "relationship to the relationship" (p. 92). A person in the fourth order is able to identify the self as the organization of the self-system. Fifth-order consciousness is marked by even greater epistemological organization and is a state that few people reach and, according to Kegan, never before their forties.

Summary of Relevant Literature

The goal of multi-culturally sensitive education in general and science education in particular, is well established. Although there is no consensus on cultural competency, most educators would agree that helping students from diverse, ethnic, cultural groups attain the scientific knowledge, beliefs, and skills needed to function as a member of modern society is an important endeavor.

Most previous work has approached the area of multicultural education as a skill to be acquired. Implicit in those approaches is a notion that teachers can be "trained" to improve those skills. This does not appear, however, to be a very successful "change management" strategy. Deeper forces appear to be at work in teachers, inhibiting them from real improvement in multicultural science education. How do teachers resolve the interference of conscious thought by the unconscious along with the emotions and feelings that result from psychic conflict? More investigation into those forces, including teachers' sense of self, is needed.

To date, there has been little empirical research that has examined pre-service science teacher experiences to uncover how they mentally organize beliefs about self and other. Current studies document and acknowledge the difficulties of change in beliefs in order to develop multicultural practice. Pre-service teachers during student teaching are developing habits or ways of dealing with cross-cultural interactions that will continue to influence their teaching practice. The ways of negotiating that interaction may impede or be an impetus for change.

This study attempts to take in consideration those forces are in place that inhibit change. Previous studies have not examined the nature and affect of cognitive dissonance on the sense of self. Kegan's (1982) model provides a framework to examine the process of emerging multicultural practice through the interactions of subject and object. Because beliefs around cultural issues may be tacit, critical incident technique should be useful to uncover implicit assumptions and beliefs as well as study participants' experiences.

CHAPTER III

DESIGN AND METHODOLOGY

This chapter describes the design of the research strategy: methodology, research population, procedures, limitations and other considerations that were significant to the design of the research framework.

The Research Strategy: Qualitative and Phenomenological

This study involves the study of pre-service science teachers' experiences within teacher culture. Human experience itself can be seen as the basic condition of all social and cultural phenomena (Baeveldt, Voestermans, & Verheggen, 2000) By focusing on the experiential nature of that which is cultural and the phenomenon of the acting individual, understanding about the cultural underpinnings of behaviors may come to light (Bargh, 1997). Culture influences perception and behavior.

Qualitative research has traditionally been associated with the study of culture (Alasuutari, 1995). In a general way, the purpose of qualitative research is to understand human experience to reveal both the processes by which people construct meaning about their worlds and to report what those meanings are.

Some of the assumptions of qualitative research methodology are that (Creswell, 1994):

- qualitative research is value-laden and biased

- qualitative research is an inductive process
- reality is subjective, and multiple (as seen by participants in a study)
- the researcher interacts with that being researched
- categories are uncovered during the research process
- categories are bound to context

Because the values, beliefs and assumptions cannot always be assessed directly, the ability to interact with the participants in order to get clarifications will be important.

Phenomenological Approach

Phenomenology has had several different definitions in the literature. Ehrich (1999) posited that the definition of phenomenology has yet to be settled. Patton (2002) suggested that phenomenology has been referred to as a philosophy, paradigm, and a methodology. Phenomenology in the context of this research has provided this researcher with the language and foundation to express the essence of the research question that is driving this project as well as the methods by which the study will be conducted. Creswell (1998) stated that a "phenomenological study describes the meaning of the lived experiences for several individuals about a concept or phenomenon" (p. 51). This study attempts to describe the essence of a sense of self for a group of math and science pre-service teachers as they experience it in development of a multicultural practice.

Phenomenology is "the careful description of aspects of human life as they are lived" (Boeree, 2000, p. 1). The phenomenological method as described by

Giorgi (1997) is a rigorous descriptive approach that offers a method for accessing the difficult phenomenon of human experience. A better understanding of the method can come from examining a phenomenological philosophical framework.

Phenomenology as a philosophy is often credited to Edmund Husserl (Ehrich, 1999; Owen, 1994; Priest, 2002). Husserl's (cited in Ehrich, 1999) conception of phenomenology arose as an alternative proposal to positivism. Phenomenology links a being and a phenomenon in a way that can not be separated (Salada & Adorno, 2001). There is only a phenomenon when there is an individual being that experiences the phenomenon. Giorgi (1997) suggested that phenomenology will "not be easy to comprehend if one remains within the empirical philosophical framework which dominates the scientific culture of our time" (p. 235).

Population

The population studied was completely relevant to this topic, and was serendipitously available. This researcher had the opportunity to work with a group of 27 pre-service math and science teachers involved with a teacher education program that was a recipient of an NSF grant that had goals specifically focused on studying and addressing the wide ranges of math and science achievement observed in high-needs populations in urban and rural settings. The institution whose teacher education program hosts the pre-service teachers is the lead research institution in diversity and equity issues of a consortium of five universities collaborating with tribal colleges and public school systems in three western states.

The pre-service science and math teachers were finishing the teacher education program at the time this research was conducted.

As a former class instructor and cohort leader for this group of math and science pre-service teachers, this researcher was involved with the training program for the participants. A good relationship had been formed with this group of teachers. This provided a good opportunity for in-depth and multiple interactions with the in-service teachers.

This study is neither an evaluation of the teacher education program in which the pre-service teachers were involved nor evaluation of the effectiveness of teaching strategies for multicultural education.

Data Collection Rationale

Two data sources were used to answer the research questions: critical incident essays and focus group interviews. A phenomenological method was used to analyze data and develop conceptual themes. To further enhance the credibility and conformability of the findings, a professional peer reviewer was asked to examine the data categories and themes.

The idea behind the focus group method is that group processes can help people to explore and clarify their beliefs in ways that would be less easily accessible in a one to one interview. An important feature of the process is that (sub) cultural values or group norms are usually highlighted by interpersonal communication (Kitzinger, 1995). Focus group interviews were video-taped and

transcribed into written text. Contact summary forms were completed to focus or summarize the main points of the contact.

These techniques are useful for the following reasons (Marshall & Rossman, 1999):

- The data being collected are set in the natural context of teacher practice
- Useful for collecting information about complex interactions
- Facilitates discovery of nuances in culture
- Provides context information
- Facilitates analysis, validity checks, and triangulation
- Provides flexibility in formulating hypothesis
- Fosters face to face interactions with participants
- Useful for uncovering participants perspectives
- Facilitates immediate follow up for clarification

Weaknesses with these types of data collection techniques include:

- Data are open to multiple interpretations due to cultural differences
- Dependent on cooperation of small group of key individuals
- Fraught with ethical dilemmas
- Data often subject to observer effects
- Overly artistic or literary style can obscure the research
- Highly dependent on the quality of research question

- Highly dependent on ability of researcher to be resourceful, systematic, honest.
- Can lead the researcher to "miss the forest while observing the trees."
- Difficult to replicate.

Critical Incident Essays were typed into a word processor and NVivo (QSR International) software was used to help with the development of conceptual themes and categories.

Critical incident. A significant research approach in this study is the use of critical incident methodology. This particular research protocol, developed by a group of psychologists led by John Flanagan during the World War II period, gathered facts concerning employee behavior in defined situations to ascertain reasons for the failure to incorporate specific behaviors and identify what helped or hindered job performance (Christie & Young, 1995). Flanagan (1954) described critical incident technique as embodying a

> set of procedures for collecting direct observations of human behavior in such a way as to facilitate their potential usefulness in solving practical problems and developing broad psychological principles. . . . To be critical, an incident must occur in a situation where the purpose or intent of the act seems fairly clear to the observer and where its consequences are sufficiently definite to leave little doubt concerning its effects. (p. 327)

A current use of critical incident technique in educational research includes critical incident as the reflective focus for analysis which identifies themes related to the cognition and behaviors (Christie & Young, 1995; Coleman, 2002; Fauske, 2002; Stitt-Gohdes, Lambrecht, & Redmann, 2000; Wasson & Jackson, 2002;

Woolsey, 1986). Brislin (1993) asserted that one of the guidelines to understanding culture is that it becomes clear in "well-meaning clashes" and difficulties people face during intercultural interactions can be captured in critical incidents. Mezirow (1991) described how we remember those incidents that are most associated with an emotion. Critical incident technique will serve two functions in this study: the focusing tool for the phenomena being studied and as an intervention.

Interaction between the researcher and pre-service teachers in this study was collaborative in nature and was noted as an intervention. Qualitative research is a "complex interplay" between researchers and participants (Marshall & Rossman, 1999). It is important to understand how in this case. By asking the pre-service teachers to reflect and describe a critical cross-cultural incident, the researcher is asking the participant to focus and reflect specifically on cross-cultural incidents in their student teaching practice. Reflecting on, or assessing one's thinking behind an action can lead to greater metacognitive awareness and intentionality in behavior, including the behavior of integrating cultural sensitivity into practice. It is this metacognition, explicit reflection on and understanding of one's own actions, which forms the nucleus for structuring the activities of data collection with the pre-service teachers under study. In addition, during the focus group process of this study; the researcher offered suggestions or answer questions from the participants.

Ethical principles were addressed by:

- Getting informed consent from all participants (Please see Appendix C)
- Getting prior approval for a Human Subjects.

- Providing honesty and trust on the part of the researcher.
- Providing privacy, confidentiality and anonymity for all participants.
- Maintaining research integrity and quality.

Summary of Data Collection, Analysis

A *study group population* of 18 mathematics and science student teachers was studied to determine aspects of their beliefs toward multicultural teaching practices.

Data sets were collected from two sources

- *Critical Incident Essays*: An essay by each pre-service teacher in the study group population describing a personal "critical incident" relating to a cross-cultural issue.
- *Focus Group Transcripts*: transcripts of three focus groups, in which a total of fourteen of the student teachers in the study group population collectively discussed their experiences and beliefs about cross-cultural multiculturalism, on topics suggested by critical incidents they identified.

Categories and themes were extracted from the data by *Category & Theme Analysis* following a triangulation process, in steps:

- *Manual Categorization* from essays and focus group transcripts,
- *Computerized Categorization* of both essays and focus group transcripts, and
- Generation of categories and themes

- *Professional Review* of the derived categories to further rationalize categories and themes, and increase accuracy and consistency with established literature

Figure 1 depicts an overview of the study methodology. This study uncovered themes occurring in the data, and organized those themes in terms of a conceptual framework which represents the essence of the sense of self of the research participants.

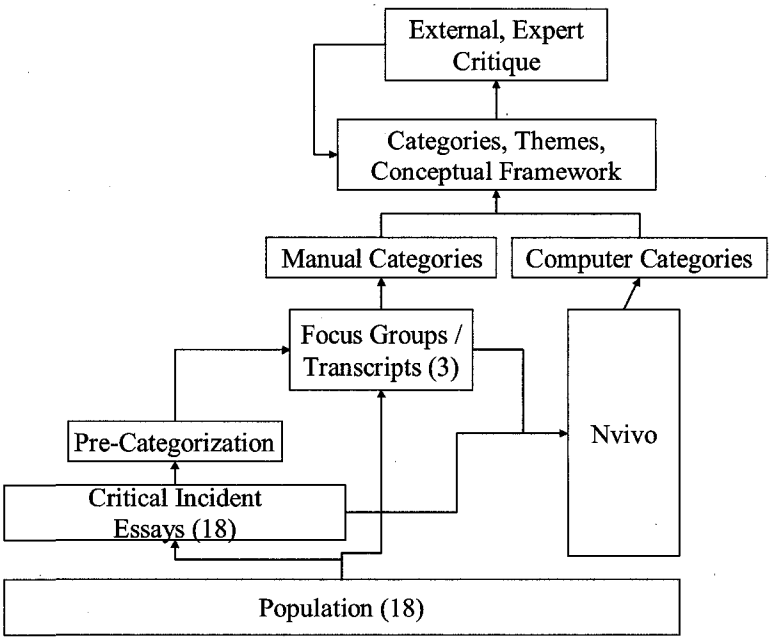


Figure 1. Summary of data collection and analysis methodology.

Data

This phenomenological study produced and analyzed data sets from two sources: critical incident essays and focus group transcripts.

Critical incident essays. The first data set consists of "critical incident" essays, one written by each pre-service teacher in the study group population. While seated in front of a computer, each pre-service science/math teacher was given a coded computer disk that contained two word documents; the demographic questionnaire (see Appendix A) and the Critical Incident Essay (see Appendix B). Students were informed they would have one hour to complete the Critical Incident Essays. After completing the Critical Incident Essays, they completed the demographic questionnaire. They were informed they would be timed, and were alerted 10 minutes before expiration.

A preliminary analysis of the critical incident essays suggested some *broad categories* to help guide discussion in the focus groups. This is depicted as "Pre-Categorization" in Figure 1.

Focus group transcripts. After the Critical Incident Essays and demographic questionnaires had been completed, the pre-service science teachers were invited to participate in focus groups. Fourteen of the eighteen study group participants were able to participate; they were scheduled into groups of 3, 4 and 7 pre-service teachers. Each group included the researcher who acted as the facilitator, responsible for maintaining the integrity of the focus group, keeping it focused and moving.

Following an established focus group protocol (see Appendix E), the pre-service science/math teachers were encouraged to dialogue about the emerging categories determined from the critical incident essays. The phenomenological

interview process is based on the thought that the essence of the participant's experience would begin to emerge and integrate into the dialogue process. The participants were allowed to take the conversation in any direction that they wished for the first 60 minutes in a semi-structured design as outlined in the focus group protocol. The second portion of the session (30 minutes) was directed toward focusing the group on topics that this researcher believed to be important to the development of this study. The focus group sessions were video-taped and transcribed into text. The researcher took general notes and noted key responses in each interview.

Effort was taken to provide an atmosphere of emotional safety, so that participants would be more inclined to share personal, potentially hurtful or embarrassing, thoughts. A minimal amount of structure was imposed on the focus groups. The "Pre-Categorization" from the Critical Incident Essays, as well as the research study questions, were used to guide focus group discussion, particularly during the last 30 minutes.

Results from the first focus group were used to validate and fine-tune the pre-categories. Then the fine-tuned pre-categories were used to guide the second and third focus groups in the manner described above.

After conducting all three focus groups, the video and audio records were transcribed, yielding textual transcripts. Those textual transcripts became the second data set, and were subjected to further analysis, described below.

Category and Theme Analysis

Both textual data sets (the critical incident essays and focus group transcripts) became the basis for further analysis. The purpose of that analysis is to extract codes, categories and then themes which would lead to the essence of the pre-service science teachers' experience and illuminate beliefs about multicultural practice in mathematics and science, as reflected in the textual data. Data analysis and category and theme extraction takes guidance from Moustakas (1994), Giorgi (1997) and Harry, Sturges, and Klinger (2005). The written narrative resulting from the pre-service teachers' description of the critical incidents was intended to help answer the central questions, as well as the following related questions.

How does the pre-service science teacher:

- (Awareness of cultural bias) describe possible bias introduced by their own cultural influences.
- (Empathize with different cultural perspectives) describe perceptions that may be held by others of different cultural backgrounds other than their own.
- (Sense of self, independent of culture) describe a sense of self that is less vested in a particular set of cultural beliefs.

Analysis was an on-going process from initial data collection through crosscheck procedures. Typical analytic procedures uses, for example: (a) organizing the data; (b) generating categories, themes, and patterns; (c) coding the data; (d) testing the emerging understanding; (e) searching for alternative explanations; and (f) writing of the report (Marshall & Rossman, 1999). Of

particular note, the framework of Harry et al. (2005) also proved useful, and provided a framework for organizing and describing the findings.

Phenomenological data analysis according to Patton (2002) includes: (1) Epoche: the researcher clears preconceptions and presuppositions and consciously sets them aside; (2) Phenomenological reduction: the researcher separates or "brackets" restrictive aspects of the researcher's lived experience; (3) Textual portrayal of each theme: a description of experience; (4) Structural Synthesis: the development of the true meanings of the experience.

Giorgi (1997) encouraged the organization and expression of raw data into disciplinary language. Potential coding schemes include types of beliefs, values and assumptions about self/other and subject/object. It was expected that codes would change and develop as the data analysis continued.

Such interpretation is unavoidably subjective, but subjectivity can be minimized by "triangulating" – analyzing the data from different perspectives, favoring reinforcing factors and filtering spurious factors. The methodology used in this study uses three perspectives (over data collected from two vantage points) to analyze themes:

- Manual Categorization
- Computerized Categorization
- Professional Review

The phenomenological methods in this section provided a structure for this investigation. The steps of the data analysis were derived from Moustakas (1994)

and Giorgi (1997). In this methodology, the researcher uses a heuristic phenomenological process as described by Moustakas:

- Immersion: is involved in the world of the experiences.
- Incubation: allows a space to develop where awareness, intuitive or tacit insights, and understanding can emerge.
- Illumination: an active knowing process to expand the understanding of the experience.
- Explication: a process of reflective actions
- Creative Synthesis: meaningful units are brought together to show the patterns and relationships.

Manual categorization. "Cut / Cluster" Categorization is a technique commonly used to determine factors for consideration arising within the group. Typically a researcher will "brainstorm" on a subject, to capture individual factors or considerations relating to the subject at hand. This usually generates a large number of factors.

The same factor might be suggested by multiple participants, perhaps named differently. Or slightly different, but related, factors might be named.

Then, typically the researcher will "cluster" the various factors (often by moving them around on a wall, or whiteboard, typically with each factor on a "sticky"). Similar factors are placed in a "cluster" and separated from other clusters of similar factors. This process tends to uncover the categories embedded in the researcher's awareness of the subject matter.

In this study the manual categorization technique was used on the textual data from both data sets: critical incident essays and focus group transcripts.

Critical incident essays were read first, and the most salient points were highlighted. If the essay's author seemed to indicate emphasis, that was weighed heavily (in vivo codes). Once key phrases and thoughts were highlighted, they were cut out from the text, and treated thenceforth as though they were on "stickies." Cut-out factors were then clustered and names were synthesized, or inherited, for each cluster.

As described in the "Focus Group Transcripts" section above, this Pre-Categorization was used to provide some structure for the discussion of the first focus group. A refinement of that pre-categorization, integrating some of the thoughts from that first focus group then provided corresponding structure to guide the ensuing second and third focus group discussions.

The three focus group transcripts themselves were then also subjected to manual categorization. As before, the transcripts were read, and key thoughts or factors thought to bear on attitudes toward multiculturalism were highlighted, and then cut out. As before, a cluster analysis then produced a refinement of the Manual Categorization. The pre-categorization influenced the Manual Categorization to a degree, but because the focus groups illuminated the subject area from a different angle, new themes appeared or were refined. Manual Categorization represents the first of three (triangulated) perspectives.

Computerized categorization. The second view of categories and themes occurring in the data sets was generated using a computerized text analysis tool, NVivo 7, from QSR International (2007). From QSR's website is the following description of the purpose of NVivo:

> ***What is qualitative research?***
>
> *Qualitative research seeks out the 'why', not the 'how' of its topic through the analysis of unstructured information – things like interview transcripts and recordings, emails, notes, feedback forms, photos and videos. It doesn't just rely on statistics or numbers, which are the domain of quantitative researchers.*
>
> *Qualitative research is used to gain insight into people's attitudes, behaviors, value systems, concerns, motivations, aspirations, culture or lifestyles. It's used to inform business decisions, policy formation, communication and research. Focus groups, in-depth interviews, content analysis and semiotics are among the many formal approaches that are used, but qualitative research also involves the analysis of any unstructured material, including customer feedback forms, reports or media clips.*
>
> *Collecting and analyzing this unstructured information can be messy and time consuming using manual methods. When faced with transcripts, emails, pictures, diaries and audio or video material - finding themes and extracting meaning can be a daunting task.*
>
> ***What is qualitative research software?***
>
> *Qualitative research software helps people to manage, shape and make sense of unstructured information. It doesn't do the thinking for you; it provides a sophisticated workspace that enables you to work through your information. With purpose built tools for classifying, sorting and arranging information, qualitative research software gives you more time to analyze your materials and discover patterns, identify themes, glean insight and develop meaningful conclusions.*

NVivo 7 was applied to both data sets from this study: Critical Incident Essays and Focus Group Transcripts. Even though the raw data was the same as

that considered by Manual Categorization, the use of this software tool and another pass over the data from a different perspective helped to uncover new categories and to see things from a slightly different perspective. This "constant comparison" is a key element of generating and rationalizing categories in phenomenological studies. The NVivo Categorization represents the second of three (triangulated) perspectives

Category rationalization. Preceding sections described the data sets (Critical Incident Essays and Focus Group Transcripts) and the approaches used for category analysis (Manual Categorization and Computerized Categorization). Categories were generated by both of these approaches. As expected, there was some commonality in results from both approaches, but also differences.

Reconciliation of categories generated by different approaches was then needed. That process was somewhat subjective and iterative, as described in Harry et al. (2005). A process of "constant comparison" was used, producing successive refinements of categories and their relationships to the data and to each other.

A deep understanding of the subject domain is helpful for seeing relationships between categories. Categorization and category rationalization was performed over a period of months, primarily by the author as a background activity, with professional review by a colleague, and a consultant.

Theme Development and Validation

This has been a complex study. The subject matter (experience of sense of self) can only be studied indirectly, because it is internal to the pre-service teachers,

and because it only becomes visible to the degree they are aware of and willing to share those experiences.

The problem of getting some visibility into that internal experience also becomes a problem of seeing from multiple perspectives. So there has been an attempt to look at the data from multiple perspectives at many levels:

- Two perspectives at the level of data: critical incident essays and focus groups
- Two perspectives at the level of open coding: manual and computerized categorization
- Multiple passes at the levels of categories and themes, from different vantage points: the research question itself, the frameworks of Kegan and Britzman, trying to separate concepts by type and level, and from reflections from the conceptual framework.
- During this phase of the study, the researcher was principal of a large multicultural middle school, so was also seeing the data from the perspective of practitioner, as well as researcher.
- To add to the confidence in the framework, a outside consultant was retained to review the finding with fresh eyes.

Conceptual Framework Formulation

The phenomenological data analysis included the process of clearing the researcher's preconceptions and presuppositions and consciously setting them aside. Because there was a four year gap from data collection to conceptual framework formulation, this was not a difficult process to follow. The epoche of the study became known to the researcher after the following process.

As themes and explanations being to emerge, they tended to acquire an apparent interconnectedness. Some themes amplified others, while some opposed others. Some causal relationships were suggested. The framework however came to the researcher in an instance of awaking early one morning in its clarity. The emergent themes were organized into a framework. With further research a model might begin to suggest new lines of investigation or might become predictive.

The framework presented here to illustrate the interconnectedness of the categories and themes emerging from this study is used primarily to help organize the results.

Professional Review

The categories and themes emerging from the study were formulated by the author in a series of passes, spanning months.

It is important to acknowledge that researcher background can lead to deeper insights into the data, and can produce a categorization which is both more accurate and more aligned with research terminology. Researcher bias is also possible, although it was minimized by reviewing categories and themes with a consultant.

Author. The author's background and experience in science teaching and multiculturalism is relevant here. The author is a female from a multicultural family (Japanese-American). She has taught a range of secondary science subjects: Biology, Chemistry, Physics. She has led several cohorts of pre-service secondary teachers, including for a short period of time the study group of secondary pre-

service science teachers was drawn, and data collected, in 2003. Since then, she has been principal of a large, heavily multicultural, mostly Hispanic middle school.

Consultant. The consultant retained for the study is an independent consultant in program evaluation; she also teaches graduate classes in research methods, qualitative methods, program evaluation, statistical programming, and lifespan development at a major state university for the Department of Applied Statistics and Research Methods and the Department of Educational Psychology. She has a Ph.D. in Educational Psychology specializing in research methods, measurement / assessment, program evaluation and statistics.

She has completed over 40 program evaluations for clients, made more than 40 presentations at national conferences, published articles in several different fields, and authored three books. She has served on 25 dissertation committees and has consulted with another 40+ doctoral students in fields including: special education, educational leadership, human rehabilitation, educational psychology, school psychology, chemistry education, biology education, and others.

Demographics

Table 1 contains the raw demographic data from the study group. Column headings are abbreviated: "#" is the *number* of multicultural courses participants in the study have taken; "Imp" is the relative *importance* they attach to such courses (1-5 max), "Int" is the relative *interest* the pre-service teachers have in such courses (1-5); "Skl" is their self-assessment of their own multicultural teaching *skill* (1-5).

Table 1

Demographic Data

Name	Age	Sx	Race	Area	Lvl	#	Imp	Int	Skl
Steve	34	M	White	Math	Mid / High	2	2	4	4
Carrie	26	F	White	Math	High Sch	2	3	4	4
John	39	M	White	Science	Mid / High	1	5	4	3
Paul	36	M	Asian	Math	High Sch		5	2	4
Patty	39	F	White	Math	Mid / High	3	1	3	6
James	26	M	White	Science	High Sch	2	3	4	4
Mary	23	F	White	Math	Mid / High	3	3	4	4
Holly Anon1	37	F	White	Science	Mid / High	1	3	4	5
Kit	24	F	White	Science	Mid	1	5	5	5
Scott	34	M	White	Science	Mid / High		4	4	4
Robert	54	M	White	Math / Sci	High Sch	1	4	4	4
Janice	28	F	White	Science	Mid / High	3	3		3
Gina	30	F	White	Science	High Sch	2	3	3	4
Jen	28	F	White	Science	High Sch	6	3	4	5
Alan	29	M	White	Science	High Sch	3	4	4	4
Vivian Anon2	40	F	White	Science	High Sch	...	3	4	3

Of the 18 pre-service teachers participating in the study, 16 completed the demographic questionnaire. Statistics cover those who answered each of the various questions. Of the 16 participants:

- Average age was about 32. 7 were male; 9 were female
- 15 Caucasian, 1 Asian-American. One "demographic data missing" student was Jamaican-American.
- 11 taught science and math, 5 taught math only, all secondary
- They had taken an average of 2.3 courses related to multicultural teaching
- On a scale of 1-5 (highest), the value they attached to multicultural teaching proficiency was 3.4 and their interest was 3.6

- On a scale of 1-5 (highest), they judged their competence at multicultural teaching at 3.6

The study group participants were all part of the same cohort, and had taken one course in multicultural teaching as part of that pre-service education program. The importance of multicultural teaching proficiency for this particular cohort was emphasized as it related to the teacher education program and to their future roles as educators. The average proficiency (self-assessed) slightly above average cultural competency of the group is probably higher than an objective observer would measure.

Organization of Findings

This section describes the findings of the study. They are organized in a manner influenced by Harry et al. (2005), which provides an exemplary framework for phenomenological studies:

- *Open Codes*

  Tags associated with raw textual data (Critical Incident Essays and Focus Group Transcripts) are called open codes. What is tagged, how it is tagged, and the relative weight of those tags are all somewhat subjective. Often important items are identified by writer or speaker (in vivo codes). At other times, the researcher brought her own understanding and interpretation that helped with the tagging. These tags on raw textual data were voluminous. They are not included, nor organized here. The open codes were then organized into Categories.

- *Categories*

  Open codes were reviewed, compared and contrasted to identify

common features among them, and then "clustered into conceptual categories." Categories stemming from combination of manual categoritzation and computerized categorization are discussed in the section below entitled "Categories." As categories emerged and were refined and adjusted, they begin to coalesce into interrelated stories, or Themes.

- *Themes*

  Themes are broader storylines or frameworks that begin to add coherence or integrity to the collection of categories. This was the next step in adding meaning, or rationalizing meaning, implicit in the categories themselves.

- *Theme Validation*

  Themes that begin to emerge are influenced by the researchers' own frames of experience. They can also be suggested by existing research on the problem domain or aspects of it. Reconciling the themes with established research is discussed in chapter 5.

- *Interrelated Explanations*

  Themes emerging from categories began to acquire interconnectedness. As these interrelationships were uncovered, a conceptual framework suggested itself. Such a framework became useful as a repository for themes uncovered by phenomenological studies.

- *Theory*

  Eventually, such a conceptual framework might be formalized as a theory, validated and used for prediction, but that step is beyond this scope of this study.

Figure 2 depicts the levels of discourse in this phenomenological study and relates them to findings.

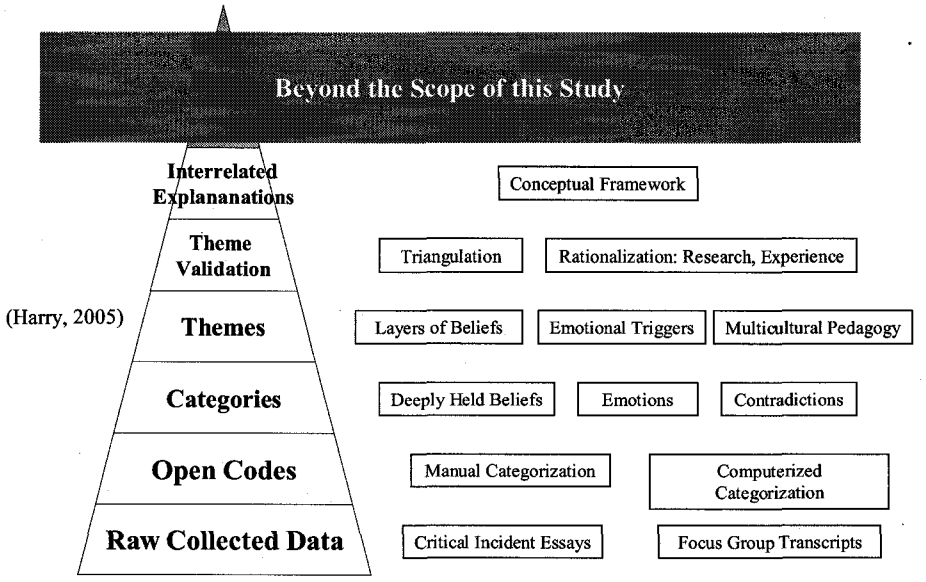


Figure 2. Levels and kinds of findings.

CHAPTER IV

FINDINGS

This section describes the key findings of the research, organized according to the framework depicted in Figure 2.

Categories

This section summarizes the first level of findings - categories. Data collected from the study group included 18 critical incident essays and transcripts from 3 focus groups. All of that textual data were subjected to a manual categorization process (cut/cluster) and to a computerized categorization process (NVivo). The resulting raw categories were compared and contrasted, over periods of months, through the lens of the questions posed by this study, frameworks of Kegan and Britzman, and the researcher's academic training and experience.

Three major categories emerged:

- Deeply held beliefs
- Emotions
- Multiculturalism

All codes and categories (from manual and computerized categories) were examined and collected in Excel files. The first file (see Appendix G) placed the codes within categories; it has been further reduced in the three main categories described below. The second file tried to extract some expression of pre-service

teachers' emotions; it has been further reduced in the section below entitled "Emotions." The third file examined the themes and extracted the essence through examples of conflicts and contradictions in thought processes."

Deeply Held Beliefs

Codes appearing in this category section were related to beliefs which were later placed in sub-categories.

- Importance of cooperation
- Ethic of caring and support
- Belief in freedom of belief,
- Belief in freedom of expression
- Value of relationship-based teaching
- Respect for others
- Importance of advocacy for others
- Everyone can become who they want to be – "American Dream"
- Tolerance for others
- Belief in "right answers" and "doing the right thing"
- Trust in competence, experts and authority
- Belief in their own intelligence / "*superiority*" because of subject *difficulty*

Emotions

This category section captures the emotions uncovered from the essays and focus groups as a list of example codes:

- Urge to separate from emotion
- Trouble describing emotional state
- Feeling emotions could "destroy" them
- Hate feeling angry
- Don't like disliking others
- Don't like feeling unprepared
- Don't like feeling inexpert
- Many "should have dones"
- Like feeling of belonging
- Like seeing students helping each other

Multiculturalism

Codes placed in this category were related to how the pre-service science teachers talked about multiculturalism in different topic areas.

- Multicultural skills/training, SIOP (Structured Instruction Observational Protocol)
- Variety of instructor's ethnic perspectives
- Diversity of students during student teaching experience
- Lack of multicultural teaching practice in schools
- Cultural clubs, activities, dances in schools
- Language support for students
- Difficulty integrating multiculturalism in science/math
- Hyperawareness of ethnicity

- Discussion of superficial multicultural practices such as bringing in books about ethnic scientists

Themes

Layers of Deeply Held Beliefs

As the collection of deeply held beliefs was examined further, the categories with corresponding codes began to "stratify" according to patterns. A structured theme for those deeply held beliefs emerged, with all belief categories accounted for in some layer of a pyramid of deeply-held beliefs" (see Figure 3).

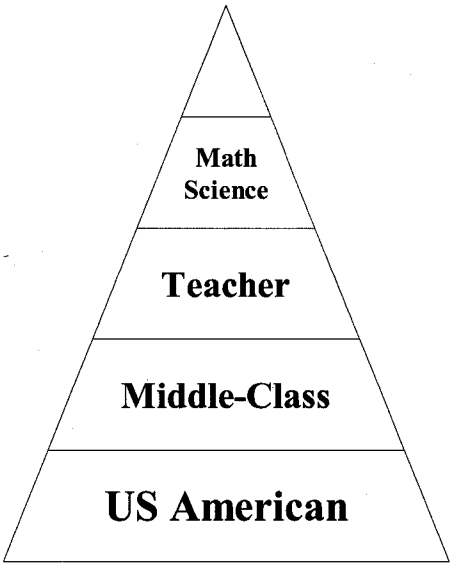


Figure 3. Layers of deeply-held beliefs.

There are four layers in the Pyramid:

- US American values and beliefs
- Middle Class values and beliefs

- Teacher values and beliefs
- Science/Math values and beliefs.

U.S. American values and beliefs stem from American ideals, principles, culture and teachings. They included primarily:

- Equality (contrasted with equity)
- Equal opportunity
- Tolerance of diversity
- "American Dream" (Everyone can become who they want to be)

Middle-class values and beliefs stem from American middle class perspectives and behavioral norms, including:

- Desirability of cooperation and harmony
- Freedom of belief, freedom of expression
- Importance of mutual respect
- Impropriety of showing emotion

Teacher values and beliefs stem from the teacher culture, and include:

- Value of learning
- Importance of caring, support and advocacy
- Importance of relationships to teaching

Science/Math values and beliefs derive from the pre-service teachers' subject areas. All of the participants had substantial background in their respective content areas. There are fifteen principle findings in this study. Each finding is designated as it is described in the text by [Finding #n]. The findings are

summarized at the end of this chapter. [Finding #1] The collection of values and beliefs proved to be the source of some conflict with multicultural teaching pedagogy (discussed below in section "Deeply Held Beliefs vs. Multicultural Pedagogy"). They included:

- Preference for black and white; belief in "right" answers
- Belief in doing the "right" thing, following the rules
- Distaste for uncertainty
- Trust in experts and authority
- Belief in their own intelligence and "superiority" because of subject difficulty

Emotional Triggers

A framework began to emerge to capture some of the emotions described by the study group participants in their critical incident essays or focus groups. A diagram for capturing the array of emotions toward the people pre-service teachers dealt with was adopted, dubbed "360-Degree Emotions Inventory" (see Figure 4). It depicts the "others" or objects with which the pre-service teachers interacted, and which contributed to the triggering of emotional responses.

The classification of these emotions fell into two groups: emotions toward "others," and emotions toward self, reflected in the two diagrams below. The diagram capturing emotions toward others divides the set of "others" into subsets: (a) peer teachers, (b) students, (c) mentor teachers, (d) university/authority representing professors, and. (e) community and school staff including

administration. The diagram capturing emotions about self was broken down according to whether those emotions were more internally generated, or reflections from others.

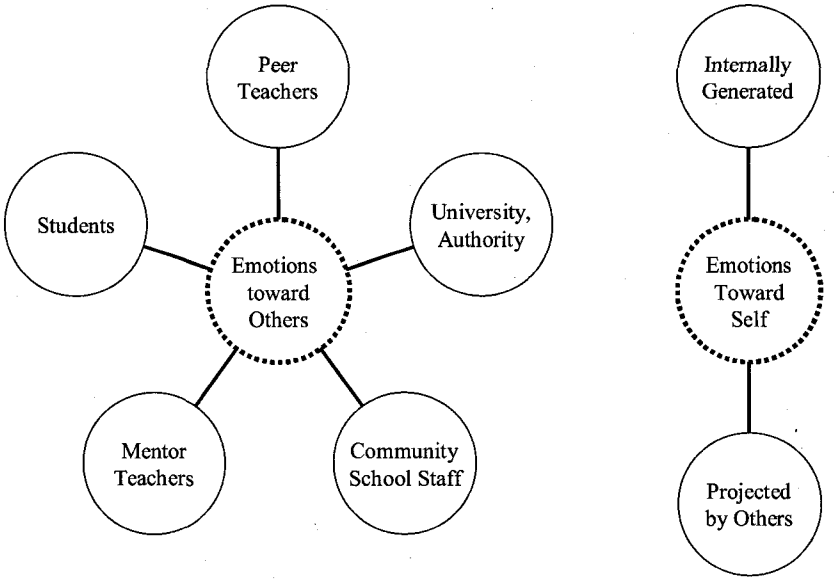


Figure 4. 360-degree emotions inventory.

In general, pre-service teachers had both positive and negative emotions about "others." The array of emotions attached to each of the groups is depicted in Figures 5 and 6. Emotions associated with mentor teachers and students are represented in the two diagrams in Figure 5, and emotions associated with authority, peers and community are represented in the three diagrams in Figure 6. If the emotions are mildly negative, they are indicated in stippled shading. Very negative emotions are indicated in hatched shading.

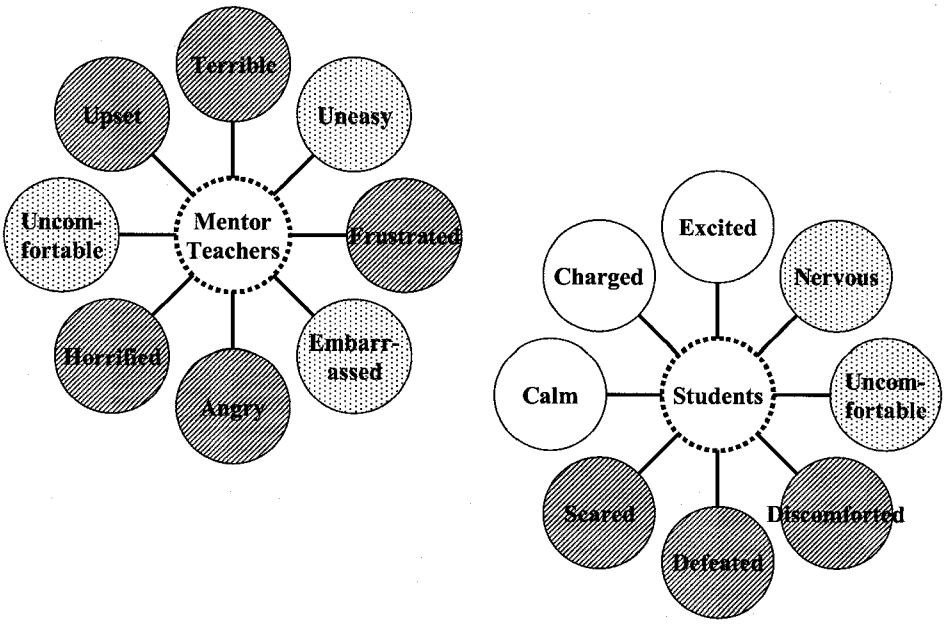


Figure 5. Emotions inventory: Mentor teachers and students.

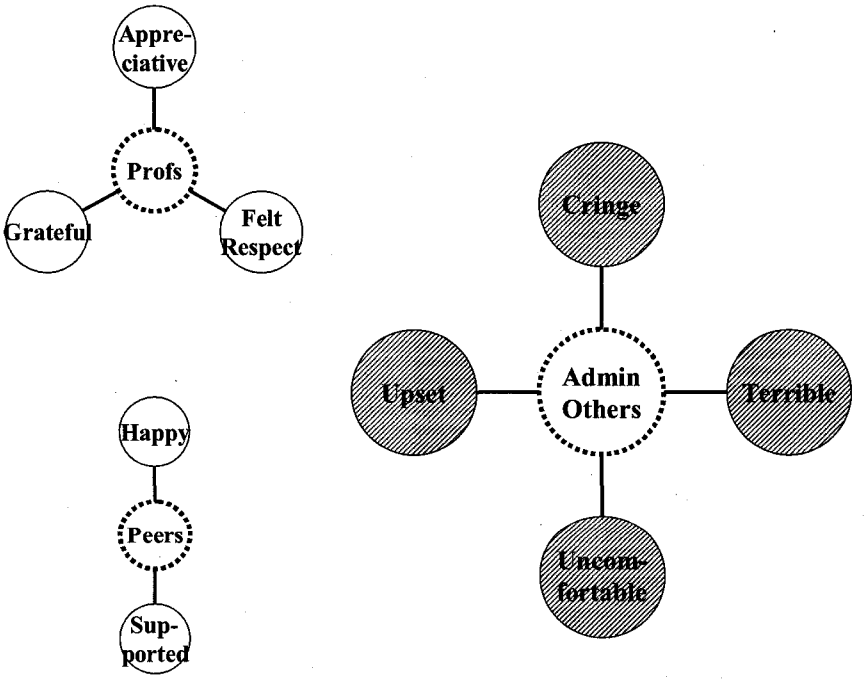


Figure 6. Emotions inventory: Peers, profs, admin.

[Finding #2] Emotions felt about mentor teachers were generally more on the negative side. Some of those emotions (embarrassed, uncomfortable, and uneasy) might be attributed to the situation. Pre-service teachers are in training with their mentor teacher. Pre-service science teacher performance is evaluated in order to graduate from the teacher education program. That might lead to a certain amount of performance anxiety or fear. In addition, however, there were some much stronger emotions (terrible, frustrated, angry, horrified, and upset). [Finding #3] Many of the emotions stemmed from incongruence with deeply held beliefs from the categories described in section above with what they encountered in the schools. The rarity or absence of the kinds of instruction or interactions expected with students seemed to generate dissonance with theories and ideas they had learned in coursework; the conflict situations generated strong emotions.

Emotions about students were mixed. Some emotions (calm, charged, excited) could be expected, since these pre-service teachers were getting their first opportunity to apply what they have learned. Others are more apprehensive (nervous, uncomfortable, discomforted, scared, defeated), possibly from any number of factors. These factors might include feelings of alienation, lack of readiness, a feeling that students are not responding as they are "supposed" to.

[Finding #4] Science/math teachers especially value expertise and competence, so the generally positive emotions (respectful, grateful, and appreciative) toward their academic professors seemed to be congruent.

Similarly, science/math teachers feel a certain kinship with each other specifically, and with fellow pre-service science teachers more generally. The connection is generated partly by the notion that math/science teachers are members of an elite club, and are going through similar experiences in their teacher education program. This is evident from the feelings the described in relation to their peers (happy, supported).

[Finding #5] Pre-service science/math teachers also felt mostly negative emotions (upset, cringe, terrible, uncomfortable) in relation to school staff and community. This could be partly because, as with mentor teachers, there is some apprehension due to performance anxiety, or because the school does not manifest best practice as they learned it, or they met situations that were incongruent with expectations based on their deeply held beliefs.

"I reacted very internally. I just nodded my head, but I was horrified. I tried for the next several weeks to get out of my student teaching assignment but to no avail" (Alan).

"As far as my emotional state, I was first extremely upset that I would hear that word. However, I held my temper and tried not to let my anger show" (Jen).

In the case of community it could be because of parenting problems, or a lack of experience working with parents. Similarly, limited relationship building exists with school staff. The feeling of safety, support and relationship that they felt with peers is absent.

Multicultural Pedagogy

This study focuses on the sense of self of pre-service teachers in multicultural science teaching. All of the study participants had taken some standardized coursework in multicultural teaching, sometimes embedded other courses in education. [Finding #6] The lack of discussion and data in multicultural practices is notable in itself, especially when this particular cohort was intended to have an additional emphasis of multiculturalism reinforced in their course work. In addition, they were told they were a cohort that was supported in part by a National Science Foundation grant that had a goal of closing the achievement gap between ethnic minority and majority students. Students did express their opinions on the lack of emphasis of multicultural education in their coursework.

> I would have liked to see it drawn more into all of the classes. So like, we had reading and writing content areas and there wasn't any focus on multiculturalism education in that situation. Even the classroom attitude ya know there wasn't that kind of focus as far as ya know culturally speaking, cause I think its really important that. (Holly)

The multicultural teaching courses the pre-service science teachers took emphasized the need to understand different cultural backgrounds of students, potentially different learning styles as well as different achievement levels, and the need for differentiated instruction as an integral part of classroom practice.

[Finding #7] The data collected from the pre-service science teachers did not reflect essential multicultural concepts from those courses that may have included these types of concepts and practices. We can nevertheless gain a little insight from the demographic data regarding multiculturalism. [Finding #8] The

data did indicate a low to neutral interest in continuing their professional development in multicultural theory and practices.

[Finding #9] The lack of un-prompted discussion of multicultural practices was glaringly noticeable through the process of gathering the data. When the researcher became aware of the lack of discussion, questions were added during the focus groups in an attempt to capture their beliefs and thoughts about multicultural practices.

[Finding #10] In the analysis of data from pre-service science teachers' discussion with prompting questions, the class/program discussions seem to center on skimming the surface of the body of knowledge about multicultural practices. The only multicultural practices they mentioned were SIOP and bringing books about ethnic minority scientists into the classroom. Excerpts include:

"----. I don't think we talk much about how you implement, other than, like the SIOP training" (Carrie).

"I got this book about African American scientists and I want to have that available in my classroom" (Janice).

[Finding #11] here was little evidence or data to support that the pre-service teachers had integrated multiculturalism into their own practices and it seemed to be covered on a superficial level. Topics that seemed more critical to the pre-service science teachers were their hyperawareness of diversity/ethnicity and the lack of experiencing multicultural teaching practices in their field experiences.

"They would do like definitely do cultural things then, and cultural dances and things of that sort. Lots of dances from different cultures" (Mary).

Multicultural competence self-assessment. Although a complete evaluation of cultural competency not available, it seemed as though as a group, [Finding #12] the pre-service teachers rated themselves more highly in multicultural teaching capability than their actual skill level.

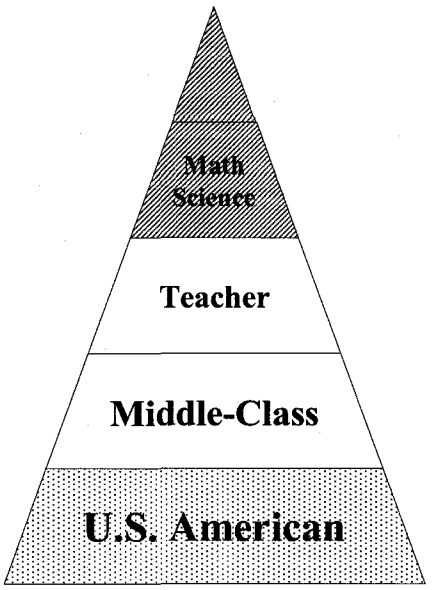
Conceptual Framework

For the purpose of analysis, the researcher constructed a conceptual framework to link the themes from the data with the essence of the category sense of self for the pre-service science teachers. This conceptual framework might be thought of as a relational model of how all the themes seem to have a common element. Shields and Tajalli (2006) have identified conceptual frameworks as one way to frame the related concepts of a research project into a working hypothesis or explanation of existing data. This next section describes a conceptual framework of interference as the common relational piece between the three themes: Deeply held beliefs, Emotional Triggers, and Multicultural Pedagogy.

Deeply Held Beliefs and Teaching Pedagogy

The section above entitled "Layers of Deeply Held Beliefs" introduced the pyramid and attributed different sets of belief to each level (see Figure 3). As the categories were reviewed, sorted and interrelated, [Finding #13] conflicts began to appear between what the pre-service teachers were taught about best practices and

the body of current educational theory including multicultural practices in their pre-service education program.



- Confusion between equality and equity
- Science/math "absolutism" appears to conflict with "relativism" of multicultural pedagogy

Figure 7. Interference: Deeply-held beliefs vs multicultural pedagogy.

One source of conflict was the common confusion between "equality", a U.S. American value, and "equity", the notion of fair and equitable, though not perhaps equal, treatment of students. Including multicultural teaching demands differentiation, so teachers must have a cognitive understanding of the difference between equality and equity. This is perhaps slightly more difficult for a science/math teacher because of the precise meaning of "equality" in that domain. Because of this conflict, the stratum labeled "U.S. American" is depicted in stippled shading in Figure 7.

[Finding #14] But far more significant and serious conflicts arose between good multicultural teaching practice and deeply held beliefs in the stratum labeled "Math/Science." In particular, the domain appears to predispose pre-service teachers to a sort of absolutism in the way they regard knowledge, learning and teaching. Science/math teachers seem to have a predisposition to right answers, right behavior, rules, certainty, authority, competence, and their own intelligence (and to a degree superiority for mastering difficult subjects). This orientation conflicts with the best practices of multicultural teaching pedagogy, which urges more differentiation in instruction: different goals, measures, instructional techniques, and more of a "different but equitable," more "relativistic" orientation.

This conflict between the desire for an absolutist view of teaching conflicts with multicultural teaching pedagogy, and for that reason the stratum labeled "Math/Science" is depicted in hatched shading in Figure 7.

There may also be an inclination for such teachers to hold tightly to such positivist notions, as they are perhaps tied to their sense of self-worth. There is no intrinsic conflict between good science or mathematics and good multicultural teaching practice, but the resolution of those is nuanced, and more complex.

Emotions vs Multicultural Pedagogy

The preceding section introduced the 360-Degree Emotions Inventory theme and noted that science/math pre-service teachers are beset with emotions of different kinds. Figure 8 consolidates (and somewhat simplifies) that array of emotions into a single view. If emotions about one group are all positive, then that

group is indicated with no shading in the consolidated diagram below. If all emotions about that group are negative, that group is indicated in hatched shading. If results are mixed, the group is indicated in stipple shading.

We can see that the student teachers are beset with a range of emotions, many negative, at a time when it is very important they be forming new beliefs in teaching practice.

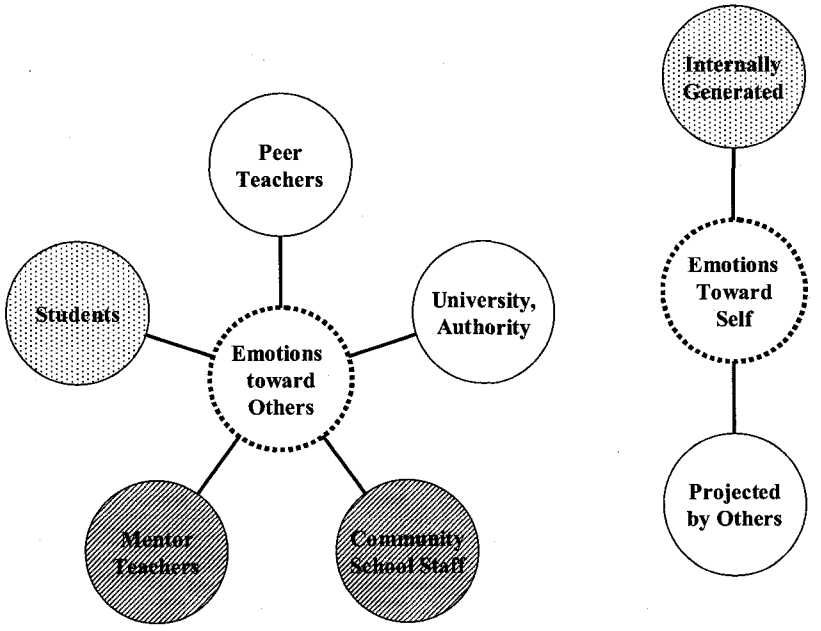


Figure 8. Emotions inventory vs multicultural pedagogy.

Interference Blocks Absorption

A more coherent "framework" which attempts to better interrelate the themes was developed by the researcher to understand the essence of the pre-

service teacher experience. Such a framework does suggest further lines of investigation.

This conceptual framework organizes the themes uncovered by this study in a way which attempts to shed light on pre-service science teachers' "sense of self" in the context of multicultural teaching.

A pre-service science teacher's sense of self is depicted in the large box in Figure 9. Feeding the sense of self is some previous exposure to good multicultural pedagogy (box at top labeled "Theory & Best Practice ..."), including coursework on multiculturalism and theory of learning. The goal of exposing pre-service teachers to multicultural concepts and experiences is that they begin to incorporate those concepts in their practice (indicated by the box at bottom labeled "Best Practice Reflected in Instruction").

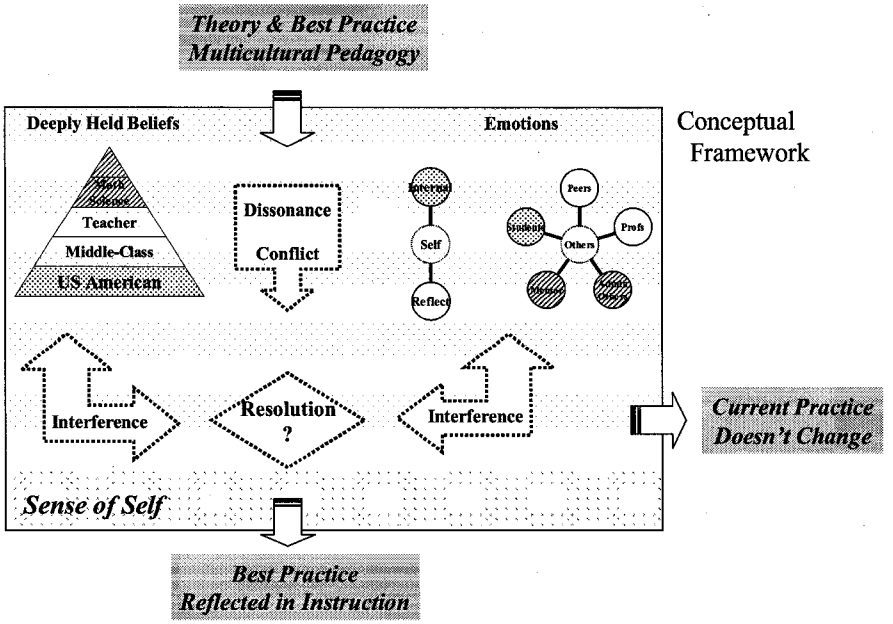


Figure 9. Experience of sense of self in pre-service science teachers.

The theme of "Deeply Held Beliefs" is represented by the pyramid at the left side of the large box. The theme of "Emotions" is depicted in the 360-degree figures at the right side of the large box. The theme of "Deeply Held Values vs. Multicultural Pedagogy" is depicted as the arrow at left and the stippled and shaded strata in the pyramid. The theme of "Emotions vs Multicultural Pedagogy" is depicted similarly as the arrow at right and the stippled and shaded portion of the Emotions Inventory figure. The theme of "Interference Blocking Absorption" is represented in the shunted exit (box at right labeled "Current Practice Doesn't Change").

Examples of Conflicts and Contradictions

From the research, it was very clear that many of the student teachers experienced conflicts and contradictions between their deeply held beliefs and new learning/experiences. These were called out in part by the critical incident essays of the data gathering design. But contradictions also resurfaced in the focus groups, once an atmosphere of some emotional safety had been established.

There were so many sources of conflict and contradictions. Some conflicts arose because of conceptual confusion or conflict between deeply held beliefs, particularly those stemming from the science/math domain and those taught to improve multicultural teaching. [Finding #15] Others seem to arise from psychoanalytic factors: a need for certain self-image or a desire for certain kinds of relationships, contrasted with the demands of teaching as well as the added emphasis on multiculturalism.

Many examples of conflicts and contradictions appeared in the study data, including these characteristic ones:

> It reminds me of the whole sexual harassment thing. Everyone's been trained in it... everyone know the definition of it and what they're supposed to do when it happens. But sometimes, when its just the two of you, you'll make jokes cause you're kind of under the policy. (Steve)

> And because here was this person telling me that everything I believed in was wrong and I went 'wait a second' and here someone who has these beliefs the same beliefs as the person who told me I was wrong, but I can't go against what I believe in. Especially as an authority figure. And especially to this girl. (Holly)

> And I know for me in my particular situation what position does that put me in to respond in these different ways and I ended up really compromising what I felt like should be done. (Scott)

> . . . which in some ways was ok because everybody was treated equally and in some ways it's kind of hard because it doesn't show the opportunities for someone of a different minority, because in one way it says that we treat everyone equally, but in another way its hard because it doesn't show the opportunities that populations might have in the world. (Gina)

> I mean, I think of myself as a tolerant person, but at the same time, I had that expectation of him. I'm not tolerating his... his sort of writing them off, and uh . . . (John)

The themes: conflicts and contradictions, of this section illustrate the conceptual framework of interference that blocks the integration of new knowledge and beliefs. The pre-service teachers' examples above describe how they are able to process contradictions and reduce their dissonance by diminishing the importance of the particular belief in question. By reducing dissonance, in turn their emotions are lessened. This process of interference, I believe, greatly reduced the ability of the pre-service teachers' ability to integrate multicultural practice or to gain the belief of the importance of such practice.

Summary of Findings

The preceding sections discussed the individual findings of this study. Recapitulating in summary form:

(1) Science/math values may have been a source of conflict with multicultural teaching pedagogy.

(2) Pre-service science teacher emotions toward mentor teachers were generally more negative than emotions generated through interactions with other people.

(3) Many of the emotions felt by the pre-service science teacher stemmed from the incongruence with deeply held beliefs and experiences from their student teaching in schools.

(4) Pre-service science teachers value expertise and competence which resulted in positive emotions toward their academic professors.

(5) Negative emotions toward other school staff/ community were felt by pre-service science teachers.

(6) The lack of discussion of multicultural practices and data was notable with a cohort of pre-service teacher that had the added emphasis of diversity issues and multiculturalism.

(7) The data collected from the research did not show that the pre-service science teachers integrated essential multicultural concepts from their coursework.

(8) The research data did indicate a low to neutral interest in continuing professional development in multicultural theory and practice.

(9) In the focus group discussion, pre-service science teachers had to be prompted to discuss multicultural practices.

(10) With prompting, the pre-service science teacher would have a discussion of multicultural practices that skimmed the surface of this body of knowledge.

(11) There was little evidence or data to support integration of multiculturalism into the pre-service science teacher's practice.

(12) The pre-service teachers rated themselves more highly in multicultural teaching capability than their actual skill level.

(13) The data showed conflicts between educational theory including multiculturalism and best practices in schools.

(14) Significant conflicts arose between multicultural pedagogy and science/math cultural beliefs.

(15) Psychoanalytic factors: a need for a certain self-image or a desire for certain kinds of relationships, contrasted with the demands of teaching and added emphasis on multiculturalism.

CHAPTER V

SUMMARY AND CONCLUSIONS

Introduction

This study has focused on the experience of pre-service science teachers who were going through a teacher education program, and a description of their sense of self. By illuminating the beliefs that they hold, insight was gained about the process they went through. Greater understanding is a step toward the improvement of multicultural science education for pre-service teachers. This study was designed to accomplish a two-fold mission: first, to raise questions about multicultural perspectives and biases for the purpose of increasing awareness of tacitly held beliefs; and; second, to provide increased understanding of a conceptual framework for multicultural education of pre-service science teachers in teacher education programs.

The conceptual framework presented in chapter 4 is substantially different from other studies in three ways. First, the study is grounded in phenomenological theory that links the phenomenon to the individuals within the group. Second, it uses the lens of psychoanalytic learning theory to assess the influence of the subconscious mind. Third, the study is also based on adult developmental stage theory which suggests that adults need to undergo critical reflection and critical affective work in order to progress through the stages of development important to

effective multicultural teaching. Most importantly, the conceptual framework is focused on the unique problem of science/math teachers in the process of further developing their multicultural practices.

One central research question was proposed with sub-questions. Primarily, what is the essence of the experience of self (sense of self) for pre-service science teachers who are developing multicultural practice? Secondarily: (a) how aware are they of their own cultural bias? (b) how do they empathize with different cultural perspectives? (c) how independent of particular cultures is their sense of self?. This final chapter will summarize the findings, compare them to the literature review, look at implications and provide suggestions for further research.

Major Findings

Conclusions

The single most important finding of this research project is the phenomenon of emerging internal contradictions or interference that interact with the pre-service science teachers' deeply held beliefs. New knowledge about teaching in general, new experiences with diversity of students and school staff, or the expectation to incorporate multicultural practices bring to the surface corresponding emotions that impede the integration of multicultural concepts. As discussed previously in this study, Britzman (1998) described these internal contradictions as interference and as an essential part of the learning process. These internal contradictions provide a framework for analysis in understanding how the pre-service science teacher's sense of self goes through a process of new learning.

This data provided a description of what the pre-service science teacher experienced and can serve as a starting point for new understanding of how these teachers might be more effectively taught and might learn about multicultural practices. This data from this study showed interference was connected in three main themes: deeply held beliefs (categorized as U.S. American, middle class, teacher, and science/math); dealing with resulting emotions that result from the dissonance and uncertainty; and the lack of accommodation in integrating multiculturalism beliefs into their practices.

Comparison to Literature

A review of the literature at the beginning of this project indicated that science itself was a unique culture and that multicultural teaching practices as a standard for teacher education programs has been difficult to teach, learn and implement. Clearly, the pre-service science teachers in this study struggled with integrating multicultural practices into their student teacher instruction. This was evident from the data from the focus groups' minimal discussion about multicultural practices and lack of interest with furthering their education in multicultural practices from the demographic data collected.

Munby, et al, found that science teachers equated facts and collections of concepts as scientific knowledge. Perry's (1970) research suggested that teachers were experts who provide right or wrong answers and students were those who should memorize the right answers and repeat them back when requested. Results from this study indicate that pre-service science teachers are still influenced greatly

by their own experience in the culture of science. Examples of this study include statements such as P6; "I want them to have correct information, not you know, something I just thought of." P7 said: "Not that you're authoritative, and harsh or strict, but that you are the authority." Interestingly, none of the participants discussed any contradictions in beliefs when it came to their expertise in science or mathematics.

Although there are standards and corresponding outcomes, assessment of cultural competency remains vague. Using M. Bennett's (1993) model, interpretation of the data indicates that this cohort of students were somewhere between a minimization level and acceptance level. In Bennett's minimization level, there is an avoidance of stereotypes and appreciation of differences while maintaining the belief that their values are universal. Bennett's acceptance level acknowledges and respects cultural differences while maintaining a person's commitment to their own values. Specific examples include, P1 saying "So when I came here and saw the focus on multiculturalism, I see something I'm really unused to and I'm trying to put the pieces together to help everybody cooperate." P2 said; "....we also all want to project to our students the tolerance." P3 said; "We have this common American value that everyone is equal..."

Evidence of the next level of Bennett's model would show proactive effort to use one's own knowledge of about cultural differences to improve relationships with culturally different people and the data did not show evidence of this type.

Studies in multicultural teacher education discuss the difficulty in changing teachers' beliefs. Courses in multicultural or diversity studies influenced the teachers' language and awareness slightly, however lesson plans, or teaching practices did not meaningfully indicate a significant shift toward multiculturalism (Bradford & Dana, 1998; Brand & Glasson, 1999; Jennings & Potter-Smith, 2002).

This study concurred with those studies. The enduring nature of teachers' beliefs, even when they uncovered contradictions in their thinking was interesting. The participants described and examined incidents where what they did was contrary to what they believed. Those participants that voiced the uncovered contradiction seemed to treat it as an anomaly and did not delve more deeply into the cognitive conflict or dissonance.

Dirkx (2001) reflected on the part that emotions play in learning experiences. In this study, the participants' choice of words showed the powerful feelings and emotions they felt as they went through the program. The types of words they used to describe the emotions they felt about themselves and others were very different. In addition there was differentiation in the types of emotions they felt when the others were their students or other adults, predominately mentor teachers or other staff in schools. In this case the pre-service teachers used words such as horrified, angry and frustrated toward adults and excited, nervous, and calm toward students. As the pre-service teachers went through the teacher education program they experienced a multitude of emotions.

In Kegan's (1994) model transformation of someone's sense of self or identity from third to fourth orders is not an instant movement and cannot be realized in a short period of time. Instead it takes more time, and even in some instances a grieving process may have to be endured before the transformation is complete. The reason for this is that it is difficult for someone to give up on values they have lived with all their lives. This is true even when those values are stifling people's development and directly contributing to the amount of emotional pain that they endure.

Kegan's (1982) described how normal people can feel confused and conflicted when confronted by the many stressful social demands that get placed upon them, many of which they are not (yet) prepared to comprehend. In Kegan's (1994) way of thinking, people exhibiting a third order consciousness remain embedded in and takes for granted (cannot easily examine and criticize) the values/beliefs they learned as they have picked up along the way.

Britzman's (1998) theory views learning as interference of conscious thought by the unconscious and the psychic conflicts that result. Our daily, disturbing inside-outside encounters are carried on at subtle levels, and we draw on many strategies to ignore them. Although the unconscious cannot be known directly, its workings interfere with our intentions and our conscious perception of direct experience. The data in this study indicated that the majority of the pre-service teachers were experiencing interference. For example when P5 said:

> . . . in some ways was ok because everybody was treated equally and in some ways it's kind of hard because it doesn't show the opportunities for someone of a different minority, because in one way it says that we treat everyone equally, but in another way its hard because it doesn't show the opportunities that populations might have in the world.

This participant identified a contradiction in her thinking, however, did not press forward with working through the conflict between the two beliefs. Britzman (1998) called this phenomenon, "lost subjects," those parts of our selves that we resist and then try to reclaim and want to explore but are afraid to. Huberman and Miles (1994) indicated that a person needs to experience the cognitive dissonance for a period of time for long lasting change in beliefs to take place. In the case of this study, I believe that the participants may have reduced the dissonance through reducing the importance of the dissonant cognitions.

Implications for Theory and Practice

Limitations

This study attempted to address some of the gaps in the literature relating to assessing the deeply held beliefs of pre-service science teachers going through a teacher education program. This researcher believes that in order to improve teacher education programs for science/math teachers in incorporating new knowledge about multicultural practices, there is a need to understand what the group of pre-service science/math teachers' over all sense of self and collective deeply held beliefs are. The phenomenological approach, which seeks an understanding of the essence of the experience for a group of students, was a good mode of exploration of the research questions.

The phenomenological method of the analysis did prove to be difficult, time consuming, and frustrating at certain points. However, approaching a sense of self or deeply held beliefs with qualitative methods did allow more depth in understanding the human experience.

There were several limitations to this study. These include a possible selection bias. The participants chosen for the study were selected for a National Science Foundation grant with a goal of closing the achievement gap for minority students. The researcher was a leader for this cohort, but dropped the position after two months of working with the group. The researcher was not an instructor for any of the courses the participants had to take as part of their teacher education program.

Another limitation of this study was the small sample size and limited racial/ethnic diversity of group of pre-service teachers. Although this is a limitation, the limited racial/ethnic diversity does more accurately reflect the mix of science teachers in the field.

Implications

The findings of this study indicate specific implications for educators and teacher education programs that include pre-service science teachers. Specifically, pre-service science teachers need additional experiences and enhanced coursework in multicultural practices.

- Faculty – Increased deep understanding, interest, skills, and training in diversity/multicultural practices.

- Include in coursework a segment of epistemological foundations of science.
- Pre/post assessment of pre-service science teachers for beliefs about multiculturalism/diversity
- Integrate diversity/multiculturalism throughout all teacher preparation coursework.
- Provide exposure to a practicing science teacher(s) who models multicultural practices.
- Provide and facilitate a safe group environment dedicated to discussions on beliefs/diversity/multiculturalism.

T. Jennings' (2006) study conducted a survey of teacher preparation programs. Faculty coordinators were asked to prioritize the relative importance of diversity-related offerings in their programs. In secondary programs, racial/ethnic diversity was identified as the most emphasized diversity topic in 52.2% of secondary programs (T. Jennings, 2006). This study also indicated, through the survey, that the major challenges to the inclusion of diversity topics included faculty disinterest, faculty discomfort, faculty lack of knowledge, and time constraints. One of the findings of the study was there was a common commitment by teacher educators to prepare students to address racial/ethnic diversity in public schools. However, there was a gap between teacher educators' commitment and the effective manner in which racial/ethnic diversity is addressed in teacher education programs. Nieto (2003) suggested that teacher educators need to purposefully engage pre-service teachers in the political nature of race and structural oppression

to challenge/dismantle the existing structures in schools that perpetuate racism and inequality. Ukpokodu (2007) strongly suggested that teacher educators themselves learn to deconstruct who they are as human beings who hold socio-cultural worldviews and positionalities; deeply understanding how this influences their thinking and practices.

Pohan and Mathison (1999) called for going beyond creating the disequilibrium and challenge to teacher beliefs by providing alternative beliefs that are intelligible and plausible and additionally providing a psychologically safe community to process their emotions. Incidentally, during the focus group sessions of this research study, several participants mentioned that the focus group although facilitated by questions and initial data for the study provided a safe place to process their feelings and the pre-service teachers voiced the wish that they could have additional sessions where they could continue the discussions. This researcher felt that the request was beyond the scope of the study.

Marbley, Bonner, McKisick, Henfield, and Watts (2007) have developed a model they call a "culturally specific pedagogical counseling model." Their model call for survey assessments of the pre-service teachers at the beginning and end of the teacher education program; as well as follow up surveys three times over nine months after leaving the program. Pre-service teachers enrolled in a multicultural/diversity course would concurrently be a part of group sessions facilitated by trained group facilitators. These group facilitators would provide a

safe environment for the pre-service teachers to process their experiences and emotions.

To summarize, the data from this research indicates that the pre-service science teacher takes courses in multiculturalism/diversity and have experiences that elicit emotional responses as the interference begins to occur. They begin to have an awareness of contradictions in their beliefs; however structures are not place in teacher education programs to further support students' process through the learning experience.

Recommendations for Future Research

Science learning by minority students continues to lag behind students from the majority culture although some improvement has been made. The National Assessment of Educational Progress (Grigg, Lauko, & Brockway, 2005) has shown that the gap increased with 4th graders, remained the same with 8th and 12th graders. Slight improvements were made in the gap between fourth grade white-Black and white-Hispanic students and the gap increased between 12th grade Black-White students. This study indicates that further research needs to be conducted in improving teacher education programs' models in approaching multicultural/diversity training if we are going to be able to effectively change science teaching practice to include multiculturalism in a meaningful way.

Examples of some needed research areas include:

- Assessments are needed of teacher education programs for multicultural practices.

- Need for identification of model multicultural teacher education programs.
- Integrate research identified practices for improvement of multiculturalism in teacher education programs and re-evaluate after implementation.
- Research further the effects of science cultural beliefs on interference of integration of multicultural practices

Closing

Insight is not enough to promote change. It is not enough to know why a pre-service teacher is stuck or not incorporating new multicultural practices. For insight to become transforming, the pre-service teacher must understand not only why they have become the (stuck, conflicted, emotional) person, but they must realize that they are one of the people who are perpetuating the stuckness and conflictedness. If pre-service teachers can begin to realize that they are not a passive participant in the creation of their experience but rather the primary author of that experience, then they may find the motivation to start doing things differently, take initiative in furthering their studies in multiculturalism and in the process help realize their authentic self. If this is to happen successfully, it would be necessary for the teacher education program to meet the pre-service teacher at the level where they are and then gently help with the process of building the necessary bridge from their current beliefs toward incorporating critical beliefs in multicultural beliefs and practices. In addition, teacher education programs that

include pre-service science teachers have additional beliefs to work with that are tied to science culture including the belief in science facts and intellectual elitism:

"A lot of the time in math and science, where they present a lot of facts, a lot of the time you didn't even recognize that anyone was different" (James).

"...we have tried to take away any emotional or personal tie to it. We're very factual" (Gina).

"we've become practiced in a different way in science where just smart people can do it" (Vivian).

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APPENDIX A

DEMOGRAPHIC QUESTIONNAIRE

1. Age
2. Gender
3. Race
   a. African American/Black
   b. Asian American
   c. European American/White
   d. Latino/a
   e. Native American
   f. Multiracial
4. Teaching Subject Area(s)
5. Level of school I plan to teach
6. Please indicate the number of course(s) you have taken that specifically focused on diversity issues
7. Multicultural issues were an important component of my teacher education program
   a. Not at all
   b. A little bit
   c. Moderately
   d. Quite a bit
   e. A lot
8. Which of the following best describes your interest in multicultural science education
   a. No interest
   b. Interesting as part of a class that I had to take in teacher education
   c. A minor part of my continuing professional development
   d. An equal part to other topics of my continuing professional development
   e. Main focus of my continuing professional development
9. How would you currently rate your level of multicultural competency?

1	2	3	4	5	6
No competence					High competence

APPENDIX B

CRITICAL INCIDENT ESSAY

Critical Incident Analysis Questions

(modified from Wasson & Jackson, 2002)

Pre-service teachers will be asked to recall an incident during their student teaching experience involving a cross-cultural issue related to racism, classism, heterosexism, or any other stereotype that exists about a specific cultural group. They will be given 60 minutes to write a detailed description of the incident per the questions:

- Describe the cross-cultural situation you experienced.
- Describe in detail the events as they occurred. This description should include the events in sequence indicating what, when, where, how, and why the events occurred.
- List the cultural status of the person(s) involved in the situation, giving their relationship to one another. (For example, were the individuals of differing ages, ethnicity, genders, or socioeconomic status?)
- Specify how you handled the situation or reacted to the situation. Please include a description of your emotional state.
- Explain the types of cross-cultural issues that arose from the situation.
- Describe how you feel the situation could have best been handled.
- Describe how you think the other person(s) felt the situation should have been handled.
- Identify any additional information we might need in order to understand this situation.

APPENDIX C

INFORMED CONSENT

Pre-service Science/Math Teacher Sense of Self in Developing Multicultural Practice

You are invited to participate in a research study conducted by Yuki Monteith from Portland State University, Curriculum and Instruction, Graduate School of Education. The researcher hopes to gain some understanding about how pre-service science/math teachers experience a sense of self in the context of developing multicultural practice in the educational setting. This study is being conducted in partial fulfillment of the requirements for a doctoral degree and is under the supervision of a faculty member from the Graduate School of Education, Portland State University.

If you decide to participate, you will be asked to take part in:

1. A one hour timed written essay describing a cross-cultural critical incident during your student teaching practice. Following the essay is a demographic questionnaire, please complete the essay first and then the demographic questionnaire. You will be provided with a computer disk to on which to save your written documents.

2. A ninety minute focus group dialogue to talk about your opinions on the accuracy of the researcher data interpretation. The focus group will be followed by an optional workshop on how to use focus groups in the secondary in the secondary classroom. You understand that the focus group dialogue will be videotaped and the dialogue transcribed into text. The focus group workshop will not be videotaped or used in the data collection process.

Any information that is obtained in connection with this study and that can be linked to you or identify you will be kept confidential. However, focus groups involve the risk of breach of confidentiality because participants can discuss conversations outside the focus group. Information obtained by this researcher will be kept confidential by coding all documents and the disks and tapes will be stored in a locked container.

Your participation is voluntary. You do not have to take part in this study, and it will not affect your status with the Graduate Teacher Education Program at Portland State University. You may also withdraw at any time.

If you have concerns or problems about your participation in this study or your rights as a research subject, please contact the Human Subjects Research Review Committee, Office of Research and Sponsored Projects, 111 Cramer Hall, Portland State University, (503) 725-4288. If you have questions about the study itself, contact Yuki Monteith at (503) 295-1299.

Your signature indicates that you have read and understand the above information and agree to take part in this study. The researcher will provide you with a copy of this form for your own records.

_____ _____

Signature Date

_____

Print Name

APPENDIX D

FOCUS GROUP LETTER

Dear Science/Math Cohort Member,

I am requesting your further participation in my research project to examine pre-service science/math teachers' sense of self in developing multicultural practice. As you know, the data collected for this research project will be used as the basis for my dissertation here at Portland State University.

I am asking you to participate in a focus group session in which I will be asking you to check the initial themes and categories that emerge from the critical incident essays that have just been completed. I am interested in your impressions of the accuracy of the emerging data.

Each focus group will consist of 6 to 11 cohort members and can be expected to last no more than 90 minutes. Sessions will be video-taped and then transcribed into text. The session will be followed by an optional 30 minute workshop on how focus groups can be used in the secondary classroom by science/math teachers. As with your participation in the critical incident essays, the focus group and workshop participation is voluntary. You may participate in both the focus group session and workshop or just one part. The focus group workshop will not be videotaped or used in the data collection process.

In order to assure confidentiality, no individuals will be identified in any document produced from this research. However, focus groups involve the risk of breach of confidentiality because participants can discuss conversations outside the focus group.

Please take a look at the schedule below and indicate some days and times you would be available by marking the section with an X in the box. Tear the bottom half of this letter at the dotted line and return it to me. I will be calling you within the next three days to schedule a time for your participation in a focus group session, if you indicate that you would like to participate. I will follow up with a reminder of your session one week before the session. In appreciation of your willingness to participate, food and beverages will be provided at your focus group session. Please indicate your preference of the types of food and drink below.

Thank you for considering this request and your participation in this research.

Sincerely,

Yuki M. Monteith

Name _____
Phone Number _____
Schedule

	Mon 6/16	Tue 6/17	Wed 6/18	Thu 6/19	Fri 6/20
Morning					
Afternoon					
Evening					

Food Preference Type		
Vegan		
Vegetarian		
Omnivorous		

Drink Preference Type		
Soda		
Coffee/Tea		
Natural Juices		

APPENDIX E

FOCUS GROUP PROTOCOL

Before the focus group sessions:

1. All participants in the focus groups will be members of the science/math cohort and invited on a voluntary basis after completion of the critical incident essays.
2. All participants will be given a written invitation to participate (See Appendix D)
3. All participants will be notified of the beginning and ending time; location and purpose of the focus group.
4. All participants will be reminded of the date, time, and location one week before their focus group session by email.
5. A comfortable room with few distractions will be selected.
6. Seating will be arranged in a "U" shaped arrangement so participants can have eye contact with each other and the focus group leader/moderator. The video camera will be placed behind the moderator.
7. Access to the video tapes will be limited to principal investigators and stored in a locked container. A date for erasure is set for three years after the completion of the dissertation.
8. All participants will be notified that all participants of the focus group will be fellow members of the science/math cohort.

During the focus group session:

Part I Semi-structured (60 minutes)

1. All participants will be greeted. Food and drink will be available to participants.
2. The purpose of the focus group will be reviewed, the beginning and ending times, and the role of the focus group leader.
3. The ground rules of the session will be outlined.
4. An explanation of how information will be collected will be given.
5. An explanation of what will be done with the information after it is collected will be given.
6. All members will be encouraged to participate - those who talk less will be invited to share their thoughts.
7. If any member tends to dominate the sessions, they will be invited to listen.
8. Members may disengage from the group at any time they choose.
9. Emerging themes and categories will be introduced to the group and feedback will be invited on each.

Part II Structured (30 minutes)

1. Specific concrete questions will be asked related to self concepts that may have not been espoused by the participants but are indicated in literature about science/math pre-service teachers.
    a. Example: role of science or math in guiding personal philosophy of teaching.

At the conclusion of the session, all participants will be thanked for their input, ideas and time.

Potential Focus Group Questions

SEMI-STRUCTURED QUESTIONS

Phenomenological Questioning Strategy: Instead of asking pre-determined questions that may limit the field of inquiry, the interviewer may use the following prompts to stay oriented to the phenomenon under study.

Themes to be used in the prompts will come from the initial data analysis.

Examples:

1. Describe how you felt during a cross-cultural situation.
2. Describe how you decided on this cross-cultural situation.
3. What do you think about the theme _____?
4. Can you tell me more about that?
5. Could you tell me more about the _____ you just mentioned about in your cross-cultural situation?
6. How did this situation influence you?

Structured Questions

Specific concrete questions may be asked related to self concept that may have not been espoused by the participants but are indicated in literature about math/science pre-service teachers and multicultural education.

Examples:

1. What role did "outside forces" have in the cross-cultural situation?
2. Describe the role of situational power in cross-cultural situations.
3. Describe any insights you might have since reflecting on this situation.
4. Describe what is different about teaching science/math than other disciplines?

a. Could you tell me if that influences you in this cross-cultural situation?

5. Describe how you would like others to see you in cross-cultural situation.
6. How relevant is multicultural education to your teaching practice?

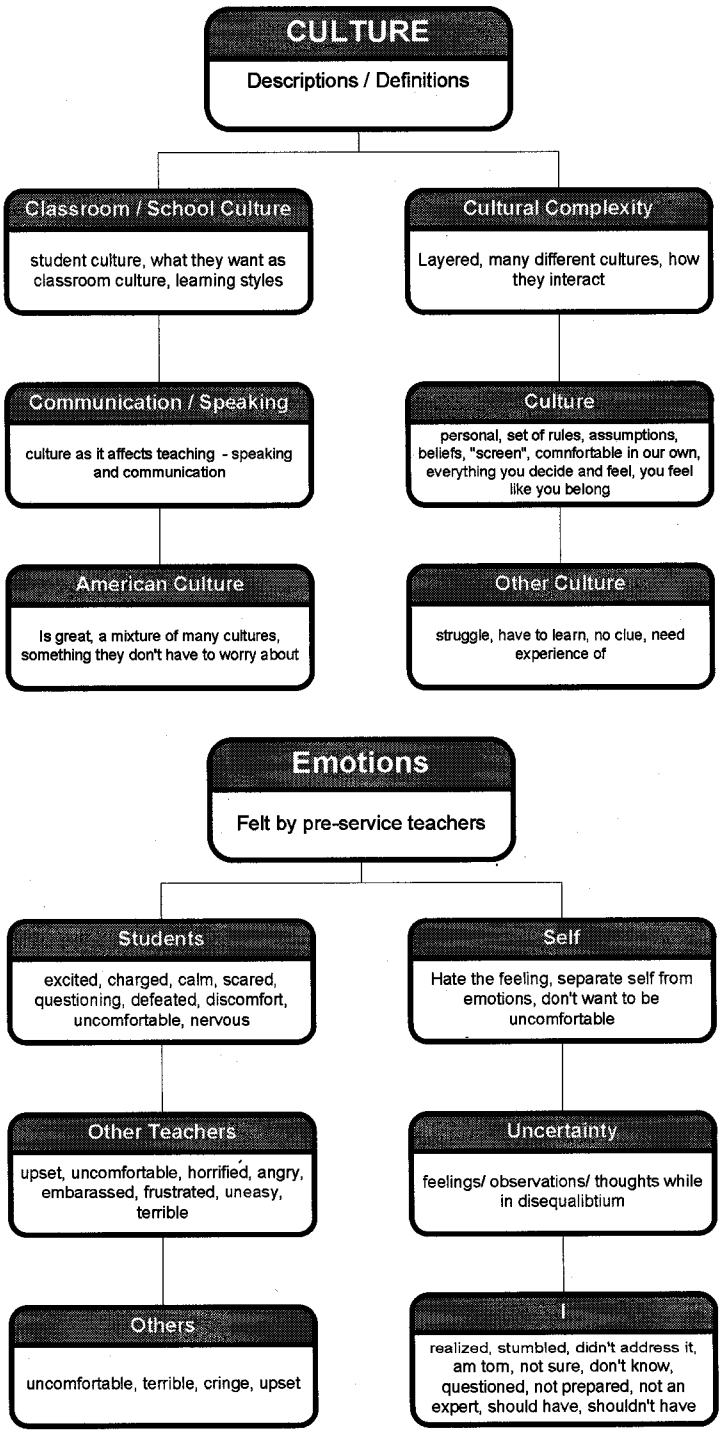
APPENDIX F

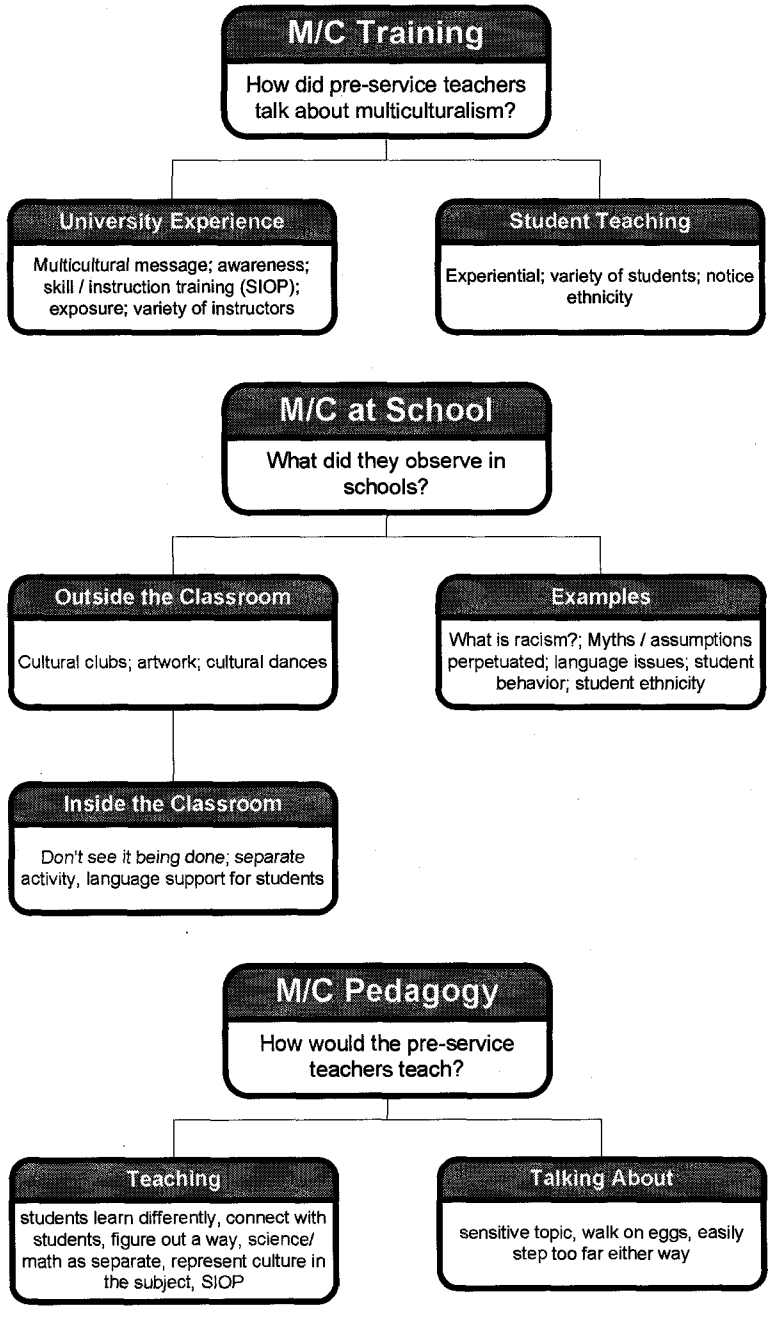
TIMELINE

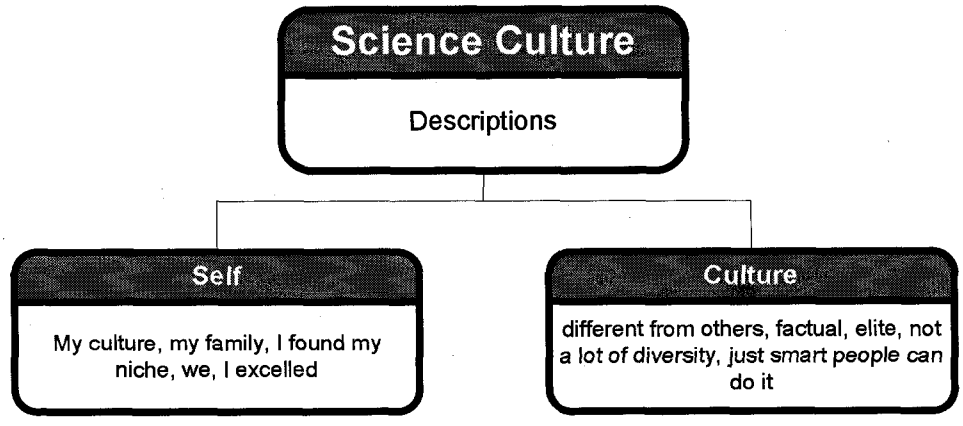
Item	*Date*
Proposal Defense	May 9, 2003
Start Data Collection	Week of May 26, 2003
Initial Data Analysis Results	Week of June 2, 2003
Peer Review of Analysis Results	Week of June 9, 2003
Focus Groups	Week of June 16 , 2003
Further Analysis of Data	June, 2003 - June 2007
Write Results	July, 2007
Finish Writing Dissertation	December 2007 - April, 2008
Defend Dissertation	May 23, 2008

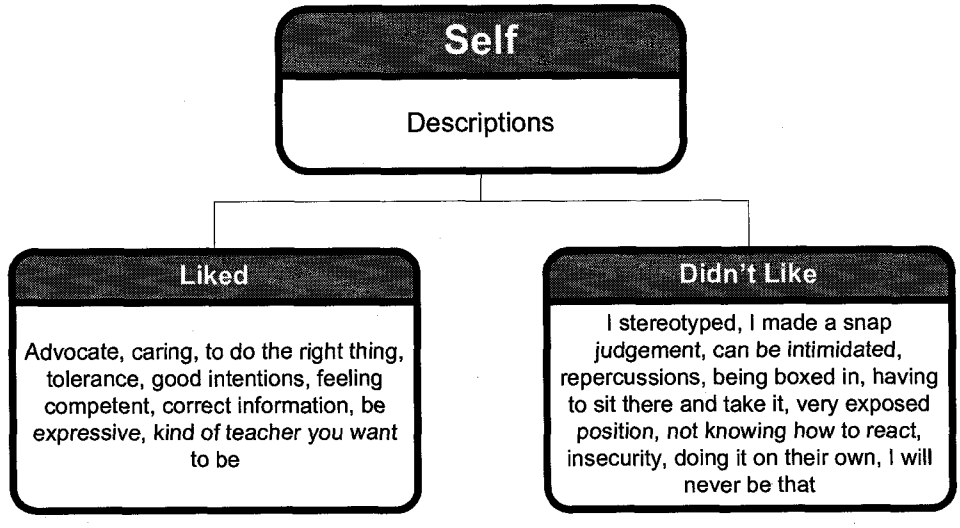
APPENDIX G

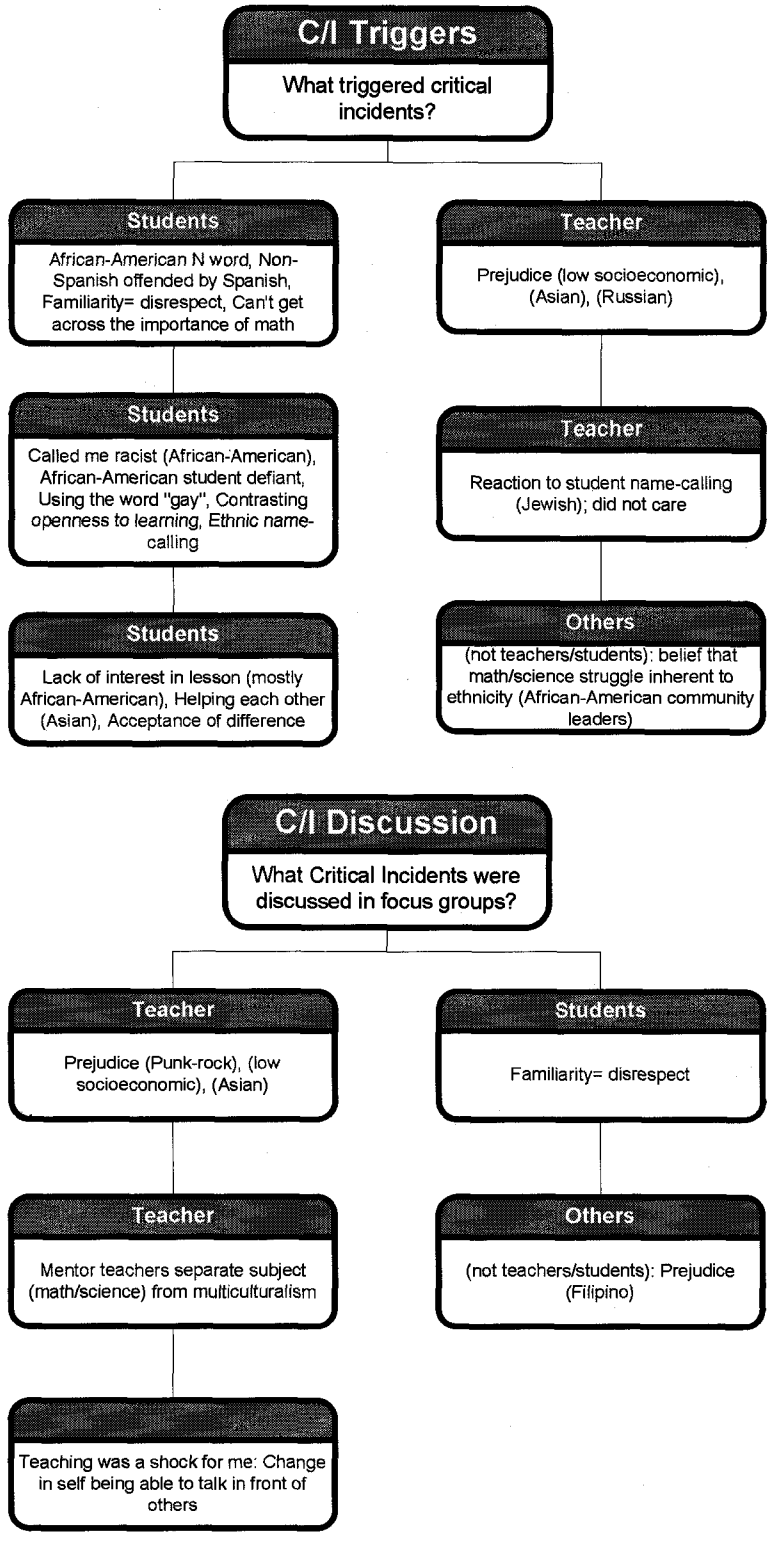
CATEGORY STRUCTURE


CULTURE
Descriptions / Definitions
Classroom / School Culture
student culture, what they want as classroom culture, learning styles
Cultural Complexity
Layered, many different cultures, how they interact
Communication / Speaking
culture as it affects teaching - speaking and communication
Culture
personal, set of rules, assumptions, beliefs, "screen", comnfortable in our own, everything you decide and feel, you feel like you belong
American Culture
Is great, a mixture of many cultures, something they don't have to worry about
Other Culture
struggle, have to learn, no clue, need experience of
Emotions
Felt by pre-service teachers
Students
excited, charged, calm, scared, questioning, defeated, discomfort, uncomfortable, nervous
Self
Hate the feeling, separate self from emotions, don't want to be uncomfortable
Other Teachers
upset, uncomfortable, horrified, angry, embarassed, frustrated, uneasy, terrible
Uncertainty
feelings/ observations/ thoughts while in disequalibtium
Others
uncomfortable, terrible, cringe, upset
I
realized, stumbled, didn't address it, am torn, not sure, don't know, questioned, not prepared, not an expert, should have, shouldn't have


M/C Training
How did pre-service teachers talk about multiculturalism?
University Experience
Multicultural message; awareness; skill / instruction training (SIOP); exposure; variety of instructors
Student Teaching
Experiential; variety of students; notice ethnicity
M/C at School
What did they observe in schools?
Outside the Classroom
Cultural clubs; artwork; cultural dances
Examples
What is racism?; Myths / assumptions perpetuated; language issues; student behavior; student ethnicity
Inside the Classroom
Don't see it being done; separate activity, language support for students
M/C Pedagogy
How would the pre-service teachers teach?
Teaching
students learn differently, connect with students, figure out a way, science/ math as separate, represent culture in the subject, SIOP
Talking About
sensitive topic, walk on eggs, easily step too far either way


Science Culture
Descriptions
Self
My culture, my family, I found my niche, we, I excelled
Culture
different from others, factual, elite, not a lot of diversity, just smart people can do it


Self
Descriptions
Liked
Advocate, caring, to do the right thing, tolerance, good intentions, feeling competent, correct information, be expressive, kind of teacher you want to be
Didn't Like
I stereotyped, I made a snap judgement, can be intimidated, repercussions, being boxed in, having to sit there and take it, very exposed position, not knowing how to react, insecurity, doing it on their own, I will never be that


C/I Triggers
What triggered critical incidents?
Students
African-American N word, Non-Spanish offended by Spanish, Familiarity= disrespect, Can't get across the importance of math
Students
Called me racist (African-American), African-American student defiant, Using the word "gay", Contrasting openness to learning, Ethnic name-calling
Students
Lack of interest in lesson (mostly African-American), Helping each other (Asian), Acceptance of difference
Teacher
Prejudice (low socioeconomic), (Asian), (Russian)
Teacher
Reaction to student name-calling (Jewish); did not care
Others
(not teachers/students): belief that math/science struggle inherent to ethnicity (African-American community leaders)
C/I Discussion
What Critical Incidents were discussed in focus groups?
Teacher
Prejudice (Punk-rock), (low socioeconomic), (Asian)
Teacher
Mentor teachers separate subject (math/science) from multiculturalism
Teaching was a shock for me: Change in self being able to talk in front of others
Students
Familiarity= disrespect
Others
(not teachers/students): Prejudice (Filipino)