Science and Mathematics Education Centre

Kindergarten Students' and Their Parents' Perceptions of Science Environments: Achievement and Attitudes

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Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgement has been made.

Signature: _____

Date: 15 July 2003

Abstract

This study explored the classroom learning environment in science among kindergarten students. In particular, I investigated both students' and their parents' perceptions of both preferred and actual learning environments. Additionally, I explored associations between student outcomes (achievement and attitudes toward science) and the nature of the classroom learning environment (as perceived by students and by their parents).

The study involved the construction and validation of a learning environment questionnaire that was used by both parents and kindergarten students. Although the questionnaire was validated for use with five- and six-year-old kindergarten students, the same format was used for both parents and students. Prior learning environment studies (Fraser, 1998a) typically have involved the use of questionnaires neither by parents (with a notable exception being the recent study by Allen and Fraser, 2002) or by such young students.

There is little doubt that, in just two decades, the field of classroom learning environment has progressed enormously (Fraser, 1998a) and that research involving qualitative methods and research involving quantitative methods each have made outstanding contributions to this overall progress (Tobin & Fraser, 1998). A historical look at the field of learning environments over the past few decades shows that a striking feature is the availability of a variety of economical, valid and widely-applicable questionnaires for assessing student perceptions of classroom environments (Fraser, 1998b).

This learning environment study is significant not only because it involves very young students (kindergarten) and their parents, but also a classroom learning environment questionnaire was developed and validated in Spanish, for both students and parents.

The design of the study involved a sample of 172 kindergarteners from six classes and 78 parents of the same students from the same six classes. The ethnic make-up for this group of 172 students was 11.8% White, 49% Black, 33.6% Hispanic, and 5.6% of other nationalities. The gender breakdown was 40.4% boys and 59.6% girls.

Approximately 45% of the kindergarten student population was made up of English Speakers of Other Languages (ESOL) students. The instruments used included modified versions in English and Spanish of the What Is Happening In This Class (WIHIC)? questionnaire and of the Test of Science-Related Attitudes (TOSRA).

A major finding of the study was that the modified version of the What Is Happening In This Class? (WIHIC) questionnaire in the English and Spanish languages displayed satisfactory factorial validity and internal consistency reliability when used with kindergarten students and their parents. Secondly, parents perceived a more favorable actual classroom environment than did kindergarten students, but students preferred a much more favorable classroom environment than did their parents. The magnitudes of differences between students and parents are greater for the preferred form than the actual form. Finally, statistically significant associations were found between kindergarten students' perceptions of the classroom environment and the outcomes of achievement and attitudes to science.

Dedication

First, this thesis is dedicated to all early childhood teachers and kindergarten teachers who recognize the importance of assessing children in the early years. Although assessing young children is not an easy task, it does help teachers to create an environment in which students can discover the self-confidence, positive attitude, and aptitude that will undeniably prepare them for a life of learning and success in school.

Secondly, the dedication applies to those educators who recognize that children need ample opportunities to participate in the learning process. Research tells us that skills and behaviors vary amongst children. Therefore, it will seem important for educators to encourage students to be part of the process so that eventually they will engage in higher-order thinking skills that will help them to create questions and solve complicated problems.

Finally, this thesis is devoted to those teachers who recognize the importance of creating a bridge that connects our students from the life of the school to the life of the home. Such a bridge will eventually lead our students to their community, so that they might develop respect for all people regardless of their gender, race, ethnicity, social status, or aspects of development.

Acknowledgements

Right from birth, a healthy child is an active participant exploring the environment, learning to communicate and, in relatively short order, beginning to construct ideas and theories about how things work the surrounding world. The pace of learning, however, will depend on whether and to what extent the child's inclinations to learn encounter and engage supporting environments (NRC, 2000).

Learning seems to be a never-ending process and, as an educator, I need to provide my students with opportunities to become actively engaged in the learning process and a rich environment for optimal development. It is my privilege to acknowledge other educators and family member who provided me with the learning environment that I needed in order to physically and mentally complete this study. I am extremely grateful to:

- Professor Barry Fraser, Director of the Science and Mathematics Education at Curtin University of Technology and my supervisor, for sharing his knowledge related to the field of learning environment with me, for his never-ending support, and for his mastermind at editing.
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Chapter 1

Background, Context and Rationale

1.1 Introduction and Aims

Children come into the world eager to learn. The first years of life are a time of enormous growth of linguistic, conceptual, social, emotional, and motor competence (NRC, 2000). This study was important to me because, as a kindergarten teacher who enjoys teaching science, I felt the need to investigate different types of learning environments geared for the very young student. Over the years, playing the role of an educator, I have come to realize that the environment does have an influence on how students learn and develop. However, in order to convince other educators, I needed to present them with research-based evidence about students' learning environments and their satisfaction with those environments. Although much research has been conducted into early childhood education, apparently no instruments assess the qualities of the classroom learning environment for five- and six-year old kindergarten students. Additionally, I was extremely interested in what parents had to say about their child's science classroom, and if kindergarten students' achievement and attitudes were linked to the students' and parents' perceptions of the learning environment in a science classroom. This personal quest to aid my own students, school, and community assisted in the formation of the research questions which ultimately guided the study.

The study involved the construction and validation of learning environment questionnaires that were used by both parents and students. Although the questionnaires were validated for use with five- and six-year old kindergarten students, the same format was used for both parents and students. Prior learning environment questionnaires (Fraser, 1998a) had not necessarily been designed or used by parents.

This study is significant because it involved very young students (kindergarten), which is a population seldom included in past learning environments research. In

addition, it included parents' perceptions of their children's learning environments, which is quite a novel approach. Finally, the classroom learning environment questionnaire was translated into and made available in Spanish, for both students and parents.

The aims of the study were:

Research Question #1: Can valid and reliable questionnaires be developed in English and Spanish to assess:

- kindergarten students' actual and preferred learning environment?
- their parents' actual and preferred learning environment?

Research Question #2: Are there differences between kindergarten students and their parents in their perceptions of:

- actual learning environment in a science classroom?
- preferred learning environment in a science classroom?

Research Question #3: Are there associations between kindergarten students' achievement and attitudes and:

- students' perceptions of the learning environment in a science classroom?
- their parents' perceptions of the learning environment in a science classroom?

The content of Chapter 1 is overviewed below:

1.2 Kindergarten Learning Environments

The field of learning environments provided a useful way of framing the present study. Children's social skills relate both to the quality and success of their school experiences (Meisels, 1996). Young children construct understanding by interacting with others and their environment (Bandura, 1986). In interacting successfully in a variety of circumstances and with a variety of people, children demonstrate interpersonal skills. They need to feel secure enough to participate, question and listen to their peers and adults. How children approach learning is central to their chances for success in school. Children's learning styles reflect how they address the task of learning (Kagan, Moore, & Bredekamp, 1995).

The extent to which teaching and learning are productive depends partly on the participants' environment, which is a set of dispositions that incline individuals to act and interact in particular ways (Bourdieu 1992; Lemke, 1985). The study of learning environments built on Lewin's (1936) theory dealing with the relationship and interaction between the individual and his/her environment. Lewin (1936) along with Murray (1938) were most likely the first individuals to recognize relationships between the environment and human behavior, thus laying the foundation for the development of the first learning environmental scales.

In the past three decades, much attention has been given to the development and use of instruments to assess the qualities of the classroom learning environment from the perspective of the student (Fraser, 1994, 1998b; Fraser & Walberg, 1991). The relationship between learning environment variables and student outcomes has provided a specific focus for the application of learning environment instruments. Fraser, Fisher, and McRobbie (1996) felt that there was a need for a single instrument that would combine some of the best features from previously-developed instruments to better understand the socio-psychological climate of classrooms. Fraser, Fisher and McRobbie (1996) developed a new learning environment instrument called *What Is Happening In This Class?* (WIHIC). The WIHIC not only incorporates scales that have been used previously and proven to be predictors of learning outcomes, but additional scales to measure current concerns in the classrooms, such as cooperation and equity which were salient in my study. In past

research, the WIHIC questionnaire has been used without any modification and, in other studies, it has been adapted to suit the specific context. For my particular study, the WIHIC was modified and translated into Spanish. The modified versions (English and Spanish) were used with kindergarten students and their parents.

The research literature seems to suggest ways to better prepare students for academic achievement. However, does it prepare the teachers to be sensitive and responsive so that students can actively engage in the learning process with a positive attitude? In order to measure students' attitudes toward learning science, I used the Test of Science-Related Attitudes (TOSRA). TOSRA (Fraser, 1981a) was created to measure seven science-related attitudes amongst secondary school students. For this particular study, the TOSRA was modified and translated into Spanish for use with kindergarten students, and only selected scales were chosen for reasons of economy.

Learning environment literature is reviewed in detail in Section 2.3 of Chapter 2.

1.3 Parental Involvement

This study examined how students' and parents' perceptions of the learning environment in science classrooms relate to student achievement and attitudes. Family variables are powerful predictors of children's subsequent language development and academic performance (Powell & D'Angelo, 2000). There are some important connections between the family environment and school-related attitudes and performance (Walberg, 1991). A higher degree of teacher-parent communication and enthusiasm seems to create a greater sense of trust between teacher and student. Parent and community involvement have been found to influence academic achievement and school climate (Stevens & Sanchez, 1999).

School, work, and family settings can be described in terms of a set of conceptually-related dimensions that appear to have common influences (Fraser & Walberg, 1991). When schools are more involved with their communities and when teachers and parents see and talk more often with one another, they are more likely to know about one another's needs and are better able to work in tandem to promote the learning and welfare of students. This implies that the developmental and

achievement outcomes of education can often be improved if schools become more involved in the lives of their local communities (Berliner & Biddle, 1995).

Although parent involvement is linked to school success, many parents are not as involved in schooling as teachers would like. This lack of involvement is not random: social class has a powerful influence on parent involvement patterns. For example, in the United States, 40-60 percent of working-class and lower-class parents fail to attend parent-teacher conferences (Lareau, 1989). For middle-class parents, these figures are nearly halved (i.e. about 20-30 percent; Lareau, 1989). In the areas of promoting verbal development, reading to children, taking children to the library, attending school events, enrolling children in summer school, and making complaints to the principal, middle-class parents consistently take a more active role in schooling than do their working-class and lower-class counterparts (Lareau, 1989, p. 3).

Another barrier concerns the disjuncture between the culture shared by educators in the school and that of the parents in the community. Even under the best of circumstances, some tension can appear in relationships between teachers and parents. After all, teachers are trained professionals who are responsible for evaluating as well as instructing their students. Parents, in contrast, often feel that they lack expert knowledge but must sometimes challenge a teacher if they think that their children are not being treated well (Berliner & Biddle, 1995).

The difficulties faced by some of our schools seem to be related to problems in the community. The proportion of impoverished students and those from single-parent homes is also likely to increase, in part because of increasing numbers of black and Hispanic students. The growth rates for these two groups alone suggest that, by the year 2020 in the United States, the proportion of impoverished children is likely to increase by roughly 33 percent and the proportion from broken homes is likely to rise by about 18 percent. In addition, it seems unlikely that the forces leading to ever-increasing numbers of impoverished and broken homes in the country will abate in the near future (Berliner & Biddle, 1995).

Parents programs have been found to have significant and positive effects on children's verbal ability, language, school-related knowledge and skills, and achievement in school subjects, especially when integrated into a network of community support (Kellaghan, Sloane, Alvarez, & Bloom, 1993). Other research has revealed that toddlers' vocabulary development is related to the amount of parental speech (Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991) and parental efforts to describe environmental stimuli that capture a toddler's attention (Dunham & Dunham, 1992). Furthermore, Kellaghan, Sloane, Alvarez, and Bloom (1993) declared that efforts to help parents to become stronger partners in their children's learning can have a significant positive impact on children's cognitive development, school performance, and social functioning.

The more encouragement and resources provided at home, the more likely students are to do well in school. Thus, it is concluded that "children are more likely to be successful learners if their parents or care-givers display an interest in what they are learning, provide access to learning materials, and serve as role models interested in their learning experiences" (Applebee, Langer, & Mullis, 1989, p. 34).

Parents gain a sense of pride and commitment in their ongoing involvement in the education of their children. In households and communities which emphasize that learning is one of the highest priorities in life, children exert themselves to succeed in school and in professional careers. Conversely, if children are not reared to believe that education is important and relevant to their lives, they do not make learning a priority (Davidson, 1997).

Parents hold a range of beliefs about what attributes and attitudes their children will need to succeed in kindergarten. Parent beliefs influence the activities in which they engage with their children and the programs and experiences that they arrange for the children. The extent to which parents of preschoolers and kindergarten teachers share a common understanding of the attributes and attitudes that children need as they enter schools is important and should be discussed by all parties involved. If parents and teachers hold similar beliefs, then there is a greater opportunity for congruence between the skills that parents encourage in their children prior to school entry and the skills that teachers look for as children enter kindergarten (Graue,

1992). While it is assumed that personal beliefs affect behaviors, correspondence between verbally-expressed beliefs and actual behaviors has always been one of the classic and most troublesome research issues (Kochanska, 1989). What parents and teachers say is important can differ from what is practised in the home or the classroom (Amos-Hatch & Freeman, 1988; Spidell-Rusher, 1992). If we are to understand more fully how beliefs about children's readiness influence practices, researchers need to examine the relationship between beliefs and actions.

It was important to find out how parents perceive and prefer the learning environment in their child's classroom, and if any differences might exist between students' and parents' perceptions and preferences. This study went beyond the usual practice of studying students' perceptions of classroom environment and included parents' perceptions also.

1.4 Kindergarteners' Needs

Earlier research has found that parents place a greater emphasis on the child's social and emotional maturity than on school-related academic skills when deciding whether the child is ready for kindergarten (Eisenhart & Graue, 1990). However, compared with teachers, parents place greater importance on academic skills (e.g., counting, writing, and reading) and prefer classroom practices that are more academically oriented (Knudsen-Lindauer & Harris, 1989). One reason for this could be that parents perceive that there are specific activities they can do to teach their children school-related basic skills, whereas ways of changing the social maturity or temperamental characteristics of their children are less apparent.

Curricula consists not just of the content and outcomes of schooling, much as one might get that impression from much that is being done on the research and policy fronts (Fraser, 1986). It also consists of places, typically classrooms, where the business of learning is transacted. It is on the quality of life lived in classrooms that many of the things that we hope for from education depend: concern for community, concern for others, commitment to the task in hand (Fraser, 1986).

Creating a stress-free environment, for most educators, represents the opportunity to increase the knowledge of the children and to enhance their individual needs. Kindergarten grade children need to be provided with explicit expectations of engaging in whole-group discussions, especially if science conversations about individual and small-group investigations are going to be successful. A first grade student reminded me: "We couldn't have done the science presentations if we hadn't first learned how to be good listeners. Learning to give our eyes, ears, and heart to the speaker was really important" (McGonigal, 1999, pp. 9-10).

It would be wonderful if each child entering kindergarten was socially and emotional prepared. Young children are often very excited about entering school. But when they do, they can face an environment that's different from what they are used to at home or even in preschool. In kindergarten, they will need to work well in large groups and get along with new adults and other children. They will have to share the teacher's attention with other youngsters. The classroom routines also might be different. Most five-year-olds do not start school with good social skills or much emotional maturity. These take time and practice to learn. However, according to Paulu (1996), children improve their chances for success in kindergarten if they have had opportunities to begin developing these qualities:

- *Confidence*: Children must learn to feel good about themselves and believe they can succeed. Confident children are more willing to attempt new tasks--and try again if they don't succeed the first time.
- *Independence*: Children need to learn to do things for themselves.
- *Motivation*: Children must want to learn.
- *Curiosity*: Children are naturally curious and must remain so in order to get the most out of learning opportunities.
- *Persistence*: Children must learn to finish what they start.
- *Cooperation*: Children must be able to get along with others and learn to share and take turns.
- *Self-control*: Preschoolers must understand that some behaviors, such as hitting and biting, are inappropriate. They need to learn that there are good and bad ways to express anger.

- *Empathy*: Children must learn to have an interest in others and understand how others feel.

The differences that we see in children's knowledge and skills as they enter kindergarten can be attributed to variations in family characteristics (e.g., maternal education family type) and home experiences (e.g., home educational activities, nonparental care). A complex and continuous collaboration exists between the child and the family, and the family can provide the resources and support that children require to increase their chances of succeeding in school (Maccoby, 1992).

Section 1.4 might allow us to conclude that not all children are ready to begin school, but that there are some things that parents and teachers can do to help children to improve their social skills and to help them develop the maturity level necessary to succeed in school.

1.5 Significance

This study is significant as it combined qualitative and quantitative approaches. It focused on 'mixed methods' with the intent to triangulate findings in order to disclose some form of connection between such findings. It is advantageous for a researcher to combine methods to better understand a concept being tested or explored (Creswell, 1994). Creswell states that the idea of combining qualitative and quantitative approaches in a single study owes much to past discussions about mixing methods, linking paradigms to methods, and combining research designs in all phases of a study. A combined method study is one in which the researcher uses multiple methods of data collection and analysis. These methods might be drawn from 'within methods' approaches, such as different types of quantitative data collection strategies (e.g., a survey and an experiment). Although my study benefited from combining methods, the qualitative component was minor relative to the quantitative component.

In addition, this learning environment study is significant in it that includes not only students, but also their parents. The inclusion of parents is rare in learning

environments research. Research suggests that children do best when parents are enabled to play four key roles in their children's learning: teachers (helping children at home), supporters (contributing their skills to the school), advocates (helping children receive fair treatment), and decision makers (participating in joint problem-solving with the school at every level (Henderson & Berla, 1994).

My study is also significant because it involved kindergarten students, and such young children have been involved seldom in past learning environments research. A historical look at the field of learning environments over the past few decades shows that a striking feature is the availability of a variety of economical, valid and widely applicable questionnaires for assessing student perceptions of classroom environments (Fraser, 1998a, 1998b). Because these past instruments were not designed for kindergarten, my study is significant as it developed a reliable and valid instrument for other professionals to use with kindergarten students. The modified instrument is also significant because I developed a Spanish version that was also used with students and parents.

1.6 Overview of Other Chapters

Chapter 2 focuses on a review of the related literature. It begins with a brief discussion of the kindergarten curriculum and the science objectives mandated by the district where the study took place. The chapter compares and contrasts the kindergarten science curriculum of long ago with today's kindergarten science curriculum, and discusses the increasingly diverse needs of current kindergarten students. In particular, the chapter reviews past research on learning environments and some instruments for assessing classroom environment. It gives emphasis to past studies of associations between learning environment and student outcomes (as my study incorporated this line of research). The chapter continues with a section on parent/home environment and the role that parents play in student achievement.

Chapter 3 concentrates on the procedures and methods used to conduct the study. The approach involved combining qualitative and quantitative methods. Information is provided about the What Is Happening In This Class? (WIHIC) questionnaire, used to investigate students' and parents' perceptions of kindergarten science

learning environments, and the Test Of Science-Related Attitudes (TOSRA) questionnaire, used to assess students' attitudes to science in my study. Chapter 3 also identifies the methods of statistical analysis used to answer the research questions concerning students' and parents' perceptions of experienced and perceived classroom environment, and associations between kindergarten students' outcomes of achievement and attitudes in science and their perceptions of the learning environment. The chapter describes qualitative data-gathering involving focus groups as well as student and parent interviews.

Chapter 4 encompasses the analyses and results for the quantitative and qualitative data collected in this study. The analyzed data helped answer the research questions that comprised the study.

Chapter 5 provides a discussion and a conclusion of the thesis. The chapter includes a summary of all findings, as well as a discussion of the distinctive contributions made by the study and its limitations. Finally, the chapter closes with suggestions for future directions for research.

1.7 Summary

This chapter introduced my study into kindergarten students' and their parents' perceptions of science classroom environment and student achievement and attitudes. The chapter identified the aims of the study: the construction and validation of modified learning environment questionnaires that were used by both parents and kindergarten students; investigation of students' and parents' preferred and actual learning environment; and investigation of associations between parents' or students' perceptions of the classroom learning environment and students' achievement and attitudes toward science. The chapter included a brief discussion of literature supporting the aims of the study, the significance of the study, and an overview of other chapters.

In everyday life, students find themselves gathering and evaluating information (Davidson, 1997). This study brought attention to how various learning environments can promote student achievement and attitudes about science.

Chapter 2

Review of Related Literature

2.1 Introduction and Overview

In spite of the dramatic renovation all through our society over the last half-century, teaching practices in mathematics and science classes have remained practically unchanged. Classroom practice has still hardly begun to take advantage of the many dimension of the learning process. Chapter 1 introduced the main focus of this study as investigating if various learning environments can promote student achievement and attitudes about science.

This chapter's aim is to review literature that supports this study into learning environments at the kindergarten level. Various instruments for assessing and investigating aspects of the learning environment are discussed, especially those best suited for exploring predictors of learning outcomes and measuring science-related attitudes among very young students. Because I was interested in what parents had to say about their child's science classroom and if kindergarten students' achievement and attitudes are linked to students' and parents' perceptions of the learning environment, a section on parent/home environment and the role that parents play in student achievement is included.

The content of Chapter 2 is overviewed below:

2.2 Kindergarten Science Learning Environments

This study is unique as it investigated associations between kindergarten student outcomes, achievement and attitudes in science and their perceptions of the learning environment. Most past studies of learning environment have involved older students at the elementary, middle, high school or university levels (Fraser, 1998b). Because of my study's unique focus on the kindergarten level, this section reviews literature that provides background information about the kindergarten level of education.

In the county where my study took place, the kindergarten population consist of a mix of different nationalities with increasingly diverse needs. Section 2.2.1 looks back at the creation of the first kindergarten as an accepted institution in US, when kindergarten was based on 'natural laws' of learning. The section then gazes into the present demands of kindergarten and how what once was recognized in the public schools as the first year of 'formal education' now emphasizes training and preparing students for the first grade. Section 2.2.2 focuses on studies, from the 1970s through to the 2000s, that spotlight kindergarteners, their parents, achievement, gaps in student achievement, and positive approaches to learning.

2.2.1 Kindergarten Education -- Then and Now

Looking back into the creation of kindergarten, we discover that the first kindergarten was started by the German educator Friedrich Froebel, in 1837, in Blankenburg, Prussia (now part of Germany). Froebel chose the German term 'kindergarten' (literally, 'children's garden') because he intended children in his school to grow as freely as flowers in a garden. Froebel's kindergarten was based on the then radical idea that children's play was significant. At the time, almost no children under the age of seven years attended school, but Froebel designed his kindergarten for children between the ages of three and seven years. The kindergarten became widely admired

for its innovative teaching strategies, and Froebel's followers soon established other kindergartens based on his educational philosophy.

Froebel developed his own ideas about education by combining his belief in scientific observation with his philosophical belief in the interconnectedness of all things. In addition, Froebel was concerned that the spread of industrialization would negatively affect the family, but he believed that kindergarteners could elevate the status of mothers and children (*Online Encyclopedia*, 2000).

German immigrants, who wanted to preserve German language and culture, while also promoting Froebel's ideas about education, brought the concept of kindergarten to the United States. It was Margarethe Meyer Schurz (a German immigrant) who opened the very first kindergarten in the US, in Watertown, Wisconsin. However, because the school served a community of German immigrants, the classes were conducted in German.

Elizabeth Palmer Peabody (a native of Billerica, Massachusetts, US) learned of Friedrich Froebel's kindergarten work in Germany, and opened the first English-language kindergarten in Boston. She helped to establish kindergarten as an accepted institution in US education, believing that great emphasis should be set on educating the very young. At that time, developing the habits of cleanliness, politeness, self-control, urbanity, training of the eye and hand (coordination), industry, training the mind to understand number and geometric forms, inventing combinations of figures and shapes, and representing them with the pencil, were included as some of the important lessons to be covered, in a half-day segment of studies. By 1885, there were 565 private kindergartens in the United States, serving 29,716 students.

In 1873, under the leadership of Susan Blow (an American educational reformer), the first public kindergarten in the United States was established in St Louis (Online Encyclopedia, 2000). And, by 1885, St Louis had 60 public kindergartens. Most of the major American cities offered public kindergarten education by 1910. Nevertheless, once recognized in the public schools, kindergartens embarked on changes. Sadly, some of the social work and outreach functions began to decline and more emphasis was given to training and preparation for first grade.

As we look back on the history of kindergarten, we see that Froebel's original philosophy for the kindergarten was based on natural laws of learning. He was sure that youngsters held the seeds of their own later developments, and that teachers could stimulate this potential growth and thus help students to recognize and use those things that they understood intuitively. More importantly, he saw kindergarten as an extension of home life.

It is important to recognize how Froebel's philosophy creates a strong link to my study, since my study involves parents' perceptions of the science learning environment. Today, a typical kindergarten class has lost many of those characteristics of German educator Friedrich Froebel. Some teachers claim that our curriculum has evolved into rigid academic training to prepare students for first grade. Still, many educators feel that the modern curriculum should set aside time to allow children to engage in more creative and self-expressive activities. Eisner (1998) tells us that vitality within any organization is more likely when there are opportunities to pursue fresh possibilities, to exercise imagination, to try things out, and to relinquish the quest for certainty in either pedagogical method or educational outcome. Indeed, one of the important aims of education is to free the mind from the confines of certainty. Our children must learn that satisfaction can come for the uncertainty of the journey, not just from the clarity of the destination (Eisner, 1998).

A typical South Florida kindergarten classroom, in the county where the research was conducted, consists of anywhere between 25 and 35 students. In most cases, the population is a mix of different nationalities and English is not the only language spoken; nor is it necessarily the students' first language. Some classrooms flourish with hands-on materials, while others struggle to obtain the bare necessities. The lessons that Elizabeth Palmer Peabody recognized as important elements in the lives of a youngster have changed in various degrees. Teachers are now faced with classrooms filled with students with limited proficiency in English. Although additional benchmarks have been included to assist Limited English Pupils (LEP), the basic curriculum expects students to understand and carry on like native speakers of comparable age. In addition, kindergarten today has been extended to a full day of

instruction in order to 'fit in' all the subjects, perhaps in the hope of creating the 'total' child.

There is also the question of whether, kindergarten or first grade should be considered as the first year of school. Although school attendance is not mandatory in most states until first grade, a national survey of parents of early elementary pupils showed that 98 percent of primary school children attended kindergarten before entering first grade (West, Germino-Hausken, Chandler, & Collins, 1992). Thus, kindergarten is now the initial year of formal schooling for nearly all children in the US.

One of those subject taught in present kindergarten classes, in the district where the research took place, is science. 'Our science classroom' is well stocked in the sense that we have most of the necessary full lab equipment/material needed to conduct experiments, create projects, and facilitate teaching and learning for limited English-proficient students that include the objectives of the ESOL Competency-Based Curriculum and Sunshine State Standards. These objectives have been modified to take into consideration the language proficiency levels of students. The levels range from Level I through Level V. Level I demonstrates very little understanding and the student is unable to communicate meaning orally or in writing, while the Level V student is able to communicate both academically and socially at the level of an educated native speaker. Most self-contained ESOL classrooms are comprised of all ESOL levels. Some schools make provisions to mainstream level five students into 'regular' classrooms.

Time has changed since Elizabeth Palmer Peabody opened the nation's first English-language formal kindergarten in Boston, and the philosophy underlying kindergarten seems to be constantly evolving. Most educators seem to believe that the kindergarten curriculum should devote attention to school readiness, but not without leaving time for children to engage in more creative and self-expressive activities. Jane M. Healey (1987) stated that explaining things to children won't do the job; the learning environment must provide a chance to experience, wonder, experiment and act it our for themselves. It is this process, throughout life, that enables the growth of intelligence.

2.2.2 Past Research on Kindergarten Education

The Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K), sponsored by the US Department of Education's National Center of Education Statistic (NCES), selected a nationally representative sample of kindergarten students from 1998 and followed these children through to the fifth grade. This study, divided into three segments, collected information from students, family members, teachers and schools. The sample contained around 22,000 kindergarteners that represented approximately 1,000 kindergarten programs throughout the 1998-99 school year.

The first two reports entitled *America's Kindergarten* (West, Denton, & Germino-Hausken, 2000) and *The Kindergarten Year* (West, Denton, & Reany, 2001), provided a national picture of the knowledge and skills of students at the kindergarten entry level as well as across the kindergarten year. Both of these reports revealed that although first-time kindergarteners are alike in various ways, their discernment and their skills vary in relation to the age at which they start school, ethnicity, health, the education of their parents, and the individual Child's former care histories. Both of these reports established the foundations for the fundamental understanding of student achievement across the kindergarten year.

Finally, the third report, *Children's Reading and Mathematics Achievement in Kindergarten and First Grade*, made in combination with *America's Kindergarteners* and *The Kindergarten Year*, presents vivid information on young children's achievement across kindergarten and first grade. This report spotlights the status of students' reading and mathematics achievement in the spring of kindergarten and the spring of first grade. However, none of the above studies measured students' actual or preferred learning environments.

The Center for Applied Research and Educational Improvement, discussing the Standards-Based Interventions in Elementary Mathematics, stated that America's national education goals acknowledge the importance of preparing youth to achieve in challenging subject areas such as mathematics and science (i.e. Goal 5). In fact, Goal 5 called for U.S. students to lead the world in mathematics by the year 2000.

The recent release of the Third International Mathematics and Science Study-Research (TIMSS-R) sheds light on the achievement of America's students relative to their same-grade peers around the world. Compared to fourth-grade students in 26 countries, American fourth-graders were among the top performers in mathematics achievement, scoring above the international average. Eight graders fared much worse; they ranked 20th out of the 41 participating nations, performing below the international average (Peak, 1996). However, the most recent report from the National Educational Goals Panel indicates that students are moving toward national education goals (1998). Between 1990 and 1996, the performance of Grade 4 and Grade 8 students in mathematics improved in 28 states.

The Education Trust, Inc., in a study entitled Achievement in America 2001, reported that, between 1970 and 1988, the gap between student achievements in different nationalities groups had narrowed. However, it stated that, since 1988, the gap has grown or remained the same. This indicates that, out of every 100 Asian kindergarteners in the U.S., 94 graduate from high school, 80 complete at least some college, and 49 obtain at least a Bachelor's degree. Of every White kindergartener in the U.S., 91 graduate from high school, 62 complete at least some college, and 30 obtain at least a Bachelor's degree. The figures begin to descend as we look at African Americans, Latinos and the Native American population. Of every 100 African American kindergarteners, 87 graduate from high school, 54 complete at least some college, and 16 obtain at least a Bachelor's degree. Of every 100 Latino kindergarteners in the U.S., 62 graduate from high school, 29 complete at least some college, and 6 obtain at least a Bachelor's degree. Finally, for every 100 Native Americans, 58 graduate from high school and 7 obtain at least a Bachelor's degree.

The study, Achievement in America, goes on to state that, when students were asked about the large difference in participation rates between these populations, they claimed that some teachers don't know the content of their subjects, counselors underestimate their potential, principals dismiss students' concerns, and the curriculum and students' expectations are low. When the general population was asked their opinion about dealing with these discrepancies, they claimed that students are not doing as well as they should because they are poor, students in high-poverty schools spend less time developing high-level reasoning skills, their parents don't

care, the students come to school without breakfast, there are not enough books for these students, and there is not enough parental involvement in the schools.

In addition, while the study indicates that African Americans are less likely to get hands-on science, Latinos are more likely to do more worksheets than whites and Asians, and mathematics activities and science classes of mostly minority students are more often taught by under qualified teachers. However, the study also indicates that by allocating time and support for teachers, by giving extra time and dollars for students who are working below grade level, and by parents providing support for their children, positive changes occur to help to increase the number of students who go on to attend college or a higher education institution.

A consistent predictor of students' achievement is the education level of their parents (National Center for Education Statistics, 1990). In general, students with less-educated parents tend to have lower academic scores than students whose parents have higher levels of educational attainment.

Children who are self-regulated learners could have an advantage (Schunk & Zimmerman, 1996; Paris & Cunningham, 1996). Consequently, children who often or very often display positive approaches to learning might more rapidly attain cognitive knowledge and skills.

Fraser (1998a) supported the existence of associations between classroom environment variables and student outcomes. As a kindergarten science teacher, I believe that the best approach to teaching science involves students in learning the science concepts that they need to learn, as they acquire the process skills needed, while focusing on positive scientific attitudes. I would consider it an honor if other educators examine this research and find it helpful in the developing and assessing of their own classroom environments, in order to create the 'ideal' learning environment for all of their students.

Teachers often speak of a classroom's climate, environment, atmosphere, tone, ethos or ambience and consider it to be both important in its own right and influential in terms of student learning. It would be rare, however, for teachers to include classroom

environment measures among their evaluation procedures. Typically, teachers concentrate almost exclusively on the assessment of academic achievement, and devote little attention to factors which might be related to their students' performance (Fraser, 1993).

Students are at a good vantage point to make judgments about classrooms because they have encountered many different learning environments and have enough time in a class to form accurate impressions. Also, even if teachers are inconsistent in their day-to-day behavior, they usually project a consistent image of the long-standing attributes of classroom environment (Fraser, 1986). As the learning environment is also crucially important at the kindergarten level, my study of kindergarten students drew on the field of learning environments, which is discussed in detail in the next section.

2.3 Learning Environment

International research efforts involving the conceptualization, assessment, and investigation of perceptions of aspects of the classroom environment have firmly established classroom environment as a thriving field of study (Fraser, 1998b; Fraser & Walberg, 1991; Goh & Khine, 2002). Although past studies have examined associations between student attitudinal outcomes and student perceptions of the learning environment in science classes (Fraser, 1998a), my study is unique in that it involved the kindergarten level. It is my hope that this study will help other kindergarten teachers to consider the major learning opportunities that they can create when they become aware of students' preferred learning environments. Many studies (Hean & Tin, 1996; Klein, 1997; Phelan, Davidson & Hanh, 1992; Pool, 1997; Waxman & Huang, 1997) suggest that students experience greater motivation, capacity of learning, and overall achievement in classrooms that they perceive as being safe. Conversely, when a student feels emotionally threatened, such as when a teacher or another student makes him/her feel stupid, that student's mind actually shuts down into a survival mode, which inhibits the brain's capacity for deep learning (Pool, 1997).

As my study focused on learning environments, it would seem important to establish that, in my particular school, kindergarten students come from increasingly diverse racial, ethnic, cultural, social, economic, and language backgrounds where teachers are faced with classrooms of children with increasingly diverse needs. In addition, growing pressure to raise academic standards, and to assess all students' progress toward meeting those standards, place even more burden on schools and teachers (Kagan, 1990; Meisels, 1992). Kindergarten teachers, who are responsible for guiding the school-related development of children once they enter school, also hold beliefs about the attributes and attitudes that children will need in kindergarten. A teacher's belief can influence his or her early evaluation of a child's ability and expectations for the child's chances of succeeding in the program.

At the kindergarten level, the quality of the teaching-learning environment is very important. While the kindergarten classroom setup and the materials available to children are important elements of quality, it is the teacher's ability to help the child to learn on a daily basis that makes a long-term difference for learning (National Institute on Early Childhood Development and Education, 2000). Chaille and Britain (1991) found that, young children who are provided with opportunities to construct their own learning become involved in scientific experimentation and problem solving. Gallas (1995), in Talking Their Way Into Science, observed that second, third, and fifth graders who had been taught science from a constructivist framework thought about, talked about, and did science continuously. Kindergarteners should have programs and practices that are more age appropriate and that better accommodate individual differences in background, learning, and experience (Bredekamp, 1987). As a kindergarten teacher, I believe that my students' learning environment strongly influences what is learned and how it is learned. Importantly, the learning environment can be extended so that it includes the student's home.

One of the objectives of this study was to investigate associations between kindergarten students' achievement and attitudes and students' and parents' perceptions of the learning environment in a science classroom. Statistically significant environment-attitude associations have been found in past research (Wong & Fraser, 1996) and are reported in major reviews of research (Fraser, 1980, 1981a, 1988a, 2002; Fraser & Walberg, 1981; Haertel, Walberg & Haertel, 1981; Moos,

1979; Walberg, 1979). Similarly, because my study involved investigation of associations between student outcome and the nature of the classroom environment, Section 2.3.4 is devoted entirely to past research into outcome-environment associations.

The next section below (2.3.1) provides an overview of past research on learning environments. Next, because my study used a classroom environment questionnaire, Section 2.3.2 reviews numerous instruments for assessing classroom learning environments. Section 2.3.3 is devoted to past studies involving the use of the What Is Happening In This Class (WIHIC) questionnaire, which was adapted and used in my study.

2.3.1 Past Research on Learning Environment

As early as 1936, Kurt Lewin (1936) recognized that the environment was a determinant of human behavior. Building on the findings of Lewin, Murray (1938) identified a Needs-Press Model of interaction in which personal needs, or 'motivational personality characteristics', represent the tendency for individuals to move in the direction of goals, whereas the environmental press is the external situational counterpart that either supports or frustrates the expression of these needs. Murray's model suggests that situational variables found in the classroom environment can account for behavioral variance. Although his Needs-Press Model of interaction was more applicable to the study of personality than the teaching-learning process, researchers have sought ways to identify the situational variables recognised in the Needs-Press Model (Anderson & Walberg, 1974; Moos, Based on Murray's Needs-Press Model, Stern (1970) formulated a Person-Environment Congruence Theory, which proposes that, when personal needs and environmental press are more congruent, student outcomes are enhanced. Also following the work of Murray's Needs-Press Model, Getzels and Thelen (1960) put forward a model that describes the class as a social system and suggests that group behavior can be predicted from the interaction of personality needs, expectations and the classroom environment.

Following the work of Lewin and Murray, two research programs focused on developing instruments that could be used to assess the learning environment.

Herbert Walberg's *Learning Environment Inventory* (Anderson & Walberg, 1968) and Rudolf Moos's *Classroom Environment Scale* (Moos & Houts, 1968; Moos & Trickett, 1974) were the first instruments developed to assess students' perceptions of their classroom learning environment. Since this time, the influence of the learning environment on the education process has received a great deal of attention, and there has been much progress in the conceptualization and assessment of learning environments (Fraser, 1994, 1998b).

The way in which the important pioneering work of Walberg and Moos on perceptions of classroom environment inspired a lot of other research is reflected in numerous comprehensive literature overviews. These include books (Fraser, 1986; Fraser & Walberg, 1991; Goh & Khine, 2002; Moos, 1979; Walberg, 1979), monographs (Fraser, 1981; Fraser & Fisher, 1983a), guest-edited journal issues (Fraser, 1980; McRobbie & Ellett, 1997), and numerous literature reviews (Anderson & Walberg, 1974; Chavez, 1984; Fraser, 1989, 1991, 1994, 1998a, 2002; MacAuley, 1990; Randhawa & Fu, 1973; Walberg, 1976; Walberg & Haertel, 1980). Some examples of this research are provided in this section.

The American Educational Research Association established a very successful Special Interest Group (SIG) on the Study of Learning Environments in 1984 and this group sponsored an annual monograph (e.g., Fraser, 1986, 1987, 1988; Waxman & Ellett, 1990). In 1998, Kluwer Academic Publishers initiated a new international journal called *Learning Environment Research* (Fraser, 1998c).

In the past three decades, much attention has been given to the development and use of instruments to assess the qualities of the science classroom learning environment from the perspective of the student (Fraser, 1986, 1994; Fraser & Walberg, 1991). Classroom environment involves the shared perceptions of the students and the teachers in a particular environment (Fraser, 1986). Although the concept of classroom environment is subtle, much progress has been made in conceptualizing, measuring and analyzing it, and in mapping its effects on students (Fraser, 1989, 1994, 1998a, 1998b). Studies have indicated that students' perceptions of their classroom learning environments are related to students' cognitive and affective outcomes (Fraser, 1986, 1989, 1994; Fraser & Fisher, 1982a; Haertel, Walberg &

Haertel, 1981; Walberg, 1976). Also, students have been found to achieve better in the types of classroom environments that they prefer (Fraser & Fisher, 1983a, 1983b).

Educational environments can be considered as the social-psychological contexts or determinants of learning (Fraser, 1994). This interest in human environments is also shared to some extent by researchers in other fields including those of psychology, sociology, physiology and engineering (Knirk, 1992; Vasi & Laguardia, 1992; Weinstein, 1979).

Walberg's theory of educational productivity (Walberg, 1981, 1984b, 1986) holds that there are nine factors which contribute to variance in students' cognitive and affective outcomes: student ability, age and motivation; the quality and quantity of instruction; and the psychological environment of the home, the classroom social group, the peer group (pressure) outside the classroom, as well as the amount of television viewing. Studies involving data collected from national samples have confirmed this model's validity in showing that student achievement and attitudes are influenced jointly by a number of factors rather than by one dominant factor (Walberg, 1986; Walberg, Fraser, & Welch, 1986). Classroom and school environment factors were found to be particularly important influences on student outcomes, even when a number of other factors were controlled.

Most past research into classroom learning environments (Fraser, 1986, 1998a, 1994; Wubbels & Levy, 1993) has been based upon students' perceptions of their learning environment. Based on how students perceive their learning environment, one study (Brekelmans, Wubbels & Creton, 1990; Wubbels, Brekelmans & Hermans, 1987) indicated that, students' perceptions of their teachers' interpersonal actions accounted for more variance in student outcomes than did the introduction of a new curriculum. In another study (Brekelmans, Wubbels & Levy, 1993), students' perceptions of their teachers' interpersonal actions accounted for variance in student grades.

Literature reviews (Fraser, 1986, 1994, 1998a; Fraser & Walberg, 1991) show that science education researchers have led the world in the field of classroom environment over the last two decades, and that this particular field has provided understanding to guide improvements in science education. Studies which built on

Lewin's (1936) influential field theory and Walberg's (1981) theory of educational productivity established that students' perceptions of the classroom psychosocial environment are associated with, and could predict, their affective, behavioral and cognitive learning (Fraser, 1986, 1994; Fraser & Fisher, 1982a, 1982b; Haertel, Walberg & Haertel, 1981).

Aldridge and Fraser (2000) claim that, although a recent literature review (Fraser, 1998a) shows that the majority of the classroom environments studies ever undertaken involved Western countries, a number of important studies have been carried out in non-Western countries. Early studies established the validity of classroom environment instruments that had been translated into the Indian (Walberg, Singh & Rasher, 1977) and Indonesian (Schibeci, Rideng & Fraser, 1987) languages and replicated associations between student outcomes and classroom environment perceptions.

A study in Brunei Darussalam was conducted to investigate lower secondary mathematics classroom learning environments and their associations with students' satisfaction with learning mathematics (Majeed, Fraser, & Aldridge, 2002). A sample of 1,565 students from 81 classes in 15 government secondary schools participated in the study. Students' perceptions of the classroom learning environments were assessed with a version of the My Class Inventory (MCI) and a measure of student satisfaction also was included. The study revealed satisfactory reliability and validity for a refined three-scale version of the MCI assessing cohesiveness, difficulty and competition. The data were used to generate information regarding the factor structure of the questionnaire and each scale's internal consistency reliability, discriminant validity and ability to distinguish among the different class groupings. The statistical data reported in this study give an indication of the suitability of the MCI questionnaire for describing the psychosocial environments of classrooms.

In Hong Kong, a study using qualitative methods involving open-ended questions was used to explore students' perceptions of the learning environments in Grade 9 classrooms (Wong, 1993, 1996). This particular study found that various students identified the instructor as the most critical element in a positive classroom learning environment. These particular teachers were found to keep order and discipline while

creating an atmosphere that was not boring or solemn. Additionally, the teachers were found not only to interact with their students in ways that could be considered friendly, but also to show concern for their students.

Cheung (1993), in a study in Hong Kong, used multilevel analysis to determine the effects of the learning environment on students' learning. The findings of this study provided insights that help to explain why Hong Kong was found to rank highly in physics, chemistry and biology in international comparisons (Keeves, 1992).

Research involving a person-environment fit perspective has shown that students achieve better where there is greater congruence between the actual classroom environment and that preferred by students (Fraser & Fisher, 1983a, 1983b). Hunt (1975) revealed that similarity between the actual environment and that preferred by students leads to improved student achievement and attitudes.

Although most individual studies of educational environments in the past have tended to focus on a single environment, there is potential in simultaneously considering the links between and joint influence of two or more environments. Majoribanks (1991) shows how the environment of the home and school interact and codetermine school achievement, and Moos (1991) illustrates the links between school, home and parents' work environments. Several studies have established associations between school-level and classroom-level environment (Dorman, Fraser & McRobbie, 1997; Fraser and Rentoul, 1982). For this reason, it was important in my study to investigate further the home environment and the role that parents play in student achievement.

The combination of qualitative and quantitative methods has been a feature of several recent learning environment studies (Fraser & Tobin, 1991; Tobin & Fraser, 1998). As a result of combining these two types of methods, we find that the advantages of each not only complement each other, but also produce a stronger research design that yields more dependable findings. Aldridge, Fraser and Huang (1999), in a cross-cultural study of classroom learning environment that included Australia and Taiwan, reported that the use of a qualitative methods provided richer interpretations and insights to their study, while the quantitative data collected supported broad generalizations.

Fraser (1988a, 1988b) reviews more lines of past research involving learning environment assessments. Classroom environment instruments have been used as a valuable source of process criteria in the evaluation of educational innovations. For example, classroom environment variables have been used in evaluating systematic reform in Texas (Dryden & Fraser, 1998) and computer-assisted learning in Singapore (Teh & Fraser, 1994). More studies have investigated differences between student and teacher perceptions of actual and preferred environments (Fisher & Fraser, 1983b) and found consistent patterns. First, both students and teachers preferred a more positive classroom environment than was actually present. Second, teachers perceived a more positive classroom environment than did their students in the same classrooms. Finally, Fraser (1998a) reviews numerous past studies in which classroom environment variables have been used as criterion variables in research aimed at identifying how the classroom environment varies with such factors as teacher personality, class size, grade level, subject matter, and the nature of the school environment.

2.3.2 Some Instruments for Assessing Classroom Environments

As noted above, a milestone in the historical development of the field of learning environment occurred over 30 years ago when Herbert Walberg and Rudolf Moos began seminal independent programs of research. In the late 1960s, two instruments were developed which pioneered the use of perceptions to measure the classroom environment. The Learning Environment Inventory (LEI), developed by Herbert Walberg (Anderson & Walberg, 1968), and the Classroom Environment Scale (CES), developed by Rudolf Moos (Moos & Houts, 1968), set in motion the way for the evolution of other measuring instruments. A historical look at the field of learning environments over the past few decades shows that a striking feature is the availability of a variety of economical, valid and widely-applicable questionnaires for assessing student perceptions of classroom environments (Fraser, 1998a, 1998b, 2002).

The original development and validation of the LEI began in the late 1960s as part of the evaluation and research related to Harvard Project Physics (Fraser, Anderson, &

Walberg, 1982; Walberg & Anderson, 1968). The final version contains 105 statements (seven per scale) descriptive of typical school classes. The respondent conveys degree of agreement with each statement using the four responses alternatives of Strongly Disagree, Disagree, Agree and Strongly Disagree. The scoring direction is reversed for some items. A representative item in the Cohesiveness scale is "All students know each other very well" and in the Speed scale is "The pace of the class is rushed".

The My Class Inventory (MCI) is a simplified form of LEI for use among children aged 8-12 years (Fisher & Fraser, 1981; Fraser, Anderson & Walberg, 1982; Fraser & O'Brien, 1985). The MCI was developed originally for use at the elementary school level, but it has been found to be useful with students in the junior high school, especially those with limited reading skills in English. The MCI differs from the LEI in five ways. First, it contains only five of the LEI's original 15 scales. Second, item wording was simplified to enhance readability. Third, the LEI's four-point response format was reduced to a two-point (Yes-No) response format. Fourth, students answer on the questionnaire rather than on a separate response sheet, thus avoiding possible errors in transferring responses. Fifth, it contains a total of 38 items instead of the 105 statements in the final LEI.

The final form of the MCI contains 38 items. However, Fraser and O'Brien (1985) developed a short 25-item version. Typical items are "Children are always fighting with each other" (Friction) and "Most children can do their school work without help" (Difficulty). Goh, Young, and Fraser (1995) changed the MCI's Yes-No response format to a three-point response format (Seldom, Sometimes and Most of the Time) in a modified version of the MCI which includes a Task Orientation scale and which was used in Singapore.

The Classroom Environment Scale (CES) (Fisher & Fraser, 1983b; Moos, 1979; Moos & Trickett, 1987) was developed as part of a comprehensive set of perceptual measures of a variety of human environments, including psychiatric hospitals, prisons, university residences and work milieus (Moos, 1974). The final published version of the CES contains nine scales with 10 items of True-False response format in each scale. Published materials include a test manual, a questionnaire, an answer

sheet and a transparent hand scoring key. Representative items in the CES are "The teacher takes a personal interest in the students" (Teacher Support) and "There is a clear set of rules for students to follow" (Rule Clarity).

These widely-used instruments--like the (LEI) and the (CES)--have been used to assess student perceptions of dimensions of their actual and preferred classroom learning environment. Walberg, Singh and Rasher (1977) used the LEI in the Hindi language in a large study involving 3000 students. They reported that student perceptions of the LEI accounted for a significant amount of achievement variance beyond that attributable to general ability. When Moos and Trickett (1987) used the Classroom Environment Scale, they standardized items in terms of format and used them to compare the learning environment experienced by students in the classes of two different teachers. However, both the LEI and the CES were designed for teacher-centered classrooms.

In contrast to the LEI's and CES's focus on teacher-centered classrooms, the Constructivist Learning Environment Survey (CLES) focuses on student-centered settings. The CLES was developed to assist teachers' attempts to transform their classroom learning environments in accordance with critical constructivist epistemology (Taylor, Dawson & Fraser, 1995). The CLES was developed in 1991 (Taylor & Fraser, 1991) to enable teachers to monitor the transformation from a more teacher-centered approach to a more constructivist teaching approaches and to counter key restraints to the development of constructivist classroom climates in school science and mathematics (Aldridge, Fraser, Taylor & Chen, 2000; Taylor, Fraser & Fisher, 1997).

The CLES assesses learners' and teachers' perceptions of five dimensions that pertain to the notion of constructivism: Personal Relevance, Uncertainty, Shared Control, Student Negotiation, and Critical Voice. The CLES is available in an actual and preferred form (Kim, Fisher & Fraser, 1999). The CLES preferred from (Fraser, 1994, 1998a) is concerned with goals and value orientations and measures the learners' perceptions of the learning environment that these students would prefer.
Taylor, Dawson and Fraser (1995) used the CLES in a study in Australia with 494 students. The results indicated that students' perceptions of the constructivist

environments provided a useful 'discover yourself' device to improve teacher-researchers' understanding of the impact on learners of their teaching modernization and the potential changes it might bring.

Dryden and Fraser (1998) used the CLES tin the United States in a longitudinal study involving 440 high school students in a pretest and 351 students in the posttest. The posttest was administered three years following the pretest. The CLES proved reliable in assessing constructivist approaches in high school science classes, and provided valuable information about changes over time.

The CLES was used in a study in Korea to assess a new curriculum (Kim, Fisher & Fraser, 1999). The Korean version of the CLES was found reliable and the results indicated that those students who were exposed to the new curriculum perceived a more constructivist learning environment than those students who were not included in the study. The CLES has also been used in Korea by Lee and Fraser (2001a).

Aldridge, Fraser, Taylor and Chen (2000) used the CLES in a cross-cultural study in Taiwan and Australia. The questionnaire was administered to 1081 students form 50 classes in Australia, and 1879 students form 50 classes in Taiwan. The data revealed that both versions of the CLES, English and Mandarin, were valid and reliable.

In order to assess and investigate those dimensions that distinguish individualized classrooms from conventional ones, the Individualized Classroom Environment Questionnaire (ICEQ) was developed. The initial ICEQ (Rentoul & Fraser, 1979) was developed by interviewing teachers and secondary school students, by reviewing the literature on individualized, open and inquiry-based education, and by seeking reactions to draft versions from selected experts, teachers and junior high school students. The instrument contains 50 items that are answered on a five-point scale. Because teachers and researchers were more interested in an instrument that would take less time to administer and score, a short version of the ICEQ (Fraser, 1998a; Fraser & Fisher, 1983b) was developed. The short version involves only 25 items designed for easy scoring and a small amount of testing time, but it still exhibits satisfactory reliability for class means. This short form was primarily based on the results of item analysis performed on data obtained by administering the long form to

a large sample. The short form of 25 items is divided equally among the five scales (Personalization, Participation, Independence, Investigation, and Differentiation) comprising the long form (Fraser, 1998a).

Looking at studies emphasizing individualized classroom environments led me to ponder the importance of school environment and the role that it plays. The potential strengths and problems associated with existing school environment instruments led to the development of a new school environment instrument named the School Level Environment Questionnaire (SLEQ) (Fisher & Fraser, 1990). The SLEQ measures teachers' perceptions of psychosocial dimensions of the school environment. The instrument consists of eight scales, Student Support, Affiliation, Professional Interest, Staff Freedom, Participatory Decision Making, Innovation, Resource Adequacy and Work Pressure. The SLEQ consists of 56 items, with each of the eight scales being assessed by seven items, and each item is scored on a five-point scale.

Fisher, Fraser and Wubbels (1993) reported validation date for the SLEQ for a number of samples including a study of 46 teachers in seven Australian schools. When the SLEQ was used in a study of differences between the climates of primary and high schools with a sample of 109 teachers in 10 schools (Fisher & Fraser 1991), the findings revealed that, on most of the SLEQ scales, the environments in primary schools were viewed as being more favorable than the environments in the high schools. Based on the SLEQ, Dorman and Fraser (1996) used a school environment questionnaire to make comparisons between government schools (public schools) and Catholic schools (private schools). The results from 208 science and religion teachers from 32 schools indicated significant differences of approximately one standard deviation between the two types of schools, specifically in terms of Mission Consensus and Empowerment. The teachers from the Catholic schools saw their schools as being more empowering and higher on Mission Consensus than teachers from the government schools.

The *Questionnaire on Teacher Interaction* (QTI) is a 48-item instrument measuring students' perceptions of their teacher's interpersonal behavior in the classroom. It is based on the Leary (1957) model of interpersonal behavior and measures students' perceptions of the degree of dominance/submission and cooperation/opposition in the

teacher's behavior in the classroom. Its reliability and validity have been well documented for studies in The Netherlands (Brekelmans, Wubbels & Creton, 1990), America (Wubbels & Levy, 1993) and, more recently, in Australia (Fisher, Henderson & Fraser, 1995; Rawnsley & Fisher, 1997; Rickards, Fisher & Fraser, 1996) and in Asian countries (Fraser, 2002).

Scott and Fisher (2000) assessed students' perceptions of science teachers' interpersonal behaviors in government primary schools in Brunei Darussalam using a 48-item Australian version of the Questionnaire on Teacher Interaction (QTI) (Wubbels & Levy, 1993) which had been translated into Standard Malay. The analyses collected from a sample of 3,104 students in 136 primary school classes supported the reliability and validity of the Standard Malay version of the QTI. Scott and Fisher (2000) also reported statistically significant associations between the scores achieved by students on an external science examination and three of the eight QTI scales, namely, Helping/Friendly, Understanding and Uncertainty behavior.

A modified *What is Happening in this Classroom?* (WIHIC) (Fraser, Fisher & McRobbie, 1996; Rawnsley & Fisher, 1997, 1998) was used to determine the perceptions of students about their classroom learning environment. The instrument consists of 64 statements which measure students' perceptions on eight scales: Student Cohesiveness, Teacher Support, Involvement/Negotiation, Investigation, Cooperation, Task Orientation, Equity, and Emphasis on Understanding in the classroom. For example, two statements from the Teacher Support scale are "The teacher takes a personal interest in students" and "The teacher considers students' feelings". Students were asked to respond to each statement by indicating whether it represented a situation which 'Almost Never Happens', 'Seldom Happens', 'Sometimes Happens', 'Often Happens' or 'Almost Always Happens'. Students' perceptions of their classroom learning environments are then profiled according to the class item mean score for each scale.

According to the researchers (Fraser, Fisher & McRobbie, 1996; Rawnsley & Fisher, 1997, 1998), students developed more positive attitudes towards their mathematics in classes where the teacher was perceived to be highly supportive, equitable, place a strong emphasis on understanding the work, involve students in investigations, show

leadership and helping-friendly behavior, and use minimal admonishment of students. Additionally, students showed the greatest cognitive gains in classes where students perceived that the teacher emphasised understanding the work. The least cognitive gains occurred in classes where students perceived that the teacher was dissatisfied, gave them too much freedom and responsibility, and where they were involved in investigations.

For my study, the What Is Happening In This Class? (WIHIC) questionnaire seemed to be a highly suitable instrument to use for the purpose of investigating kindergarten students' and their parents' perceptions of actual and preferred classroom learning environments. Therefore, Section 2.3.3 is devoted to discussing the WIHIC in greater detail.

2.3.3 What Is Happening In This Class? (WIHIC) Questionnaire

Despite the fact that numerous learning environment instruments have provided a better understanding of the social structure climate of school classrooms, various researchers have felt a need to develop a single instrument that incorporates the best elements of past instruments. Thus, based on previous studies, Fraser, Fisher and McRobbie (1996) developed a new learning instrument called the *What Is Happening In This Class?* (WIHIC) questionnaire. The instrument not only includes scales that have been used and proven to be significant predictors of learning outcomes, but additional scales to measure modern concerns in the classroom, like cooperative learning and equity issues.

The WIHIC is made up of seven scales and 56 items (Fraser, Fisher, & McRobbie, 1996; Aldridge & Fraser, 2000). The seven scales are Student Cohesiveness, Teacher Support, Involvement, Investigation, Task Orientation, Cooperation and Equity. The original questionnaire in English has been translated into Chinese for use in Taiwan (Aldridge & Fraser, 2000), into Korean (Kim, Fisher, & Fraser, 2000) and into Indonesian (Margianti, Fraser, & Aldridge, 2001b; Soerjaningsih, Fraser & Aldridge, 2001). Chionh and Fraser (1998) used the English version of the actual and preferred forms of the WIHIC in Singapore to further validate the instrument and to investigate associations between actual classroom environment and student outcomes. The study

revealed that attitudes were more positive in classrooms perceived as having more Teacher Support, Task Orientation and Equity. Additionally, the study revealed that better grades were found in classrooms where students perceived the environment as more cohesive.

Kim, Fisher, and Fraser (2000) used the WIHIC in Korea to investigate gender-related differences in students' perceptions of their learning environment. The study revealed statistically significant differences between boys' and girls' perceptions of the learning environment on all seven scales. The study showed that boys perceived more Teacher Support, Involvement, Investigation, Task Orientation, and Equity than girls did.

Rawnsley and Fisher (1998a), using the WIHIC in Australia, investigated associations between learning environments in mathematics classrooms and students' attitudes towards mathematics. The study revealed that, if the teacher involved the students in investigations, was equitable and was supportive, those students showed a more positive attitude toward mathematics.

Fraser and Aldridge (2000) examined classrooms in Australia and Taiwan using English and Chinese versions of the WIHIC. They discovered that students from Australia perceived their classrooms environments more positively than students from Taiwan. These results were reflected on the WIHIC scales of Involvement, Investigation, Task Orientation, Cooperation, and Equity. Students from Australia believe that they were given more opportunities to get involved in experiments and investigations. These cross-cultural studies revealed that the WIHIC displayed factorial validity and differentiated between the classroom environments in the two countries.

Riah and Fraser (1998) reported associations between perceptions of learning environment and attitudinal outcomes when they used a modified English-language version of the WIHIC with students in Brunei. Simple correlation and multiple analyses showed significant relationships between the environment scales and students' attitudes toward their classes.

Goh and Khine's (2002) book of readings shows that, even though the WIHIC is a comparatively a recent instrument, it has been translated into several Asian Languages and cross-validated. A study that used the English versions of the WIHIC in Singapore (Fraser & Chionh, 2000) reported strong validity and reliability for both an actual and a preferred form when it was responded to for the subjects of mathematics and geography by a sample of 2310 students in 75 senior high school classes. Khoo and Fraser (1998) used the WIHIC with a sample of 250 adults attending computer courses in 23 classes in four Singaporean computing schools.

The studies mentioned above indicate that the WIHIC has proved to be valid, reliable and useful for measuring actual and preferred learning environments in numerous countries. Therefore, I chose the WIHIC of assessing and investigating perceptions of the learning environment of very young students and their parents. These elements made my study unique as it involved the assessment of learning environments at the kindergarten level, while evaluating both students' and parents' perceptions of the learning environment.

2.3.4 Associations Between Learning Environments and Student Outcomes

As noted in Section 2.3.1, the strongest tradition in past classroom environment research has involved investigation of associations between students' cognitive and affective learning outcomes and their perceptions of psychosocial characteristics of their classrooms (Fraser & Fisher, 1982; Haertel, Walberg & Haertel, 1981; McRobbie & Fraser, 1993). Various research studies have shown that student perceptions account for appreciable amounts of variance in learning outcomes, often beyond that attributable to background student characteristics. Fraser's (1994) tabulation of 40 past studies in science education showed that associations between outcome measures and classroom environment perceptions have been replicated for a variety of cognitive and affective outcome measures, a variety of classroom environment instruments and a variety of samples (ranging across numerous countries and grade levels).

Because one of the aims of my study was to investigate associations between student outcomes and classroom environment, this section is devoted to reviewing past research into outcome-environment associations.

Using the Science Laboratory Environment Inventory (SLEI), associations with students' cognitive and affective outcomes have been established for a sample of approximately 80 senior high school chemistry classes in Australia (Fraser & McRobbie, 1995; McRobbie & Fraser, 1993), 489 senior high school biology students in Australia (Fisher, Henderson & Fraser, 1997) and 1,592 grade 10 chemistry students in Singapore (Wong & Fraser, 1996). Using an instrument suited for computer-assisted instruction classrooms, Teh and Fraser (1995a) established associations between classroom environment, achievement and attitudes among a sample of 671 high school geography students in 24 classes in Singapore. Using the Questionnaire on Teacher Interaction (QTI), associations between student outcomes and perceived patterns of teacher-student interaction were reported for samples of 489 senior high school biology students in Australia (Fisher, Henderson & Fraser 1995), 3,994 high school science and mathematics students in Australia (Fisher, Fraser & Rickards 1997) and 1,512 primary school mathematic students in Singapore (Goh, Young & Fraser 1995).

There are other past studies that have shown major associations between particular types of learning environments and higher student outcomes, both academic and attitudinal outcomes. After studying these relations, Walberg (1985) concluded that students' perceptions of the social environment of learning account for a significant variance in cognitive, affective and behavioral post-course measures beyond that accounted for by parallel pre-course measures.

Some aspects of the learning environment in environmental science classrooms have been found to be associated with students' attitudinal outcomes and suggest that favorable student attitudes could be promoted in classes where the students perceive more cohesion amongst students, a greater degree of student involvement in classroom activities, and a higher level of task orientation (Henderson, Fisher, & Fraser, 1998). At the same time, as an improvement in students' attitudinal outcomes is desirable for its own sake, it is possible that more positive student attitudes will be reflected in higher achievement outcomes (Freedman, 1997; Schibeci & Riley, 1986), particularly if achievement is measured by students' class work, rather than by end-of-year examinations and tests (Germann, 1988).

In a meta-analysis that examined 823 classes in eight subject areas representing the perceptions of 17,805 students in four nations, Haertel, Walberg, and Haertel (1981) found enhanced student achievement in classes in which students perceived greater Cohesiveness, Satisfaction, and Goal Direction and less Disorganization and Friction. Other literature reviews since then have supported the existence of associations between classroom environment variables and student outcomes (Fraser, 1998a).

Fraser and Fisher (1983a) extended research on outcome-environment associations also to encompass students' preferences. The finding that higher actual individualization was associated with high learning levels only among those classes whose students preferred individualization suggests that student achievement is likely to be greater in classrooms in which there is similarity between the actual environment and that preferred by students. Consequently, teachers might strive to improve student achievement of cognitive and affective outcomes by changing their actual classroom environments in ways which make their levels of individualization more congruent with those preferred by students (Fraser & Fisher, 1983a).

A study conducted in Western Australia, entitled the Western Australian School Effectiveness Study (WASES) (Young, 1998) discusses how most of the variability in student achievement is at the classroom and student level, with negligible amounts at the school level. The study suggests that effective schools are characterized by high staff morale and self-esteem and students with high self-esteem.

Asian researchers have undertaken a wide variety of valuable studies into associations between student outcomes and students perceptions of their classroom learning environment. These studies also cover a wide range of environment instruments, student outcomes, school subjects and grade levels. While some studies have involved English-language versions of questionnaires, other studies have involved learning environment questionnaires that have been translated into various Asian languages (Fraser, 2002; Goh & Khine, 2002).

Goh and Fraser (2002) reported that, in Singapore, relationships exist between a variety of student outcomes and students' classroom environment perceptions as assessed by several instruments. Wong and Fraser (1996) established links between

students' attitudes and scores on scales of the Science Laboratory Environment Inventory (SLEI) for a sample of 1592 Grade 10 chemistry students in 56 classes. In a different study in Singapore, Goh used both the MCI and the QTI with 1512 primary mathematics students in 39 classes to establish associations between the classroom environment and mathematics achievement and attitudes (Goh & Fraser, 1998, 2000). Fraser and Chionh's (2000) unusually comprehensive study established associations between WIHIC scales and three student outcomes (examination results, attitudes and self-esteem) among a large sample or 2310 mathematics and geography students in 75 classes. Teh and Fraser (1995) found associations between classroom environment, achievement and attitudes among a sample of 671 high school geography students in 24 classes in Singapore.

Fraser (2002) reported that, in Brunei Darussalam, outcome-environment associations have been established for satisfaction and scales of the MCI for a sample of 1565 Form 2 mathematics students in 81 classes (Majeed, Fraser, & Aldridge 2002). A sample of 1188 Form 5 students in 54 science classrooms (Khine, 2001; Khine & Fisher, 2001, 2002) established outcome-environment associations for science attitudes and scales of both the WIHIC and the QTI. Riah and Fraser (1998) established outcome-environment relationships for achievement and attitudes and scales of the WIHIC, QTI, and SLEI with a sample of 644 chemistry students in 35 classes from 23 government secondary schools. And Scott and Fisher (2001) established outcome-environment associations for enjoyment of science lessons with scales from the primary school version of the QTI that had been translated into Standard Malay and used with 3104 students in 136 classes in 23 private schools

Lee and Fraser (2001a, 2001b, 2002) reported that, in Korea, outcome-environment associations exist between students' attitudes to science and a Korean-language version of the SLEI, CLES, and QTI for a sample of 440 Grade 10 and 11 science students in 13classes. Kim (1999) reported that, in Korea, outcome-environment associations exist for student attitudes and Korean-language versions of the CLES for a sample of 1083 science students in 24 classes. Finally, Kim (2000) reported that, in Korea, outcome-environment associations exist for student attitudes and Korean-language versions of the QTI and WIHIC for 543 students in 12 schools.

Margianti, Fraser and Aldridge (2001a, 2001b) reported that, in Indonesia, associations were found between the outcomes of achievement and attitudes and students' perceptions on an Indonesian-language version of the WIHIC with a sample of 2498 university students in 50 classes. Soerjaningsih, Fraser and Aldridge (2001a, 2001b) used Indonesian-language versions of the WIHIC and QTI to establish links with student outcomes among 422 university students is 12 classes.

In Taiwan, outcome-environment relationships were found for student satisfaction and a Chinese-language version of scales for both the WIHIC and CLES for a sample of 1879 science students in 50 classes (Aldridge & Fraser, 2000; Aldridge, Fraser & Huang, 1999; Aldridge, Fraser, Taylor, & Chen, 2000). Aldridge and Fraser (2000) explored the relationship of classroom environment and student outcomes in a cross-national study of classroom environments in Taiwan and Australia.

2.4 Students' Attitude to Science

My study is distinctive as it involved assessing students' attitudes and investigating associations between attitudes and learning environment among kindergarten students in science classrooms. Fraser (1998a) stated that classroom and school environments have been found to be a strong predictor of both achievement and attitudes even when a comprehensive set of other factors was held constant.

For my study, I used selected scales from the Test of Science-Related Attitudes (TOSRA) to determine attitudinal measures. TOSRA (Fraser, 1981) was created to measure seven science-related attitudes amongst secondary school students. The seven scales are Social Implications of Science, Normality of Scientists, Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lessons, Leisure Interest in Science, and Career Interest in Science.

Fraser (1981) reports several studies conducted for cross-validation data since the initial validation of TOSRA in 1977. Two samples in a study by Lucas and Tulip (1980) included 567 Year 10 students and 273 Year 12 students in four state high schools in Brisbane. Next, Schibeci and McGaw (1980) conducted a study which included 1041 Year 8-10 students from 11 schools in suburban areas of Perth,

Western Australia. Fraser and Butts (1982) reported on a study that included 546 Year 9 girls in two urban Catholic schools in Philadelphia, United States. Consequently, Fraser and Butts (1982) conducted a study which included 712 Year 7-9 students from 23 different classes. Each class consisted of a different teacher in eight different schools in Sydney, Australia. For all samples described above, high internal consistency reliability and satisfactory discriminant validity were reported. These results are noteworthy because they support the validity of TOSRA in general, as well as specifically for use in the United States.

The studies mentioned above indicate that the TOSRA is a reliable instrument for the use of measuring science-related attitudes of students and or whole classes. My study is unique in that it involved the assessment of science-related attitudes at the kindergarten level. For the purpose of this study, a modified version of TOSRA was used to assess science-related attitudes among very young (kindergarten) students. The modified TOSRA included three of the seven original TOSRA scales, namely, Attitude to Scientific Inquiry, Adoption of Scientific Attitudes and Enjoyment of Science Lessons. Also, only 24 items/questions were included and the questions were read aloud to the students in their preferred language (English or Spanish).

According to Jere Brophy (1986), motivation to learn is a competence acquired through general experience but stimulated most directly through modeling, communication of expectation, and direct instruction or socialization by significant others (especially parents and teacher). Children's home environment shapes the initial constellation of attitudes that children can develop toward learning. When parents nurture their children's natural curiosity about the world by welcoming their questions, encouraging exploration, and familiarizing them with resources that can enlarge their world, they are giving their children the message that learning is worthwhile and frequently fun and satisfying.

One of the goals for school science that underlies the National Science Education Standards (1996) is to educate students who are able to experience the richness and excitement of knowing about and understanding the natural world. This development of positive attitudes toward science is a critical component of science instruction (Gardner, 1991; NAEP, 1987). It is judged to be imperative that students develop, at

an early age, favorable attitudes toward science (NAEP, 1987) and that this favorable orientation be maintained (Anderman & Maehr, 1994, pp. 55-64).

If it is vital that students develop favorable attitudes toward science, then are we to expect the same for teachers who teach science? In 1993, D.B. Rosenthal (1968) published a study that compared students' attitudes toward scientists with instructors' attitudes toward scientists. Rosenthal discovered that instructors who held a negative attitude toward science reflected a negative attitude in their teaching. This negative perception created a negative attitude toward science in the students.

Jane Butler Kahle (1993) reported that, teachers' behaviors and instructional strategies affect students' skills, interests and retention rates in science. In addition, Kahle reported some research evidence to suggest that teaching in a particular way could affect students' images of scientists. A defining feature of a supportive environment is a responsive and responsible adult who nurtures children's dispositions to learn. The quality of early teacher-child relationships affects social competence and school achievement (National Institute on Early Childhood Development and Education, 2000).

2.5 Parent/Home Environment and the Role of Parents in Student Achievement

My study investigated associations between kindergarten students' achievement and attitudes and their parents' perception of the learning environment in science classrooms. Therefore, I felt that a section on the role that parents play in student attitudes and achievement was appropriate, because I believe that parents can contribute to their children's eagerness to learn, and possibly affect how children learn.

In a case study funded by the Office of Education Research and Improvement (1999), parental involvement in the academic process was seen by all as a critical ingredient in school success and achievement. Schools have been found to vary in their ability to nurture and support parental involvement. In addition, older siblings and the values that they hold about education can influence students, both negatively and positively.

Family variables are powerful predictors of children's subsequent language development and academic performance. Parental beliefs and attitudes about literacy and reading affect children's literacy development (Powell & D'Angelo, 2000). Kelleghan, Sloane, Alvarez, and Bloom (1993) declared that the research on the role of home environment in schools learning has various implications. First, the home environment is a most powerful factor in determining the school learning of students, their level of school achievement, their interest in school learning, and the number of years of schooling that they will receive. Second, when the home and school have divergent approaches to life and to learning, children are likely to suffer in their school learning. Third, the socioeconomic level or cultural background of a home need not determine how well a child does at school. Fourth, and finally, parents should be in a better position to decide what to do in their homes if they have some understanding of the home factors that affect their children's school learning and know something about what they can do to encourage and support that learning.

Parents are truly the first teachers of their children. This notion is so powerful that there are growing numbers of programs called Parents as First Teachers around the US. Recent advances in brain research inform us that the first years of life are critical in terms of determining the learning abilities of our children (Sylwester, 1994). Much can be done to help parents to make the most out of the first years of life. Helping parents to understand that their job is to 'turn on' receptors in their young children's brains goes a long way toward achieving this goal.

Parent programs have been found to have significant and positive effects on children's verbal ability, language, school-related knowledge and skills, and achievement in school subjects, especially when integrated into a network of community support. They have also been found to alter parents' attitudes, self-concepts, and behavior, and to affect other members of the family and ultimately the community in which the family lives (Kelleghan, Sloane, Alvarez, & Bloom, 1993).

The most effective way to create a learning environment for the young child would be to take advantage of those experiences that most enrich human growth. Parents have for years approached the cognitive areas of learning cautiously for fear of harming their child or teaching something in the 'wrong' way that would need to be unlearned

at a later time. With a receptive environment approach, there can be no wrong way of learning. In a situation in which the child and the parent or teachers' respond sensitively to each other, only growth and pleasure in learning can be the outcome (Clark, 1983).

Most revealing is the fact that parents' educational attainment continues to be a strong predictor of their children's reading and writing abilities even after children reach adulthood. On average, adults whose parents had completed high school or beyond scored 1 to 1.5 levels higher on English literacy tasks in 1992 than adults whose parents had never completed high school (Kirsch, Jungeblut, Jenkins, & Kolstad, 1993).

Pianta and Kraft-Sayre (1999) reported that most of what we know about children's entry into school is from the perspectives of schools and educators. Little is known about the perspectives of parents, particularly parents with a wide range of backgrounds and resources. If schools are to communicate effectively with parents concerning transitions between home and school, it is essential that parents' voices be heard. Communication and continuity between preschool, home, and school are often recommended in promoting children's successful transitions to kindergarten (Love & Yelton, 1989).

Hoover-Dempsey and Sandler (1997) identified three constructs central to parents' involvement: the role that parents perceive for themselves; the parents' sense of efficacy; and the parents' perceptions about the level of welcome in the school.

Popkin's (1995) research indicates that children benefit from parental involvement in the following ways:

- better grades and test scores
- better attendance
- greater completion rate of homework
- higher graduation rates
- more involvement in extra-curricular activities
- improved attitude and better all-round behavior

If it is accepted that adolescents' aspirations are important determinants of young adults' educational and occupational attainment, then such findings provide support for the contention that programs directed at reducing inequalities in educational outcomes must consider the subtleties of the interplay between family and school learning environments. Unless adolescents perceive their parents as being supportive of their learning, then they are likely to have depressed educational and occupational aspirations, even if they perceive that their teacher is being strongly supportive (Marjoribanks, 1991).

My study investigated parents' perceptions of the learning environment as they relate to/influence student achievement and attitudes in science classrooms. Parents' opinions of their children's schools provide an indicator of the perceived relative health of education. Examining parents' levels of satisfaction with schools can help to define perceived problems within America's schools (NCES, 2002).

Parents often remark that their learning patterns are similar to those of their children, and so they have strategies of their own to share. Unfortunately, some also limit the child's early experiences because of their own preferences (Healy, 1987).

Laurent Steinberg, Professor of Psychology at Temple University, and Pedro Noguera (1999), Professor at the University of California, Berkeley, reported that the interacting forces of peers, parents, and ethnicity, all working in tandem, shape the attitudes that students have toward school and their academic achievement. Steinberg

portrays low academic motivation as near epidemic among American teenagers – especially among Latino and African-American students. Noguera readily acknowledges the powerful influence of peers and parents, insisting that the school can do much more than it currently does to address issues of intra-school segregation, academic tracking, and the underachievement of minority students.

After diagnosing the problems associated with low student achievement in California, Steinberg (1999) made several recommendations. Some of these are that schools make it clear in the minds of young people and parents that the primary activity of childhood and adolescence is school. He recommended that schools provide candid discussions about the high rate of parental irresponsibility in the country and the toll that it is taking on our youngsters' lives. He insisted that schools expand their efforts to actively draw parents into school and school programs. In addition, he recommended that schools transform the debate so that it is less about reforming schools and more about changing students' and parents' attitudes toward school achievement.

In reference to the problems associated with low student achievement in California, some of Noguera's (1999) recommendations are that schools make parents, especially the parents of low-achieving students, get involved in the process of school change. He reminded schools that students' outcomes are what matters most. In other words, if more kids don't graduate from high school and go on to college, then perhaps the school itself is not really improving. Therefore, he suggested that student achievement data be used to forge real plans for improvement. Finally, he recommended that schools pay teachers more, but only while also making them more accountable for student learning.

All parents want their children to become successful, caring adults. Similarly, many parents want to be involved with the formal education of their children. Sometimes, however, they don't know where to start, when to find the time, or how to go about making positive connections with the school. At the most basic level, parents can begin encouraging the education of their children by showing them that they truly value education themselves. Family support is influential in children's adjustment to school (Johnson, 1997).

Research (Entwisle, 1995) shows that children do better in school when parents talk often with teachers and become involved in the school. There is a number of ways in which parents and teachers can communicate with each other, rather than relying on the scheduled parent-teacher conferences. Close communications between parents and teachers can help the student. Teachers who facilitate parent participation tend to engender positive attitudes towards school from both parents and children (Onsman, 1996).

Parents who participate in school activities and events will have added opportunities to communicate with teachers. Becoming involved with parent-teacher organizations (PTO, PTA, and Booster Clubs) gives the teacher and parents the possibility to interact outside the classroom. In addition, the parent also will have input into decisions that can affect their child's education.

Teachers usually welcome meeting their students' parents early in the school year. Making an effort to do this will help the teacher to better understand the parent, the child, and how the teacher will support the education of the child. Teachers appreciate knowing that parents are concerned and interested in their child's progress. And this helps to open the lines of communication.

Talking with a child about life's everyday experiences will help you to understand the others' viewpoints, values, dreams, and interests. Parents need not only talk, but also to listen to their children. Answering questions, or helping children find the answers, will help a child to develop a sense of value and self-respect.

Kindergarten is a critical period in children's early school careers. It sets children on a path that influences their subsequent learning and school achievement. For most children, kindergarten represents the first step in a journey through the world of formal schooling. However, children entering kindergarten in the United States today are different from those who entered kindergarten in prior decades. They come from increasingly diverse racial, ethnic, cultural social, economic and language backgrounds. Many kindergarteners now come from single-parent families, step-parent families and homes with very different social and economic backgrounds, than

those of twenty/thirty years ago. They also differ in the level and types of early care and education experiences that they have had prior to kindergarten (Zill, 1995).

Whether or not children succeed in school is in part related to events and experiences that occur prior to their entering kindergarten for the first time. Children's preparedness for school and their later school success are related to multiple aspects of the children's developments, such as their physical well-being, social development, cognitive skills and knowledge and their approaches to learning (Kagan, 1995).

The first five years of life are a time of enormous growth in linguistic, cognitive, social, emotional, and motor competence. Because children learn continuously from birth, childcare and education cannot be thought of separately. Early education promotes the overall development of a healthy child, but it is also critical because children who have had the right kinds of educational experiences before kindergarten do better in school (West, Denton, & Reaney, 2000).

My study explored associations between kindergarten students' achievement and attitudes and their parents' perceptions of the learning environment in science classrooms. The more involved parents are in the education of their children, the more positive are students' attitudes toward science and higher are their achievement levels. It is important to underscore the point that children's learning and development are strongly influenced by myriad family factors, including parental interaction styles and family aspirations and expectations for achievement (NRC, 2000).

2.6 Summary

This study is unique as it investigated associations between kindergarten student outcomes (achievement and attitudes in science) and their perceptions of the learning environment. The research questions for the study guided this literature review chapter.

Because my study focused on kindergarten students and their parents, the literature chapter explored the writings that support learning environments in association with kindergarten (past and present), current kindergarten students, and their parents.

Various instruments to investigate and assess aspects of the learning environment were discussed, and those best suited for assessing kindergarten students' and their parents' perceptions of classroom environment (as well as for measuring science-related attitudes) among very young students were reported. Various lines of past research on learning environment were reviewed, including research studies in Asia (section 2.3.1). In particular, because one of the aims of my study involved investigating outcome-environment associations, a separate section (2.3.4) was devoted to reviewing past research on associations between classroom environment and student outcomes.

In view of the fact that I was interested in what parents had to say about their child's science classroom and if kindergarten student's achievement and attitudes were linked to the students' and parents' perceptions of the learning environment in science classrooms, a section on parent/home environment, and the role parents play in student achievement was incorporated.

The next chapter, Chapter 3, describes the sample used for my study and how different types of data were collected. The chapter expands on the instruments used for the data collection, and the methods for analyzing the data. Finally, the qualitative data-collection methods, based on students' and parents' interviews, are described.

Chapter 3

Procedures and Methods

3.1 Introduction and Overview

There is a growing awareness that children, who experience similar environments and expectations at home and at school, are likely to find the transition from home to school, as well as school in general, an easier process (Morrison, Griffith & Alberts, 1997; Nelson, 1995). Chapter 2 reviewed literature about curriculum, kindergarten (past and present), connections amongst learning environment, classroom environments, students' attitudes and perceptions of science, links between parent/home environment and student achievement, and the roles that parents can play in student achievement.

The literature review chapter (Chapter 2) included numerous learning environment studies that focused on science classrooms and on student attitudes. My study was significant as it used learning environment instruments to assess and investigate kindergarten students' and their parents' perceptions. This study was consistent with past research traditions in that it explored connections between students' perceptions of the learning environment in their science classrooms and their achievement and attitudes. But my study extended past research because it also investigated the connection between parents' perceptions of the learning environment in their children's science classrooms and their children's achievement and attitudes. In addition, the study focused on the differences between students' and parents' actual learning environment in science, as well as their preferred learning environments in science. Furthermore, the study centered on validating a modified version of a classroom learning environment questionnaire for assessing either kindergarten students' and parents' actual and preferred classroom environments.

The purpose of this chapter is to describe the sample used for the study, how different types of data were collected, the instruments that were used for data

collection, the methods for analyzing the data, and the qualitative data collection based on student and parent interviews.

The content of Chapter 3 is overviewed below:

3.2 Research Questions

This study validated and used a widely-applicable questionnaires to assess students' and parents' perceptions of their children's learning environment and student attitudes toward science. Therefore the first research question was formulated as follows:

Research Question #1: Can valid and reliable questionnaires be developed in English and Spanish to assess:

- kindergarten students' actual and preferred learning environment?
- their parents' actual and preferred learning environment?

Once validated, the new questionnaires were used to investigate two further research questions:

Research Question #2: Are there differences between kindergarten students and their parents in their perceptions of:

- actual learning environment in a science classroom?
- preferred learning environment in a science classroom?

Research Question #3: Are there associations between kindergarten students' achievement and attitudes and:

- students' perceptions of the learning environment in a science classroom?
- their parents' perceptions of the learning environment in a science classroom?

3.3 Sample

The school in Florida where the study was conducted has approximately 1060 students whose ethnic make-up is comprised of 15.5% White, 53.4% Black, 25.8% Hispanic, and 5.4% of other nationalities. The school's ethnic make-up had important implications for the languages needed for the questionnaires. The school's 1060 students encompass Pre-Kindergarten to Grade 5. The gender breakdown is 51.4% boys and 48.5% girls. The researcher, a kindergarten teacher, targeted all kindergarten classes (six classes), consisting of approximately 172 kindergarteners, for the research. The ethnic make-up for this group of 172 students was 11.8% White, 49% Black, 33.6% Hispanic, and 5.6% of other nationalities. The gender breakdown was 40.4% boys and 59.6% girls. Approximately 45% of the kindergarten student population was made up of English Speakers of Other Languages (ESOL) students.

Seventy-eight (78) parents of the same students from the above six classes participated in the study. As explained in Section 3.5.3, it is usually very difficult to gain access to large samples of parents.

Finally, interviews and focus groups were conducted with parents and students. Ten students and ten parents, respectively, participated in the interviews, which were conducted in English and Spanish according to the students' and parents' language preference.

The school where the research took place is a typical Florida elementary school, in that the school provides educational services consistent with the Sunshine State Standards, the Competency-Based Curriculum and the Comprehensive Reading Plan to students in Grades K-5. The school has a high percentage of student tardiness, of overcrowded classrooms, and of parents and students of limited English proficiency. The school serves a growing community comprised mostly of single-family homes, rental apartments and condominium complexes. Most students live within walking distance of the school. The student population is ethnically made up of White Non-Hispanic, Black Non-Hispanic, Hispanic, and Asian/Indian/Multiracial students.

The school is distinctive in that it has a separate building within the school's property for kindergarteners and first graders. Parents are given the opportunity to participate in the decision-making process and the school enjoys collaboration with nearby universities that provide tutoring and mentoring to the students.

3.4 Qualitative and Quantitative Methods

Fraser and Tobin (1991) advocated that research on learning environments can be enhanced by using multiple theoretical frames to illuminate the experiences of key participants in the learning of science and by using a variety or research methods that can lead to a rich yield of qualitative and quantitative data. They went on to add that the benefit of using multiple approaches is that complementary insights can lead to the identification of new problems and possible solutions to new and persistent problems. They were unable to envision why learning environment researchers would opt for either qualitative or quantitative data, when clearly the use of both can be used to obtain more credible and authentic outcomes. Fraser and Tobin discuss three cases of successful attempts at using questionnaire survey and ethnographic methods together within the same investigation. Other authors and researchers in the

field of educational research are also recommending combining quantitative and qualitative methods in the same study (Anderson & Arsenault, 1998; Houtz, 1995; Lee, 2001; Tobin & Fraser, 1998).

Educational researchers interested in educational evaluation have advocated the merits in combining qualitative and quantitative methods within the same study (Cook & Reichardt, 1979). My study combined qualitative and quantitative methods. Qualitative data were collected from students and parents, as I gathered information from interviews and focus groups. The questionnaires and the quantitative data partly guided the interview questions. Quantitative data were collected using the What it Happening in this Class? (WIHIC) questionnaire (Fraser, Fisher & McRobbie, 1996) along with the Test of Science-Related Attitudes (TOSRA) (Fraser, 1981).

Creswell (1994) explains that the idea of combining qualitative and quantitative approaches in a single study owes much to past discussions about mixing methods, linking paradigms to methods, and combining research designs in all phases of a study. In terms of mixing methods, Campbell and Fisk (1959) used more than one method to measure a psychological trait to ensure that the variance was reflected in the trait and not in the method (see Brewer & Hunter, 1989, for a summary of Campbell and Fisk's multimethod-multitrait approach). Creswell goes on to state that, by 1978, Denzin used the term 'triangulation', a term borrowed from navigation and military strategy, to argue for the combination of methodologies in the study of the same phenomenon. The concept of triangulation was based on the assumption that any bias inherent in particular data sources, investigator, and method would be largely neutralized when used in conjunction with other data sources, investigators, and methods (Jick, 1979).

Mixing methods from qualitative and quantitative traditions has contributed to discussions about their value, especially because they raise the question of the operative paradigm being used. Whether paradigms should be linked with methods has led to different schools of thinking. Mixing methods also has raised a methodological issue as to whether the other 'design' components of a study should follow one paradigm or the other (Creswell, 1994).

The interviews and focus groups provided information about students' and parents' attitudes about science and how these students and parents viewed learning and achievement. This practical triangulation of qualitative and quantitative data strengthened the validity of the findings.

The procedures of a qualitative study includes advancing the assumptions of qualitative designs, indicating the specific type of designs, reflecting on the researcher's role, discussing data collection, developing data-recording procedures, identifying data-analysis procedures, specifying verification steps, and delineating the narrative outcomes of the study (Creswell, 1994). Creswell (1994) explains that, in relation to qualitative methods, the human and social sciences offer several traditions. These traditions can be method types for data collection, analysis, and reporting writing, or overall designs that include all phases in the research process.

A survey design provides a quantitative or numeric description of some fraction of the population -- the sample -- through the data-collection process of asking questions of people (Fowler, 1988). The data collection, in turn, enables a researcher to generalize the findings from a sample of responses to a population.

Quantitative questions, objectives, and hypotheses flow from a theory, use a language that orders the variables from independent to dependent, often include demographic variables as mediating influences, and employ standard wording to enable a reader to understand clearly the variables in the study. A model for writing quantitative questions is to pose descriptive questions, followed by multivariate questions (Creswell, 1994).

While questionnaires offer an economical way to access perceptions of the learning environment for a relatively large 'grain size' sample (Aldridge, Fraser & Huang, 1999), interviews and classroom observations provide plausible explanations and additional validity for a 'fine grain' size sample. Through triangulation of quantitative data and qualitative information, greater credibility can be place on the findings of the study (Fraser & Tobin, 1991).

Gay (1996) states that *triangulation* is the term for the use of multiple methods, data-collection strategies, and or data sources. This approach is characteristic of qualitative research. While participant observation, for example, might be the primary data-collection strategy, collection of documents and use of interviews serve two purposes: 1) providing a more complete picture of what is being studied; and 2) providing a way to cross-check our information. If what we are surmising based on our observations agrees with what people are telling us, for example, we have more confidence in our data than if we depend solely on either our powers of observation or the motives, veracity, and openness of the persons interviewed. Similarly, if several different people have similar stories, we have more confidence in the insights that we are gaining than if only one person is interviewed. Even if their perceptions of reality are not accurate, we at least have evidence that the perception is a shared one.

Questionnaires offered me an economical way to assess a large sample. The study also incorporated the use of interviews and observations, in the hope of observing a 'truer' representation of the learning environment. However, there seems to be multiple levels available to assess perceptions of the learning environment. The researchers tried to determine the best possible method to use that would have the most impact on the population to be assessed. Any methodology used to explore learning environments will produce a landscape that is incomplete and represents only one of the possible portraits which is likely to be appealing and relevant to different stakeholders (Tobin & Fraser, 1998).

Quantitative data resulting from the questionnaires allowed statistical significance testing. The quantitative approach used in this study enabled the research questions to be answered: overall description of classroom environments; differences between students' and parents' perceptions of the actual and preferred learning environment; and associations between achievement and attitudes. As mentioned earlier, the What is Happening in This Class? (WIHIC) questionnaire (Fraser, Fisher & McRobbie, 1996) along with the Test Of Science-Related Attitudes (TOSRA) (Fraser, 1981) provided quantitative information that directed the foundation of interview questions.

Quantitatively this study was able to investigate relationships between variables that were governed by the research questions using modified versions of the WIHIC questionnaire and the TOSRA. Qualitatively, students in the classrooms and parents were interviewed to provide support and clarifications for the quantitative segments of the study that were used to assess perceptions of the learning environment.

3.5 Instruments

As previously mentioned (Section 3.4), there were two questionnaires used in this study. First, a learning environment questionnaire, developed by Fraser, McRobbie and Fisher (1996) entitled the What Is Happening In This Class? (WIHIC) questionnaire, was modified and used for the purpose of assessing students' and parents' perceptions of the science classroom learning environment. Secondly, a modified version of Test Of Science Related Attitudes (TOSRA), originally designed for use among secondary school students (Fraser, 1981), was used for the purpose of assessing students' attitudes in my study. Also, several tests were used to assess student achievement in my study.

Sections 3.5.1 – 3.5.3 discuss the What Is Happening In This Class? questionnaire, its administration, and the limitations associated with this questionnaire. Sections 3.5.4 – 3.5.6 discuss the Test of Science-Related Attitudes (TOSRA), its administration, and the limitations associated with the questionnaire.

3.5.1 What Is Happening In This Class (WIHIC)? Questionnaire

The WIHIC was chosen for this study because (see Chapter 2, Section 2.3.3) it has been found to be valid and useful in past research (Aldridge & Fraser, 2000). The WIHIC questionnaire brings parsimony to the field of classroom environment by combining modified versions of the most salient scales from a wide range of existing questionnaires with additional scales that accommodate contemporary educational concerns (e.g. equity and constructivism) (Fraser, 1998a).

The WIHIC was modified from 56 items in seven scales, to 20 items in five scales, in order to facilitate understanding and to reduce administration time among five- and

six-years old students who participated in this study, along with members of a self-contained English Speakers of Other Languages (ESOL) class, and parents. The modified version of the WIHIC questionnaire used by kindergarten students and their parents (see Chapter 2, Section 2.3.3) had four forms. Two forms were used to measure students' and parents' perceptions of actual classroom environment, while the other two were used to measure students' and parents' preferred classroom environment.

A sample of one hundred and seventy six (176) kindergarten students and seventy-eight (78) parents completed the WIHIC questionnaire (see section 3.2). To minimize the degree of complexity, students and parents responded using the three-point response scale of Always, Sometimes, and Never rather than the previous five-point scale used by older students (Almost Never, Seldom, Sometimes, Often, and Almost Always).

In view of the fact that the research questions focused on the actual and preferred science learning environments of students and their parents, as stated earlier, four configurations of the WIHIC were generated. The two forms measuring students' and parents' actual classroom environment, and the two forms measuring students' and parents' preferred classroom environment are provided in Appendices A, B, E and F.

Selected students and parents reviewed the questionnaires for preliminary language problems, in an effort to improve the comprehension level of the questions being asked. These selected few students and parents who acted as 'field testers' assisted in suggesting re-wording of items in the questionnaire for the purpose of improving clarity. For example, an original statement in the WIHIC questionnaire reads: "The teacher takes a personal interest in me." An example of a modified statement in the WIHIC questionnaire reads: "The teacher likes me." A total of four questionnaires were composed.

All forms were available is English and Spanish. The procedures of translation were based on those described in Aldridge and Fraser (2000) and Brislin (1970). The instrument (WIHIC) was translated into Spanish by team members (staff members)

based in the school where the research took place. The next step involved an independent back translation of the Spanish version into English by team members (staff members) who were not involved in the original translation. Then the researcher (who is fluent in English and Spanish), along with the main schools' English Speakers of Other Languages (ESOL) teacher, checked the back translation for any needed modifications (see Appendices C, D, G, and H for the Spanish versions).

An effort was made to have the forms translated into Creole, but this effort failed when the not-so-reliable sources found to translate the forms from Creole back to English were taking too long to complete the task, thus prolonging the project beyond reasonable timing.

After all the modifications were completed, the students' modified versions of the actual and preferred forms served as guide for the parents' modified versions or the actual and preferred forms of the WIHIC. Table 3.1 and 3.2 present scale descriptions and sample statements used in the modified version of the WIHIC for students and parents.

3.5.2 Administration of What Is Happening In This Class (WIHIC)? Questionnaire

Prior to administering the WIHIC questionnaire, I sent letters home to the parents/guardians of the kindergarten population, seeking permission for the researcher to administer the questionnaire. Additionally, letters were sent home inviting parents to participate in this study by completing the modified actual and preferred parent questionnaire versions of the WIHIC, and to participate in future interviews and focus groups.

Table 3.1 Scale Descriptions and Sample Items for the Modified Version of the Actual WIHIC for Students and Parents

Scale	Description	Sample Item	
		Student	Parent
Student Cohesiveness	Extent to which students know, help and are friendly toward each other	I am nice to kids in this class.	My child is nice to other kids in this class.
Teacher Support	Extent to which teacher is interested in the students, while displaying characteristics of helpfulness, trustfulness, friendliness, etc.	The teacher's questions help me understand.	The teacher's questions help my child understand.
Involvement	Extent to which student's involvement reflects enjoyment.	My ideas are used during science class.	My child's ideas are used during science class.
Cooperation	Extent to which students collaborate and support each other.	Other kids and I work together like a team.	Other kids and my child work together like a team.
Equity	Extent to which students are treated equally	I am treated the same way as other students in my science class.	My child is treated the same way as other students in his/her science class.

Table 3.2. Scale Descriptions and Sample Items for the Modified Version of the Preferred WIHIC for Students and Parents

Scale	Description	Sample Item	
		Student	Parent
Student Cohesiveness	Extent to which students know, help and are friendly toward each other.	I would be nice to kids in this class.	My child would be nice to other kids in this class.
Teacher Support	Extent to which teacher is interested in the students, while displaying characteristics of helpfulness, trustfulness, friendliness, etc.	The teacher's questions would help me understand.	The teacher's questions would help my child understand.
Involvement	Extent to which students' involvement reflects enjoyment.	My ideas would be used during science class.	My child's ideas would be used during science class.
Cooperation	Extent to which students collaborate and support each other.	Other kids and I would work together like a team.	Other kids and my child would work together like a team.
Equity	Extent to which students are treated equally.	I would be treated the same way as other students in my science class.	My child would be treated the same way as other students in his/her science class.

A paraprofessional was very interested in my study and wanted to help me to administer the actual and preferred modified version of the WIHIC questionnaire. Unfortunately, she felt unease working with such young children and asked that I retest the students to ensure that she had correctly done the administration process, such as asking the questions from the questionnaire or clarifying any questions that students might have. I re-administered the questionnaire to the 36 students to whom the paraprofessional had already given the questionnaire, and came up with the same results. However, due to lack of self-confidence verbally expressed to me by the paraprofessional, I took over the administration of the questionnaire for the rest of the sample.

Administering the questionnaire proved easy because, at the time, I had an intern (a student teacher who was implementing her last segment of teacher training by acting as a full-time teacher) in my class. At this particular segment of time, the intern was supposed to have total control of the class without the presence of the classroom teacher (myself). My role was to be available at all times to the intern, by remaining in the proximity of the building, and overseeing lesson plans, implementation of curriculum, student behavior, student or parent needs, field trips, etc. While the intern remained in the class teaching my students, I was able to administer the WIHIC questionnaire to all 176 kindergarteners, oversee administration of the parents' questionnaires, and conduct interviews and focus groups sessions.

It should be noted that only 16 of the 176 students chose to answer the questionnaire in Spanish. Unfortunately this sample size was too small to allow meaningful validation of the Spanish version.

3.5.3 Limitations of the What Is Happening In This Class (WIHIC)? Questionnaire

A limitation of the WIHIC found in my study was that some students' and parents' experienced difficulty in differentiating between the meaning of the actual and preferred versions of the survey. Both students and parents had to be told that 'actual' referred to what is happening right now within the science classroom and that 'preferred' referred to a science class designed just the way that they would want

it. In other words, if they could pick the perfect class, this is the way that it would most likely be.

The parents who encountered difficulties chose to fill out only one part of the questionnaire. Those who filled out only the actual version felt that this is how the class is or should be and that the preferred was not really a choice. However, those who filled out only the preferred version, oddly enough, felt that this is how their classroom is already. In addition, some who filled out only the preferred version did so because they were not familiar with their child's science classroom, and so they felt that they could not comment on the actual classroom science setting.

An interesting observation was that the majority of the parents experiencing misunderstandings with the questionnaire (i.e. confusion with the distinction between actual and preferred environment) were parents who completed the English version of the questionnaire. These parents, in most cases, completed one version of the questionnaire and sent it back to the researcher. In comparison, those parents who encountered difficulties with the meaning of actual and preferred, and had completed the Spanish version of the questionnaire, sent me a note asking for clarification/ explanations, or came directly to me for advice, so that they could complete both versions.

The population of parents who encountered difficulties with the meaning of 'actual' and 'preferred' was mixed. Some of these parents seemed confused due to their inability to speak English, while others were confused because they failed to see the importance of completing both questionnaires. After explaining to the parents why both forms were needed, most of them complied. All forms were included in the data analyses.

3.5.4 Test of Science-Related Attitudes (TOSRA)

As my study involved the assessment of student attitudes, I tried to identify and modify a suitable questionnaire.

The test of Science-Related Attitudes (TOSRA) is designed to measure seven distinct science-related attitudes among secondary school students. These scales are called Social Implications of Science, Normality of Scientists, Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lessons, Leisure Interest in Science, and Career Interest in Science. The seven scales are suitable for group administration and all can be administered within the duration of a normal class lesson. Furthermore TOSRA has been carefully developed and extensively field tested and has been shown to be highly reliable (Fraser, 1981).

A major advantage that TOSRA has over some other science attitude tests is that it yields a separate score for a number of distinct attitudinal aims instead of a single overall score. This makes it possible to obtain a 'profile' of attitude scores for groups of students (Fraser, 1981).

Klopfer (1971) claims that the promotion of favorable attitudes to science is an important aim of science education, but that there is some confusion about what meaning should be placed on these attitudes to science. He provides a classification that can be used to classify the aim measured by each of the TOSRA scales. For example, the TOSRA scale Attitudes to Scientific Inquiry is classified in Klopfer's (1971) scheme as 'Acceptance of scientific inquiry as a way of thought' (see Table 3.2).

Table 3.3 presents each scales' name, its classification and a sample item according to Klopfer, (1971). See appendices G and H for items designated and scored as positive (+) and items designated and scored as negative (-).

Table 3.3 Scale Classification and Sample Items for the Modified Version of TOSRA

Scale	Kloper (1971) classification	Sample item
Attitude of Scientific Inquiry	Acceptance of scientific inquiry as a way of thought.	I would rather find out about things by asking an expert than by doing an experiment.
Adoption of Scientific Attitudes	Adoption of 'scientific attitudes.	Finding out about new things is unimportant.
Enjoyment of Science Lessons	Enjoyment of science learning experiences.	I really enjoy going to science lessons.

A modified version of (TOSRA) (see Chapter 2, Section 2.4) was used for this study for the purpose of exploring associations between students' attitudes to science and their perceptions of the learning environment. Due to the young age of the students (five to six years old), the number of questions were reduced from 70 to 24. Out of the seven original conceptual categories, only three were investigated in my study: Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, and Enjoyment of Science Lessons. The three categories selected seemed to be the most appropriate ones to measure attitudinal aims for kindergarten students in my study. Attitude to Scientific Inquiry measures attitude to scientific experimentation and questioning as a way to obtain information about our natural world. Adoption of Scientific Attitudes measures 'scientific attitudes' like eagerness to modify/change opinions after acquiring new information. And finally, Enjoyment of Science measures contentment with science learning experiences at school or in the classroom.

TOSRA items involve a response format, first described by Likert (1932), which requires students to express their degree of agreement with each statement on a five-point scale consisting of responses of Strongly Agree (SA), Agree (A), Not Sure (N), Disagree (D) and Strongly Disagree (SD) (Fraser, 1981). Items receive a score of 5, 4, 3, 2, 1 in that order for the responses SA, A, N, D, SD for items designated as positive (+) (see Appendices I & J). A score of 1, 2, 3, 4, 5 for the responses SA, A, N, D, SD in that order is given for Items designated as negative (-). Items 1, 3, 5, 7, 9, 11, 13, 15, 16, 17, 19, 21, 23 were scored as positive (+) responses, while Items 2, 4, 6, 8, 10, 12, 14, 18, 20, 22, and 24 were scored as negative (-) responses.

An important feature of Liker-type items is that their intention is often obvious to the respondent and, therefore, it is possible for the respondent to fake responses to reflect opinions which are more positive or more negative than they really are. In interpreting student responses to TOSRA, therefore, the possibility of faking responses to some items cannot be completely overlooked. However, as long as TOSRA is not used for grading, there would be little point in students faking responses and reasonable confidence could be placed in student responses (Fraser, 1981). I assured the kindergarten students that all responses would remain anonymous and that no grades would be given for responses.

Selected students and parents (as described in Section 3.5.1 for the WIHIC) reviewed the given answers in an effort to improve the clarity of the questionnaire. These selected few, who acted as 'field testers,' assisted in guiding the re-wording of items in the questionnaire, for the purpose of clarification. The TOSRA was available in English and Spanish. The procedures of translation (as discussed in Section 3.5.2) were based on those described in Aldridge and Fraser (2000). As recommended by Brislin (1970), the instrument (TOSRA) was translated into Spanish by team members (staff members) based in the school where the research took place. The next step involved an independent back translation of the Spanish version into English by team members (staff members) who were not involved in the original translation. Both the school's English Speakers of Other Languages (ESOL) teacher and I checked the back translation for any needed modifications (see Appendices I, J, K, and L).

As effort was made to have the forms translated into Creole (as stated in Section 3.5.1), but this failed when the reliable sources found to translate the forms from Creole back to English took too long to complete the task, thus prolonging the project beyond a reasonable duration.

3.5.5 Administration of Test of Science-Related Attitudes (TOSRA)

As described in section 3.5.2 (in regards to the administration of the WIHIC), preceding administering the TOSRA, letters were sent home by the researcher to parents/guardians of the kindergarten population, seeking permission by the researcher to administer the questionnaires. One original letter was sent home to acquire permission for both questionnaires, WIHIC and TOSRA. The same letter asked for parent volunteers to participate in future interviews and focus groups. The researcher administered the TOSRA to one hundred and seventy six (176) kindergarten students.

3.5.6 Limitations of Test of Science-Related Attitudes (TOSRA)

The limitations/restrictions to the TOSRA dealt with kindergarten students having too many choices from which to select (i.e. Strongly Agree, Agree, Not Sure, Disagree, and Strongly Disagree). Explanations were necessary in order to emphasize to the students that, when they choose 'strongly agree' or 'strongly disagree', it was because they felt very strongly about this answer. This difficulty in making decisions, or having to make too many decisions as in the case of responding to the TOSRA, might be tied up with the possibility that not all children entering school are equally adept at performing in kindergarten, or that some could struggle with the curricula, and or that students differ in school readiness.

Readiness for learning is considered to be the level of development at which the individual has the capacity to undertake the learning of specific subject matter, and recognizes the fluidity of the multiple developmental processes that influence such readiness. In contrast, readiness for school is a more rigid construct, dictating the belief that a specific set of cognitive, linguistic, social, and motor skills must be attained to indicate readiness (Kagan, 1990).

3.5.7 Achievement Measures

Students' achievement levels were assessed in order to enable investigation of associations between student achievement and dimensions of the modified WIHIC. Students report card, diagnostic test, and readiness test (all reviewed or issued four times a year) were used to assess achievement.

3.6 Statistical Analysis Methods for Quantitative Data

The research methods for this study focused on examining the reliability (consistency in measurement) and validity (including the independence of different scales within a questionnaire) of the modified What Is Happening In This Class? (WIHIC) questionnaire and Test Of Science-Related Attitudes (TOSRA). These questionnaires were used in this study to investigate differences between kindergarten students' and their parents' perceptions of the learning environment (actual and preferred) and,

finally, to examine associations between kindergarten students' outcomes (achievement and attitudes) and students' or parents' perceptions of the learning environment in a science classroom.

Statistical analyses were used to examine the internal consistency reliability using Cronbach's (1951) alpha coefficient and discriminant validity (mean correlation with other scales) for two units of analysis for the WIHIC (actual and preferred) and the modified TOSRA. For the actual form of the WIHIC for the student sample, factor analysis was used to look at the factor structure, and ANOVA was used to test the ability of each scale to differentiate between the perceptions of students in different classes.

To examine differences between students and their parents in their perceptions of actual and preferred classroom environment, effect sizes, and *t* tests for matched pairs were used for each WIHIC scale. These are discusses at length in Chapter 4.

To examine the relationship of kindergarten students' achievement and attitudes to students' or parents' perceptions of the learning environment in a science classroom, simple correlation and multiple regression analysis were chosen. These results are also discussed in Chapter 4.

In this process of collecting quantitative data and analyzing it, statistical methods were appropriate because this quantitative research was based on relationships between variables that were governed by the research questions (Punch, 1998). Additional qualitative data collected from interviews were extremely useful as they allowed some of the participants involved to discuss, defend, and explain findings based on questionnaire data.

3.7 Interviews/Focus Groups

Qualitative methods were used for my study for the purpose of describing as accurately and comprehensively as possible all relevant aspects of the situation observed. Interviews add an inner perspective to outward behaviors. In this way, interviews are a source of meaning and elaboration for program observations. We

also interview to learn about things that we cannot directly observe. We cannot observe everything. We cannot observe feelings, thoughts, and intentions. We cannot observe behaviors that took place at some previous point in time. We cannot observe behaviors that preclude the presence of an observer. We cannot observe how people have organized the world and the meanings which they attach to what goes on in the world. We have to ask people questions about those things. The purpose of interviewing, then, is to allow us to enter the other person's perspective (Patton, 1987).

The style of 'key informant' interviews focuses on the views of a small number of individuals. For this reason, the researcher felt that key informant interviews were the most appropriate approach for this study. Interviewing has been with us for a very long time, as even ancient Egyptians conducted censuses of their population (Babbie, 1992). In recent times, the tradition of interviewing has been twofold (dual). Interviewing found great popularity and widespread use in clinical diagnosis and counseling, for which the concern was on the quality of the response. Later, during World War I, interviewing came to be widely employed in psychological testing, for the purpose of obtaining individual data, with an emphasis on measurement (Maccoby & Maccoby, 1954).

Quantitative survey research moved into academia and dominated sociology for the next three decades after World War I (Denzin & Lincoln, 1998). They reported that an Austrian immigrant by the name of Paul Lazarsfeld spearheaded this move of integrating the use of quantitative survey into academia. Lazarsfeld welcomed *The American Soldier* and he and Robert Merton in 1950 edited a book of reflections on *The American Soldier.* In 1940, Lazarsfeld moved to Columbia University, taking with him his market research and other applied grants, and became instrumental in directing the Bureau of Applied Social Research. In addition, two other survey organizations were also formed: in 1941, Harry Field began the National Opinion Research Center, first at Denver and then at Chicago; and, in 1946, Likert and his group founded the Survey Research Center at the University of Michigan.

We live in what has been called an 'interview society' (Silverman, 1993). Not only the media, but also human service professionals and social researchers, increasingly

get their information via interview. Some estimate that 90% of all social science investigations exploit interview data (Briggs, 1986).

Most researchers recognize interviews as social interactions, but the literature on interview strategies and techniques remains primarily concerned with maximizing the flow of valid, reliable information while minimizing distortions of what the respondent knows (Gorden, 1987).

Sociolinguist Charles Briggs (1986) argues that the social circumstances of interviews are more than obstacles to respondents' articulation of their particular truth. Briggs notes that, like all other speech events, interviews fundamentally, not incidentally, shape the form and content of what is said.

Holstein and Gubrium (1995) point out the need to develop a better understanding of the meanings that are being conveyed in practice by both interviewer and respondent, either to avoid misunderstanding or errors of interpretation or to cast interpretation as a social construction in its own right.

In extreme cases, the interpretation brings to light more of the interpreter's understanding (and misunderstanding) of the topic investigated than of the students' understanding. A spiral-like process appears to operate in which the interpreter first develops ideas of students' understanding, proves these ideas by going back to the data (e.g., the interview), refines the achieved understating of students' understanding, and so on (Treagust, Duit & Fraser, 1996).

From a more traditional scientific standpoint, the objectivity or truth of interview responses might be assessed in terms of reliability, the extent to which questioning yields the same answers whenever and wherever it is carried out, and validity, the extent to which inquiry yields the 'correct' answers (Kirk & Miller, 1986).

It was of interest for me to try to determine feelings and perceptions of the students and parents without necessarily having them arrive at any consensus. Thus focus groups seemed like a useful way of obtaining particular information such as: differences between students' and parents' perceptions of the actual and preferred

learning environment; associations between achievement and attitudes and students' and parents' perceptions of the learning environment in science.

Focus groups produce qualitative data that provide insights into the attitudes, perceptions, and opinions of participants. These results are solicited through open-ended questions and procedures in which respondents are able to choose the manner in which they respond, and also from observations of those respondents in a group discussion. The focus group presents a more natural environment than that of an individual interview because participants are influencing and are influenced by others --just as they are in real life (Krueger, 1994).

The rationale behind the use of qualitative inquiry is the research-based belief that behavior is significantly influenced by the environment in which it occurs. In other words, because behavior occurs in a context, a more complete understanding of the behavior requires understanding of the context in which it occurs. Organizations such as schools, for example, definitely influence the behavior of persons within them (Wilson, 1977). Because quantitative researchers attempt to control as many variables as possible, they therefore prefer research strategies such as random sampling, use of standardized instruments and, when appropriate, equalizing of conditions of groups to be compared. In other words, the issue really revolves around setting and degree of control sought, not methodology utilized, although various strategies of inquiry are typically associated with qualitative or quantitative research (Guba, 1981).

Quantitative researchers are characterized by a desire to be objective (i.e., value-free) in their investigations. Qualitative researchers, on the other hand, argue that there is no such things as 'value-free science' and that the values and beliefs of both the researcher and the phenomena studied are important variables which, to the degree possible, should be taken in consideration when conducting, reporting, or reviewing research (Denzin 1994).

Qualitative and quantitative research represents complementary components of the scientific method (i.e. inductive and deductive) (Gay, 1996). For the purpose of this

study, I combined quantitative and qualitative approaches because I wanted to generalize to a large population while getting a deeper understanding of the single situation studied.

Those parents who agreed by letter response (see Section 3.5.2) to participate in the interviews, as well as to allow their child attending kindergarten to participate in the interviews, were the ones selected for the interviews. The need for permission for youth focus groups has a double purpose. The first purpose is to meet the legal expectation of informing child and parent. The second purpose is to adequately inform the parent of the proposed focus group interview (Krueger, 1994). I conducted four sets of interviews in my study. The first two interviews involved students. One student interview was conducted in Spanish and the second interview was conducted in English. The second set of interviews involved parents. One parent interview was conducted in Spanish and the second interview was conducted in English. The parents who participated in the interviews were the parents of the students who participated in the student interviews. All interviews were conducted at different times and dates.

The topic for discussion for the interviews was predetermined based on the analysis of the questionnaires (WIHIC and TOSRA). The researcher used open-ended discussions, but participants were given opportunities for any group discussion. Guidelines for discussion were given to the respondents prior to the interviews.

Focus groups have considerable potential for uncovering how young people think about issues, programs, and opportunities; however, special logistical procedures and moderator skills are often essential. Focus groups with young people are different from those with adults. For example, young people are greatly influenced by the environment and might be skeptical, or the moderators could claim that all opinions are wanted and that both negative and positive views are appreciated (Krueger, 1994).

With the approval of the students and parents, all interviews in my study were recorded and field notes were taken. The interviews were recorded so that I would have the exact wording of what was said by all respondents, thus eliminating the

possibility of guessing what was said. All parties were given paper and pencil to draw or write down responses. The job of the interviewer was to write down the answers that their respondent gave. The key to standardized recording is to have no interviewer judgment, no interviewer summaries, and no interviewer effects on what is written down (Fowler & Mangione, 1990). Whenever possible, the researcher should attempt to provide the reports in a combination of modes, because each method offers unique advantages. Written reports are well suited for distribution within an organization and are preferred when people are difficult to gather together. Oral reports allow for questions, clarification, and the use of taped highlights or quotations. When written and oral reports are used together, the advantages are multiplied (Krueger, 1994).

I found it necessary on only one occasion to probe two students in order to obtain some form of response. I tried hard not to probe with a directive format in order to avoid getting the results that I wanted, rather than getting the respondent to be forthcoming with his/her own answers. An example of a probe was: "Tell me more about that, and anything else?"

Hyman (1954) found that interviewer expectations affected their probing behavior, specifically when they obtained answers that are consistent with what they expected. The less that interviewers have to probe, the less opportunity they will have to make errors (Fowler & Mangione, 1990).

In an ideal situation, the researcher writes a question, the interviewer reads it as written, and the respondent provides a complete answer, which meets the question objectives. Of course, that does not always happen. If the initial reading of the question does not produce a satisfactory answer, then the interviewer must engage in some kind of behavior to move the process along and reach the desired end point. The interviewer's behavior cannot be completely pre-programmed, because the problem to be solved will vary from situation to situation. However, the goal is to have interviewers handle the problem in a way that is consistent across interviewers and respondents and that does not influence the content of the answers that result. This behavior, which actually involves several steps, is called 'non-directing probing' (Fowler & Mangione, 1990).

The interviewer's background knowledge can sometimes be an invaluable resource for assisting respondents to explore and describe their circumstances, actions, and feelings. Indeed, citing shared experience is often a useful way of providing concrete referents on which inquiries and answers can focus (see Holstein, 1993).

My questions at the end of the interview allowed me a closer look at what parents found interesting and perhaps important. Morgan (1997) reports that interpreting the data from focus groups requires distinguishing between what participants find interesting and what they find important. When participants discuss a topic at length, this is a good indication that they find it interesting, but that is not the same as saying that they think it is important. The most basic method for determining what the participants think is important is to ask them!

Students and parents seemed eager to express their opinions, and they did. The participants were reminded that their names would not be used, and nor would their comments be repeated to another member of the staff. They were once again assured that they, as well as their child, would be identified only as numbers. Confidentiality in research implies that private data identifying the subjects will not be reported. If a study involves publishing information potentially recognizable to others, the subjects need to agree to the release of identifiable information. The protection of subjects' privacy by changing their names and identifying features is an important issue in the reporting of interviews (Kvale, 1996).

The interview questions of this study were carefully selected to enhance the results of the questionnaires by focusing on the validity and reliability of these findings. Gordon (1987) examines the flow of valid, reliable information while minimizing distortions of what the respondent knows. Although interest in the content of answers persists, most attention now is focused on how and what the subject/respondent, in collaboration with an equally active interviewer, produces and conveys about the subject/respondent's experience under the interpretive circumstances at hand (Holstein & Gubrium, 1995).

Analyzing deals with whether the questions put to an interview text are valid and whether the logic of the interpretations is sound (Kvale, 1996). "Validity is often

defined by asking the question: Are you measuring what you think you are measuring?" (Kerlinger, 1979, p. 138). Miles and Huberman (1994) emphasize that there are no canons or infallible decision-making rules for establishing the validity of qualitative research. Their approach is to analyze the many sources of potential biases that might invalidate qualitative observations and interpretations.

Punch (1998) claims that the process of analyzing brings order to the data by organizing the raw data into patterns, categories and basic descriptive units. I tried to interpret the similarities and dissimilarities between the students' and parents' responses, by looking at the way the respondent interpreted and answered the question, rather than by the way in which the interviewer behaved.

Although the use of interviews was considered to be a very important component of my study, nevertheless it should be acknowledged that the scope of qualitative data-gathering was limited in comparison with the scope of quantitative data-collection.

3.8 Summary

The approach of this study involved combining qualitative and quantitative methods. By combining methods, the advantages of each method can be maximized and the disadvantages of each minimized, thus making a stronger research design and more valid and reliable findings. The inadequacies of individual methods are minimized and more threats to internal validity are realized and addressed (Duffy, 1987).

Quantitatively, information was collected by assessing students' and parents' perceptions of the science learning environment, along with information about student outcomes (attitudes and achievement). The What Is Happening In This Class? (WIHIC) questionnaire (Fraser, McRobbie & Fisher, 1996) and the Test Of Science-Related Attitudes (Fraser 1981) were used to collect this information. The WIHIC was modified in order to facilitate understanding by five- and six-year old students who participated in this study, along with members of a self-contained English Speakers of Other Languages (ESOL) class and parents. The modified version of the WIHIC questionnaire used by kindergarten students and their parents (see Chapter 2, Section 2.3.3) had four forms. Two forms were used to measure the

students' and parents' perceptions of the actual classroom environment, while the other two were used to measure the students' and parents' preferred classroom environment.

A modified version of TOSRA was used in this study for the purpose of exploring associations between students' attitudes to science and their perceptions of the learning environment (see Chapter 2.4). Due to the young age of the students (five to six years old), the number of questions was reduced from 70 to 24. Out of the seven original conceptual categories, only three were investigated in my study: Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, and Enjoyment of Science Lessons. The three categories selected seemed to be the most appropriate ones to measure attitudinal aims for kindergarten students. Attitude to Scientific Inquiry measures attitude to scientific experimentation and questioning as a way to obtain information about our natural world. Adoption of Scientific Attitudes measures scientific attitudes like eagerness to modify/change opinions after acquiring new information. And finally, Enjoyment of Science measures contentment with science learning experiences at school or in the classroom.

The questionnaire data were analyzed to answer the research questions. Factor analysis was used to provide information about factor structure, Cronbach's alpha coefficient was used as a measure of internal consistency, and ANOVA was used to explore whether WIHIC scales could differentiate between the perceptions of students in different classrooms. Simple correlation and multiple regression analyses were used to explore associations between student attitudes and achievement and dimensions of the modified WIHIC questionnaire. Effect sizes and *t* tests for paired samples were used to test for differences between the actual and the preferred scores for parents and students on the modified WIHIC questionnaire.

Qualitative data gathering involved interviewing students in the classroom and parents. I conducted four sets of interviews for my study. The first two interviews involved students. One student interview was conducted in Spanish and the second interview was conducted in English. The second set of interviews involved parents. One parent interview was conducted in Spanish and the second interview was conducted in English. The parents who participated in the interviews were the

parents of the students who participated in the student interviews. All interviews were conducted at different times and dates.

Finally, it is useful to draw together some of the limitations of the study identified in this chapter. First, the qualitative data-collection, although considered important, was of more limited scope than the quantitative data-collection. Second, because only 16 students elected to respond to the WIHIC in Spanish, it was not possible to validate the Spanish version meaningfully for such a small sample. Third, because achievement data were available only for my own class of 28 students, analyses of outcome-environment associations had low statistical power.

Chapter 4

Analyses and Results

4.1 Introduction and Overview

Chapter 3 described the samples used for my study, how various types of data were collected, the instruments that were used for data collection, the methods for analyzing the data, and the methods followed for students' and parents' interviews.

The purpose of this study was to explore the classroom learning environment in science among kindergarten students, to investigate students' and their parents' perceptions of the actual and preferred learning environment, and to explore associations between student outcomes (both achievement and attitudes toward science) and the nature of the classroom learning environment as perceived by students and their parents.

The study used two instruments that were administered to the entire sample consisting of 172 kindergarten students in six classes and 78 parents of the same students from these six classes. The instruments used were the What is Happening in This Class? (WIHIC) questionnaire, to assess classroom environment, and the Test of Science-Related Attitudes (TOSRA).

The WIHIC and the TOSRA questionnaires were available in English and Spanish and the procedure of translation was based on those described by Brislin (1970) and Aldridge and Fraser (2000). The WIHIC was used for the purpose of assessing students' and parents' perceptions of the science classroom learning environment. The TOSRA was used for the purpose of assessing students' attitudes in science.

As previously mentioned in Chapter 3, my study took place an elementary school in Miami-Dade County in the state of Florida. The students involved in the study were kindergarten students whose ages ranged from five to six years of age. In an effort to reduce the amount of probable frustration (due to their young age), and to obtain the

largest amount of salient information, both instruments were modified and validated as explained in section 4.2 of this chapter.

Finally, Chapter 4 discusses the results of follow-up interviews consisting of individual and focus groups that were conducted in an effort to tender credible explanations for and to further validate the quantitative results.

The analyzed data helped to answer the research questions that comprise the study:

Research Question #1: Can valid and reliable questionnaires be developed in English and Spanish to assess:

- kindergarten students' actual and preferred learning environment?
- their parents' actual and preferred learning environment?

Research Question #2: Are there differences between kindergarten students and their parents in their perceptions of:

- actual learning environment in a science classroom?
- preferred learning environment in a science classroom?

Research Question #3: Are there associations between kindergarten students' achievement and attitudes and:

- students' perceptions of the learning environment in a science classroom?
- their parents' perceptions of the learning environment in a science classroom?

The content of Chapter 4 is overviewed below:

4.2 Validity and Reliability of the What Is Happening In This Class (WIHIC)? and TOSRA

4.2.1 Factor Structure for Actual Form of WIHIC (Student Version)

4.2 Validity and Reliability of the What Is Happening In This Class (WIHIC)? and TOSRA

Research Question #1: Can valid and reliable questionnaires be developed in English and Spanish to assess:

- kindergarten students' actual and preferred learning environment?
- their parents' actual and preferred learning environment?

In order to check the validity and reliability of the What is Happening in this Class (WIHIC) questionnaire, the following statistical measures were determined: factor structure, internal consistency (alpha reliability), discriminant validity, and the ability to differentiate between classes (by using ANOVA). In order to check the validity and reliability of TOSRA, the Cronbach alpha coefficient was calculated to establish the internal consistency reliability of the scales. Additionally, the discriminant validity was calculated using the correlation between scales.

4.2.1 Factor Structure for Actual Form of WIHIC (Student Version)

To investigate the factor structure of the modified version of the actual form of the WIHIC used with kindergarten students, factor analysis with varimax rotations was conducted. In order to determine the factorial validity of the students' actual form, Table 4.1 presents these results. The sample entailed 172 students, ranging from five to six years of age. Students came from six kindergarten classes from the same public school in the state of Florida. Of the sample of 172 kindergarten students, 156 answered the questionnaire in English and 16 answered the questionnaire in Spanish. The small number of students answering in Spanish (n=16) is a limitation of my study because it was not possible to perform meaningful validation analyses for this sample size. Thus I combined the English and Spanish responses for the purposes of statistical analysis.

Table 4.1 Factor Loadings for the Modified WIHIC Scales (Student Sample)

Item No	Factor Loading			
	Teacher Support	Involvement	Cooperation	Equity
5	-			
6	0.55			
7	0.67			
8	0.54			0.47
9		0.65		
10		0.41		
11		0.58		
12		0.52		
13			0.68	
14			0.70	
15			0.50	
16			0.41	
17				0.58
18				0.64
19				0.71
20				0.65
Eigenvalue	1.14	1.20	1.33	5.69
% Variance	8.95	10.40	11.34	14.82

Factor loadings smaller than 0.40 have been omitted. The sample consisted of 172 students.

Faulty questionnaire items were identified using factor and item analyses. Exclusion of those faulty questionnaire items enhanced the internal consistency reliability and factorial validity. Sixteen of the original modified 20 items were kept in the original four-factor structure of Teacher Support, Involvement, Cooperation, and Equity as shown in Table 4.1.

Table 4.1 provides the factor loading for each of the retained 15 items of each of the WIHIC's four scales. To facilitate interpretation, only loadings of at least 0.4 have been included in Table 4.1.

For 15 of the 16 retained items in Table 4.1, the loading is greater than 0.40 on the a-priori scale and less than 0.40 on the other three scales. Item 8 ("The teachers' questions help me understand") loaded on both Teacher Support and Equity. Items 1, 2, 3, and 4 loaded smaller that 0.40 on their a-priori scale and therefore were omitted. Although items 5's loading was less than 0.40 on its own scale (Teacher Support), it was retained in the instrument.

Finding 1: The student WIHIC displayed satisfactory factorial validity.

Finding 2: Item 8 "The teacher's questions help me understand" loaded greater than 0.40 on the two scales of Teacher Support and Equity. Item 5 "The teacher likes me" loaded less than 0.40 on its own scale of Teacher Support.

4.2.2 Internal Consistency Reliability (Cronbach Alpha Coefficient), Discriminant Validity (Mean Correlation with Other Scales) and ANOVA Results (Ability to Differentiate Between Classes) for Two Units of Analysis

The internal consistency reliability of the scales was checked using Cronbach's alpha coefficient. The discriminant validity, or scale independence, was calculated by using the mean correlation of a scale with other scales. Internal consistency and discriminant validity were calculated separately for actual and preferred forms of the WIHIC and for the student sample (n=172) and the parent sample (n=78). Also the ability of the actual version of each WIHIC scale of each scale to differentiate between the perceptions of students in different classes was checked, using ANOVA with class membership as the main effect. These results are found in Table 4.2.

The internal consistency (alpha reliability) for different scales for students ranges from 0.67 to 0.81 for the actual science learning environment, and from 0.64 to 0.77 for the preferred science learning environment. The alpha reliability for parents ranges from 0.89 to 0.95 for the actual science learning environment, and from 0.64 to 0.86 for the preferred science learning environment.

The discriminant validity (mean correlation with other scales) indicates whether each scale is distinctive in what it measures. The mean correlation with other scales for students ranges from 0.45 to 0.51 for the actual science learning environment, and from 0.56 to 0.60 for the preferred science learning environment. The mean correlation with other scales for parents for the actual science learning environment ranges from 0.68 to 0.73, and from 0.31 to 0.47 for the preferred science learning environment. Overall, many of the discriminant validity values are quite high for actual and preferred forms and for students and parents. This suggests that raw scores on the WIHIC assess overlapping dimensions.

If, however, the factor analysis results (Table 4.1) attest to the independence of factor scores on the WIHIC's student actual version for the student sample. But, possibly because of the small sample size, the factorial validity of the WIHIC could not be established for the parent sample. Overall, then, there is a need for further research into the independence of WIHIC scales when used with large samples of kindergarten students and their parents.

Finding 3: The WIHIC demonstrated satisfactory internal consistency reliability for students and parents in both its actual and preferred forms.

Finding 4: Raw scores on the student and parent version of the actual and preferred forms of the WIHIC did not exhibit good discriminant validity. The parents' results might be due to the small sample of parents who participated in the questionnaire survey (78 parents).

The final column in Table 4.2 reports the results of the ANOVA results (ability to differentiate between classes) for each scale. These results (only for the actual from, and only for students) attest to whether each scale can differentiate between the perceptions of students in different classes. Table 4.2 reports the amount of variance accounted for by classroom membership (eta^2 statistic) and whether results are statistically significant. The eta^2 statistics ranges from 0.16 to 0.30, and it is statistically significant for each of the four WIHIC scales.

Finding 5: The student actual form of each WIHIC scale can differentiate significantly between the perceptions of students in different classrooms.

4.2.3 Internal Consistency Reliability (Cronbach Alpha Coefficient), and Discriminant Validity (Correlation With Other Scales) for Two Units of Analysis for the Modified TOSRA

The original TOSRA (Fraser, 1981) consists of 70 items designed to measure seven distinct science-related attitudes among secondary school pupils. However, for the purpose of this study, only the three scales of *Enjoyment of Science Lessons*, *Adoption of Science Attitudes* and *Attitude to Scientific Inquiry* were used. For each

TOSRA scale, the internal consistency reliability was determined using Cronbach's alpha coefficient and the discriminant validity was calculated using the correlation between scales. The findings are reported in Table 4.3 for the student sample of 172 students.

Table 4.2 Internal Consistency Reliability (Cronbach Alpha Coefficient), Discriminant Validity (Mean Correlation With Other Scales) and Ability to Differentiate Between Classes (ANOVA Results) for Actual and Preferred Forms of WIHIC for Students and Parents

Scale	No of Items	Unit of Analysis	Alpha Reliability		Mean Correlation with other Scales		ANOVA Eta^2
			Students	Parents	Students	Parents	Students
Teacher Support	4	Actual	0.67	0.89	0.48	0.70	0.20**
		Preferred	0.73	0.64	0.60	0.44	
Involvement	4	Actual	0.69	0.90	0.45	0.68	0.17**
		Preferred	0.75	0.86	0.59	0.47	
Cooperation	4	Actual	0.77	0.89	0.50	0.73	0.16**
		Preferred	0.77	0.70	0.62	0.44	
Equity	4	Actual	0.81	0.95	0.51	0.71	0.30**
		Preferred	0.64	0.76	0.56	0.31	

** $p < 0.01$.
The sample consisted of 172 students in 6 classes and 78 parents.

The alpha reliability coefficient for *Enjoyment of Science Lessons* was 0.96, for *Adoption of Science Attitudes* was 0.56, and for *Attitudes to Scientific Inquiry* was 0.80. The magnitude of the correlation between pairs of scales ranges from 0.03 to 0.33, suggesting reasonable scale independence.

Table 4.3 Internal Consistency Reliability (Cronbach Alpha Coefficient), and Discriminant Validity (Correlation With Other Scales) for the Modified TOSRA

Scale	No of Items	Alpha Reliability	Correlation with other Scales	
			Enjoyment of Science Lessons	Adoption of Science Attitudes
Enjoyment of Science Lessons	4	0.96	-	-
Adoption of Science Attitudes	4	0.56	0.04	-
Attitude to Scientific Inquiry	4	0.80	-0.03	-0.33

The sample consisted of 172 students in 6 classes.

Finding 6: TOSRA scales exhibit satisfactory internal consistency reliability and discriminant validity.

4.3 Differences Between Parents and Students in Their Preferred Classroom Environment and Their Perceptions of the Same Actual Classroom Environment

Research Question #2: Are there differences between kindergarten students and their parents in their perceptions of:

- actual learning environment in a science classroom?
- preferred learning environment in a science classroom?

To examine any differences between students and their parents and between actual and preferred learning environment, means, standard deviations, effect sizes, and *t* tests for paired samples were produced. Differences between actual and preferred scores are considered in section 4.3.1, whereas differences between students and parents are the focus in section 4.3.2.

4.3.1 Differences Between Actual and Preferred Learning Environment for Either Students or Parents

Table 4.4 compares the average item mean (i.e. the scale mean divided by the number of items in that scale) of each WIHIC scale for the actual and preferred forms. Data are provided separately for students and parents. The average item mean was used to enable easy comparison of the average scores on scales containing different numbers of items.

The differences between actual and preferred scores on each scale were investigated using effect sizes and *t* tests for paired sample. The effect size, or the difference between means expressed in standard deviation units, provides an index of the magnitude of an effect (see Table 4.4) and therefore its educational importance. On the other hand, the *t* test results provide information about the statistical significance of differences.

Table 4.4 shows the difference between the actual and preferred scores separately for students and for parents on modified the WIHIC scales for the individual as the unit

of analysis. This table shows that students' scores are significantly higher on each scale for the preferred version than for the actual version. The effect sizes for students range from 1.58 to 2.48 standard deviations, suggesting quite large differences between students' actual and preferred learning environments.

For parents, Table 4.4 shows that actual-preferred differences again are statistically significant on all four WIHIC scales. Effect sizes for parents range from 0.56 to 0.96 standard deviations

Although actual-preferred differences are statistically significant in Table 4.4 for all WIHIC scales for both students and parents, the magnitudes of the differences clearly are bigger for students than for parents. For example, effect sizes for actual-preferred differences range from 0.56 to 0.96 for parents, but they have the much larger range from 1.58 to 2.48 standard deviations for students.

Table 4.4 Average Item Mean, Average Item Standard Deviation, Difference Between Actual and Preferred Scores (Effect Size and *t* Tests for Paired Samples) for Both Students and Parents on Modified WIHIC

Scale	Parents/ Students	Average Item Mean		Average Item Standard Deviation		Difference	
		Actual	Preferred	Actual	Preferred	Effect Size	*t*
Teacher Support	Students	1.67	2.80	0.61	0.44	1.58	17.95**
	Parents	2.25	2.83	0.82	0.39	0.96	6.22**
Involvement	Students	1.51	2.77	0.54	0.48	2.47	21.48**
	Parents	1.78	2.24	0.82	0.81	0.56	4.14**
Cooperation	Students	1.55	2.82	0.64	0.43	2.37	21.66**
	Parents	1.81	2.42	0.81	0.64	0.84	5.94**
Equity	Students	1.57	2.86	0.69	0.35	2.48	21.10**
	Parents	2.11	2.74	0.92	0.49	0.89	5.68**

**$p < 0.01$.
$N = 172$ students and 78 parents.

Figure 4.1 graphically illustrates the average item means. Overall both students and parents perceive a less favorable actual science classroom environment than what they would prefer. This is consistent with previous studies conducted by Fraser (1982, 1998a), Fisher and Fraser (1983) and Henderson, Fisher and Fraser (2000) that show that students prefer a classroom environment that is more favorable than the one which they perceive as actually being present.

Finding 7: Both students and parents prefer a more positive learning environment than was perceived to be actually present.

Finding 8: The magnitudes of differences between actual and preferred learning environment scores are larger for students than for parents.

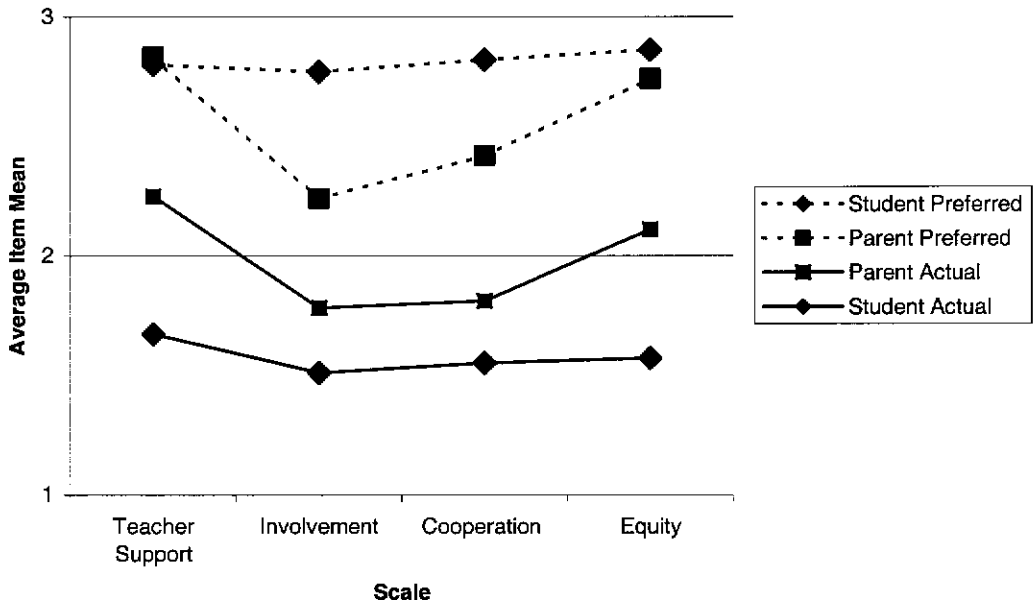

Figure 4.1 Students' and Parents' Average Item Mean on the Actual and Preferred Versions of the WIHIC

4.3.2 Differences Between Students and Parents in Their Perceptions of Either Actual or Preferred Learning Environment

Table 4.5 compares students and parents in terms of the average item mean of each WIHIC scale for both actual and preferred forms. The differences between students' and parents' scores on each scale were investigated using effect sizes and *t* for 78 matched pairs of students and parents.

Table 4.5 shows the difference between students' and parents' scores on the actual and preferred forms of the WIHIC. This table shows that students' and parents' scores are significantly different on every scale, except preferred Teacher Support and actual Cooperation. The effect size, which indicates the magnitude of

differences, for different scales ranged from 0.29 to 0.74 standard deviations for the actual form and from 0.83 to 1.63 standard deviations for the preferred form. These effect sizes indicate a large difference between students' and their parents' perceptions of both actual and preferred learning environments.

Parents perceived the actual environment appreciably more favorably than students, while student prefer a more favorable environment than parents. This striking finding agrees with patterns revealed in the interview and focus groups (see Section 4.5) when parents indicated satisfaction with their child's current science classroom.

Table 4.5 Average Item Mean, Average Item Standard Deviation, and Differences Between Student and Parent Scores (Effect Size and *t* Test for Paired Samples) on the Actual and Preferred Forms of the Modified WIHIC

Scale	Form	Average Item Mean		Average Item Standard Deviation		Difference	
		Student	Parent	Student	Parent	Effect Size	*t*
Teacher Support	Actual	1.72	2.25	0.62	0.82	0.74	5.12**
	Preferred	2.80	2.83	0.44	0.39	0.08	-0.40**
Involvement	Actual	1.54	1.78	0.55	0.82	0.35	2.06*
	Preferred	2.76	2.23	0.48	0.81	1.47	-8.63**
Cooperation	Actual	1.60	1.81	0.65	0.81	0.29	1.80
	Preferred	2.82	2.43	0.43	0.63	1.63	-9.53**
Equity	Actual	1.61	2.11	0.70	0.92	0.62	3.95**
	Preferred	2.87	2.73	0.31	0.51	1.22	-6.43**

**$p<0.01$

N= 78 matched pairs of students and parents

Figure 4.2 graphically illustrates the differences between students and parents in terms of the average item means on the WIHIC. Overall, both students and parents prefer a more favorable environment. However, parents perceive a more favorable actual environment than students, while students prefer a more favorable environment than parents.

Finding 9: Parents perceive a more favorable actual environment than students perceive.

Finding 10: Students prefer a more favorable environment than parents prefer.

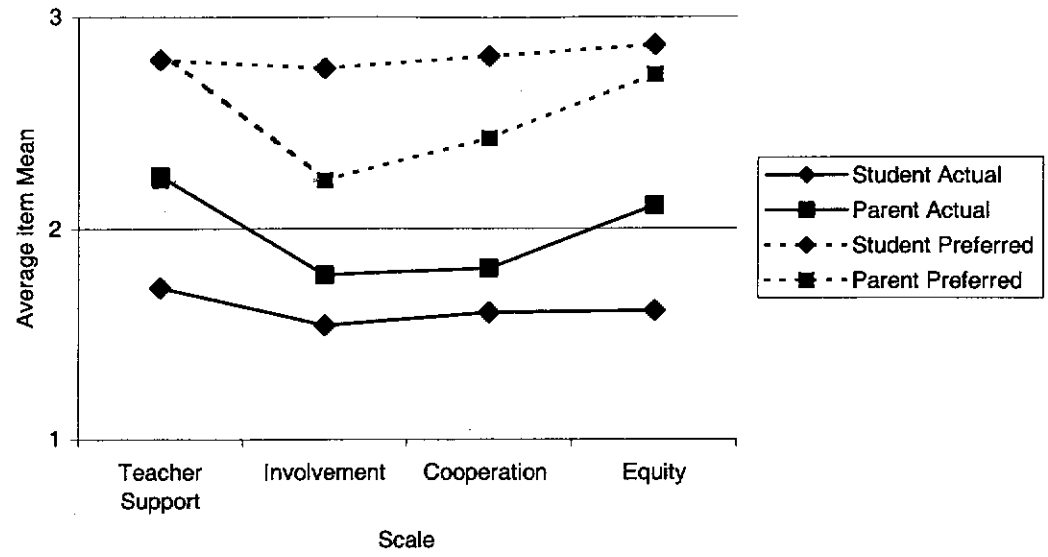

Figure 4.2 Students' and Parents' Scores on the Actual and Preferred Versions of the WIHIC

4.4 Associations Between Students' and Parents' Perceptions of the Learning Environment and the Outcomes of Achievement and Attitudes

Research Question #3: Are there associations between kindergarten students' achievement and attitudes and:

- students' perceptions of the learning environment in a science classroom?
- their parents' perceptions of the learning environment in a science classroom?

To examine associations between kindergarten students' achievement and attitudes in relation to students' and parents' perceptions of the learning environment, simple correlation and multiple regression analysis were calculated. Whereas the simple correlation analysis provides information about bivariate associations between an outcome and an individual environment dimension, the multiple regression analysis provides a more parsimonious picture of the joint influence of a set of correlated environment scales on an outcome. Section 4.4.1 reports the associations between environment scales and achievement, whereas Section 4.4.2 reports associations between student attitudes and dimensions of the modified WIHIC.

4.4.1 Associations Between Student Achievement and Dimensions of the Modified WIHIC

Simple correlation and multiple regression analyses were calculated to determine associations between the environmental scales and each of the student achievement measures described in Chapter 3. It should be noted that achievement data were only collected for the small sample of students (n=28) in the researcher's own class. Therefore, the statistical power of these analyses is low.

All simple correlations are positive (see Table 4.6) and four of the 12 correlations are statistically significant ($p<0.05$). Each of the WIHIC scales (Teacher Support, Involvement, Cooperation, and Equity) had a statistically significant correlation with one of the achievement measures (Final Report, Final Diagnostic Test, and Kindergarten Readiness Test). Kindergarten Readiness scores are significantly correlated with Teacher Support and Equity, and Final Diagnostic Test scores are significantly related to Involvement and Cooperation.

The multiple regression analyses revealed no significant overall associations between any student achievement measure and the set of dimensions of the WIHIC as a whole. However, this result is not surprising as it might not be meaningful to conduct a multiple regression analysis involving four predictors of achievement with a sample size of only 28. Nevertheless, this analysis was still conducted to provide a parallel to the multiple regression analysis reported in Table 4.7 for attitudinal outcomes. Clearly, this is a limitation of the present study that needs to be rectified through replication in future research involving a larger sample.

Table 4.6 Simple Correlation and Multiple Regression Analyses for Associations Between Student Achievement and Dimensions of the Modified WIHIC

Scale	Achievement-Environment Association					
	Final Report		Final Diagnostic Test		Kindergarten Readiness Test	
	r	*β*	*r*	*β*	*r*	*β*
Teacher Support	0.37	0.15	0.20	-0.23	0.38*	0.36
Involvement	0.23	0.16	0.51**	0.41	0.35	0.12
Cooperation	0.13	0.00	0.40**	0.11	0.28	-0.19
Equity	0.29	0.19	0.33	0.29	0.39*	0.06
Multiple Correlation (*R*)		0.43		0.55		0.40

*$p < 0.05$. **$p < 0.01$.
$N = 28$ students.
The sample size ($N = 5$) was too small to generate dependable statistics for class means.

Finding 11: Teacher Support, Involvement, Cooperation, and Equity each showed a significant simple correlation with one of three achievement measures.

Finding 12: Multiple regression analyses revealed no significant associations between each student achievement measure and the set of modified WIHIC scales as a whole (perhaps because of the small sample size).

4.4.2 Associations Between Student Attitudes and Dimensions of the Modified WIHIC

Simple correlation and multiple regression analyses were calculated to determine associations between students' attitudes and dimensions of the WIHIC. Table 4.7 shows the relation between each of four students' attitude and the four scales of the modified WIHIC. The results of the simple correlation analysis in Table 4.6 show that 3 of the 12 simple correlations are statistically significant. *Adoption of Science Attitudes* was significantly and positively correlated with the environment scale *Equity*. *Attitudes to Scientific Inquiry* was significantly and positively correlated with the two environmental scales of *Teacher Support* and *Equity*.

Table 4.5 shows that the multiple correlation between an outcome measure the set of four environment scale was 0.08 for *Enjoyment of Science Lessons*, 0.21 for *Adoption of Science Attitudes*, and 0.23 for *Attitude to Scientific Inquiry*. The multiple correlation was statistically significant ($p<0.05$) only for *Attitude to Scientific Inquiry*. Regression coefficients were used to identify which of the four modified WIHIC scales account for unique variance in student *Attitude to Scientific Inquiry*. The regression coefficients in Table 4.7 show that *Equity* is the only significant independent predictor of *Attitude to Scientific Inquiry*.

Finding 13: Higher levels of Equity in the classroom were significantly correlated with Adoption of Science Attitudes.

Finding 14: Higher levels of Teacher Support and Equity in the classroom were significantly correlated with Attitude to Scientific Inquiry. Only Equity was

significantly related to Attitude to Scientific Inquiry when the other WIHIC scales were mutually controlled.

Table 4.7 Simple Correlation and Multiple Regression Analysis for Associations Between Student Attitudes and Dimensions of the Modified WIHIC

Scale	Attitude-Environment Association					
	Enjoyment of Science Lessons		Adoption of Science Attitudes		Attitude to Scientific Inquiry	
	r	*β*	*r*	*β*	*r*	*β*
Teacher Support	0.06	0.10	-0.06	0.07	0.15*	0.03
Involvement	-0.00	-0.02	-0.07	0.04	0.13	0.03
Cooperation	0.00	-0.02	-0.14	0.10	0.13	-0.01
Equity	0.00	0.04	0.19*	0.19	0.23**	0.20*
Multiple Correlation (*R*)		0.08		0.21		0.23*

*$p < 0.05$. **$p < 0.01$.
$N = 172$ students.
The sample size ($N = 5$) was too small to generate dependable statistics for class means.

4.5 Interviews and Focus Groups

As discussed in Chapter 3, qualitative information based on interviews was a minor, but still important, component of my study.

Follow-up interviews with parents and students were conducted after the questionnaires had been administered to 172 kindergarten students and 78 parents. The researcher conducted four interviews. The first two interviews involved students. One student interview was conducted in Spanish and the second interview was conducted in English. The second set of interviews involved parents. One parent interview was conducted in Spanish and the second interview was conducted in English (see Chapter 3, Section 3.7) for details of interviews and focus groups.

Section 4.3 showed that statistically significant differences were found between students and parents in term of both actual and preferred learning environment. However, parents perceived an actual environment more favorable than students perceive, while students prefer a more favorable environment than parents prefer. Both students and parents showed a preference for a more favorable learning environment than was perceived to the present.

When students and parents were interviewed, they both indicated satisfaction with the current science classroom. However, parents indicated dissatisfaction with overcrowding, and the lack of paraprofessionals (teachers' assistants) available to teachers. They all felt that each kindergarten teacher should have a full-time paraprofessional.

Some parents indicated that they were fairly aware of what was going on in their child's class because students discussed their science experiments at home, students needed help with their homework, parents encountered difficulty with the English language and required explanations of how to help their child with their homework, or students participated in donating materials from home to be used in their science class.

Finding 15: The students who participated in the interviews (English and Spanish versions) were satisfied with their current science class.

Finding 16: The parents who participated in the interviews (English and Spanish versions) were satisfied with their child's current science class.

Finding 17: Parents were dissatisfied with student overcrowding in their child's kindergarten class.

Finding 18: Parents felt that each kindergarten teacher should have a paraprofessional in his/her classroom.

Finding 19: Some Spanish-speaking parents encountered language difficulties (language barrier/language deficit) when helping children with homework.

The *t* tests for paired samples for differences between the actual and preferred scores on the modified WIHIC illustrated statistically significant differences on all four scales (*Teacher Support, Involvement, Cooperation* and *Equity)* for both students and parents. Each of these scales is discussed respectively in relation to findings from students and parents interviews in Sections 4.5.1, 4.5.2, 4.5.3, and 4.5.4.

4.5.1 Teacher Support

The quantitative findings (see Table 4.4) indicate that both parents and students, but especially students, prefer statistically significantly greater levels of Teacher Support in the classroom. The factor loadings for the modified WIHIC for students' actual scores (Table 4.1) revealed that one *Teacher Support* item loaded less than 0.40 on its own scale. This Item 5 was: "The teacher likes me." I was curious to see why this had occurred. So, when I interviewed the students, I asked them to comment on this question. The students' responses fell into four categories. Two of the students responded with answers like: "I don't like her either." Four of them responded: "I am bad" or "I never do my homework." Two of them responded: "Well, I like her!" And the remaining two responded: "I don't know why she doesn't like some kids. Maybe they don't do their work."

As a whole group, the same students focused on how important it is to get help from the teacher. The comment that most students agreed with, even though they had stated that the teacher didn't like them in the individual interviews, was: "My teacher likes to do all those experiments. She thinks it is fun to work with all that stuff."

As I wanted to compare and contrast the responses that the students had given me with those of their parents, I asked the parents for their comments. Interestingly enough, their responses fell into three categories. Three parents responded: "She doesn't like my child because I don't have time to help him/her with any work." Two of them responded: "That lady is so mean." Two of them responded: "I really like the teacher and she seems very nice, but my kid is a little terror." The last three parents responded: "I think that she likes to teach, but she has too many kids in that class, and there is no help at all!"

As a whole group, the same parents had various responses, but they seemed to agree that, if the teacher likes the child and her job, then she would teach, even when she has too many kids in the class. A parent comment derived from the focus group interviews was: "If my child feels like she is nurtured in class, then I think that she will learn." The entire group agreed with her comment. This statement, along with the students' focus group statements, seems consistent with the quantitative findings

in Table 4.7, where we can see that *Attitude to Scientific Inquiry* was positively and significantly correlated with *Teacher Support.* In addition, we find a statistically significant correlation between *Teacher Support* and Kindergarten Readiness Test scores (taken from achievement reports) in Table 4.6.

Finding 20: Some students felt that the teacher didn't like them because they didn't do their homework or their school-work.

Finding 21: Some parents felt that the teacher had too many students in the class.

4.5.2 Involvement

The quantitative findings (see Table 4.4) indicate that both parents and students, but especially students, prefer statistically significantly greater levels of *Involvement* in the classroom. Some of the ESOL students stated that they were afraid of mispronouncing words, or of not being able to fully explain their answers because they didn't know how to articulate their sentences. Other students claimed that they didn't understand the process of experiments. They added that the teacher usually went too fast and that she didn't have time for too many explanations. While others claimed that they didn't want to appear dumb and that they liked it better when the classroom volunteer (an elderly lady who volunteered her time once a week) was there because she would take a small group to the side and go over the lesson with them.

Some students during the individual interviews stated that, although they really liked science, the teacher didn't have time to help everyone who needed help with clarification. During the student focus groups, most students agreed that the teacher didn't call on them enough, and that the lessons were too short.

Some parents during the individual interviews stated that science was their favorite subject in school, because it was the one subject for which the parents (when they were students themselves) had opportunities to participate in the experiments. During the parent focus interviews, the most commonly-shared comment dealt with effort. A parent stated: "If the teacher makes an effort to get my child involved in what is

happening in class, then my child will be responsive. If he is responsive, then he is learning." Additionally, several parents stated that they took many field trips in connection with their 'science explorations'. These trips included visits to lakes and ponds to see 'critters' in their own habitat. However, they understood that schools are apprehensive about allowing children to attend trips for which they are going to be close to the water (security reasons), and that many schools do not have the funding necessary to facilitate trips. During the focus group interview conducted in Spanish, some parents expressed that they felt bad because they knew that their child had trouble understanding the teacher, and thus the child felt uneasy about participating in class. They felt that the teacher needed a helper in the classroom to help with all of those students who didn't speak English. They stated that their child possesses the background knowledge, but lacks the language experience (language deficiency). Thus, they felt strongly about wanting someone who could speak Spanish in their child's classroom, at least until the school's third marking period.

Classroom Involvement clearly is important because of the strong correlation found between *Involvement* and *Final Diagnostic Test* taken from achievement reports as reported on Table 4.6.

Finding 22: Most students felt that the teacher didn't have time to help them.

Finding 23: Some parents felt that the teacher needed a helper to work with students who don't speak English.

4.5.3 Cooperation

The quantitative findings (see Table 4.4) indicate that students and parents, but especially students, preferred statistically significantly greater levels of *Cooperation*. Students stated that there were too many of them in the class and that they didn't have opportunities to work in groups.

Some students during the individual interviews stated that, although they really liked working together in groups, they seldom had the opportunity to do so. In contrast, three of the students stated: "Sometimes I need help with my work. I like it when the

teacher lets us work in groups or lets us help each other." During the student focus groups, most students agreed that they really liked it when they had the opportunity to work in groups.

Some parents during the individual interviews stated that they remembered working in groups or teams in their science classes. They also stated that they found working in a group stimulating because they had to defend their answers not only to the teacher, but also to the rest of the members in their group. One parent stated that working together to solve a problem was like trying to put a puzzle together: no-one was finished until everyone had placed his or her puzzle piece down. During the parent focus interviews, a salient comment that shared was: "If the teacher allows the students to work in groups, then those who know more can help those who need help." Another comment was: "My daughter always says that her teacher encourages them to guide and help each other. I like that!"

Cooperation is important in the classroom because there is a positive and significant correlation between *Cooperation* and *Final Diagnostic Test* scores taken from achievement reports reported on Table 4.6.

Finding 24: Parents felt that it would be beneficial if students had more opportunities to work cooperatively in groups/teams.

4.5.4 Equity

The quantitative findings (Table 4.4) indicated that both parents and students, but especially students, prefer statistically significantly greater levels of *Equity*. A student stated that, although he didn't get a chance to participate in class, neither did the rest of the class. Therefore, he thought that the treatment was fair.

Some students during the individual interviews stated that, although they would really like their teacher to help them with their work, they realize that there are too many kids in the room and the teacher can't help them all. One student stated: "My teacher is nice because she tries to help everyone in the same way. She tries to see who has the same problems, and then she puts that group together and tries to help us

in that way." Another comment was: "The teacher treats everyone the same. Sometimes she has to spend more time with other kids, but that is ok with me. She has to do that because they don't understand stuff like I do." During the student focus groups, most students agreed that they really liked it when their work was praised and put up for display.

Some parents during the individual interviews stated that they felt that, in general, their child's teacher was very fair. One parent stated that, when they went on a field trip, the teacher tried to spend time with each group of students as they went around the Science Museum. During the parent focus interviews, a telling comment that was shared was: "I feel bad that the teacher has so many students in the class, but I think that she tries hard to give everyone an equal chance." Another comment was: "I think that my child can tell if the teacher cares or not. She tells me that, in her class, the teacher is very fair and treats everyone in the same way."

The statement made by most students and parents are consistent with the quantitative findings (Table 4.7) where we see that *Equity* has a positive and significant correlation with student attitudes. In addition, there was a significant correlation between *Equity* and the Kindergarten Readiness Test scores (Table 4.6).

Finding 25: Students stated that they liked their learning environment because, even though they did not have as much time with the teacher as they would like/need, the teacher was fair and treated everyone in the same way.

Finding 26: Parents felt that the teachers cared about their child and was fair.

4.6 Summary

Chapter 4 presented the results and analyses of the study based on quantitative and qualitative data-gathering methods. In order to ascertain parents' and students' perceptions of the learning environment, 172 students in six classes and 78 parents agreed to participate in the study.

Modified versions of the WIHIC and TOSRA were developed to assess kindergarten students' or parents' actual and preferred learning environment, and the scales were validated with the present samples. Differences between kindergarten students' and their parents' perceptions of their actual and preferred learning environment in a science classroom were investigated. And associations were investigated between students' perceptions of the learning environment and the outcomes of achievement and attitude toward science. Individual interviews and focus groups provided supplementary clarification and validity to the findings. The findings were listed at the end of each section to facilitate understanding and to serve as a partial summary. These findings have been compiled at the end of this chapter's summary for easier recollection. They are divided into two categories: findings for quantitative data-collection methods (see Section 4.6.1) and findings for qualitative data-collection methods (see Section 4.6.2). Additionally, the findings are organized according to the research questions. Finally, the chapter closes with general findings and an overview of the next chapter, Chapter 5.

4.6.1 Findings for Quantitative Data-Collection Methods

The findings for the first research question, which involved developing valid and reliable questionnaires to assess kindergarten students' and parents' actual and preferred learning environment, are summarized below:

Finding 1: The student WIHIC displayed satisfactory factorial validity.

Finding 2: Item 8 "The teacher's questions help me understand" loaded greater than 0.40 on the two scales of Teacher Support and Equity. Item 5 "The teacher likes me" loaded less than 0.40 on its own scale of Teacher Support.

Finding 3: The WIHIC demonstrated satisfactory internal consistency reliability for students and parents in both its actual and preferred forms.

Finding 4: Raw scores on the student and parent version of the actual and preferred forms of the WIHIC did not exhibit good discriminant validity. The parents' results

might be due to the small sample of parents who participated in the questionnaire survey (78 parents).

Finding 5: The student actual form of each WIHIC scale can differentiate significantly between the perceptions of students in different classrooms.

Finding 6: TOSRA scales exhibit satisfactory internal consistency reliability and discriminant validity.

The findings for the second research question, which involved investigating any differences between kindergarten students and their parents in the actual and preferred learning environment in a science classroom, are summarized below:

Finding 7: Both students and parents prefer a more positive learning environment than was perceived to be actually present.

Finding 8: The magnitudes of differences between actual and preferred learning environment scores are larger for students than for parents.

Finding 9: Parents perceive a more favorable actual environment than students perceive.

Finding 10: Students prefer a more favorable environment than parents prefer.

The findings for the third research question involving investigating associations between kindergarten students achievement and attitudes and either students' or parents' perceptions of the learning environment in a science classroom, are summarized below:

Finding 11: Teacher Support, Involvement, Cooperation, and Equity each showed a significant simple correlation with one of three achievement measures.

Finding 12: Multiple regression analyses revealed no significant associations between each student achievement measure and the set of modified WIHIC scales as a whole (perhaps because of the small sample size).

Finding 13: Higher levels of Equity in the classroom were significantly correlated with Adoption of Science Attitudes.

Finding 14: Higher levels of Teacher Support and Equity in the classroom were significantly correlated with Attitude to Scientific Inquiry. Only Equity was significantly related to Attitude to Scientific Inquiry when the other WIHIC scales were mutually controlled.

4.6.2 Findings for Qualitative Data-Collection Methods

Qualitative data-gathering, although modest in scope, was an important component of the study that complemented quantitative data-gathering. Qualitative information was based on interviews and focus groups that were conducted with both students and parents and in both English and Spanish.

Finding 15: The students who participated in the interviews (English and Spanish versions) were satisfied with their current science class.

Finding 16: The parents who participated in the interviews (English and Spanish versions) were satisfied with their child's current science class.

Finding 17: Parents were dissatisfied with student overcrowding in their child's kindergarten class.

Finding 18: Parents felt that each kindergarten teacher should have a paraprofessional in his/her classroom.

Finding 19: Some Spanish-speaking parents encountered language difficulties (language barrier/language deficit) when helping children with homework.

Finding 20: Some students felt that the teacher didn't like them because they didn't do their homework or their school-work.

Finding 21: Some parents felt that the teacher had too many students in the class.

Finding 22: Most students felt that the teacher didn't have time to help them.

Finding 23: Some parents felt that the teacher needed a helper to work with students who don't speak English.

Finding 24: Parents felt that it would be beneficial if students had more opportunities to work cooperatively in groups/teams.

Finding 25: Students stated that they liked their learning environment because, even though they did not have as much time with the teacher as they would like/need, the teacher was fair and treated everyone the same.

Finding 26: Parents felt that the teachers cared about their child.

4.6.3 Conclusion

A modified version of the What Is Happening In This Class (WIHIC) questionnaire was developed in both English and Spanish. However, because only 16 students responded in Spanish, it was not possible to validate the Spanish version separately. Therefore English and Spanish responses were combined for all validity analyses. The actual version of the WIHIC displayed satisfactory factorial validity for the student sample. Internal consistency reliability was satisfactory when used with either kindergarten students or their parents.

Parents perceived a more favorable actual classroom environment that did kindergarten students, but students perceived a more favorable preferred classroom environment that did their parents. The magnitudes of differences between students and parents are greater for the preferred form than the actual form.

Some statistically significant associations were found between kindergarten students' perceptions of the classroom environment and the outcomes of achievement and attitudes to science.

Chapter 5 provides a discussion and summary of other chapters. Additionally, the chapter identifies the distinctive contributions made by the study, possible limitations of the study, and future directions for research.

Chapter 5

Discussion and Conclusion

5.1 Introduction and Overview

Little information is available on the achievement of children in kindergarten programs in the United States and on the nation's children as they enter kindergarten and move through the primary grades. In the fall of 1998, about four million children were attending kindergarten in the United States, approximately 95 percent of them for the first time. Over the past few decades, the nature of kindergarten programs has shifted from typically half-day programs to full-day programs (NCES, 1998). Therefore, my study of kindergarten students from a learning environment perspective is timely.

This study adds to the field of learning environments because it modified and validated questionnaires in English and Spanish to assess kindergarten students' and their parents' perceptions of the actual and preferred learning environment, investigated differences between parents' and students' perceptions of the actual and preferred learning environments, and explored associations between the environment and students' achievement and attitudes in science classrooms.

During focus groups and interviews, these kindergarteners had a lot to say about their classrooms, their teachers, what they would like to see happening in their classrooms, and the way in which they would like the teacher to behave and teach. Their parents also had a lot to say about their children's classrooms, teachers and what they would prefer to see happening in their children's class.

Kindergarten students are overflowing with inquisitiveness. Their heads seem to be filled with interest questions, curiosity, nosiness, improving, and so much more. I you ever taught kindergarten, then you know that there is never a dull moment. As a kindergarten teacher, I felt that, if students were involved in their own process of

learning, and if they had something to say about their own learning environment, then perhaps I could help them to improve their attitudes and academic development in science. While there is considerable consensus of opinion that the promotion of favorable attitudes to science is an important aim of science education, there is confusion about what meaning should be placed on the term 'attitude to science' (Fraser, 1981).

The purpose of this chapter is to summarize all previous chapters, to discuss the contributions made by my study, as well as the limitations found, and to speculate about the future directions.

The content of Chapter 5 is overviewed below:

5.2 Summary of Chapter 1: Introduction

Chapter 1 introduced my study of kindergarten students' and their parents' perceptions of science classroom environment and students achievement and attitudes. The chapter established the aims of the study: the construction and validation of modified learning environment questionnaires that were used by both parents and kindergarten students, investigation of differences between students' and parents' preferred and actual learning environment; and investigations of associations

between students' or parents' perceptions of the learning environment students' achievement and attitude toward science.

Additionally, the chapter discussed parental and community involvement in schooling and how these have been found to influence academic achievement and school climate. Finally, the chapter talked about the needs of kindergarten children and about some of the things that parents and teachers can do to help children to improve their social skills and develop the maturity level necessary to succeed in school.

5.3 Summary of Chapter 2: Literature Review

Chapter 2 reviewed literature related to my study, especially literature from the field of learning environment as this field underpinned my study. The literature included numerous learning environment studies that have focused on science classrooms and on student attitudes and perceptions of science. The research questions for the study guided the literature review chapter. The chapter explored the writings related to kindergarten learning environments (past and present), current kindergarten students, and their parents. Instruments such as the Learning Environment Inventory (LEI), Classroom Environment Scale (CES), My Class Inventory (MCI), Constructivist Learning Environment Survey (CLES), Individualized Classroom Environment Questionnaire (ICEQ), and Questionnaire on Teacher Interaction (QTI) were reviewed. Particular attention was paid to the What is Happening in this Class? (WIHIC) questionnaire because it was chosen for use in my study. In addition, the Test of Science-Related Attitudes (TOSRA) was discussed because it was used to assess students' attitudes in my research.

I selected the WIHIC to assess classroom environment because past studies (see Section 2.3.3) indicate that the WIHIC is a valid and reliable instrument for measuring actual and preferred learning environments. I felt that this instrument would most likely accommodate my research questions as I tried to analyze and investigate perceptions of the learning environment of very young students and their parents. I selected TOSRA for measuring science-related attitudes, because past studies (see Section 2.4) indicate that the TOSRA is a reliable instrument for the use

of measuring students' attitudes towards science. Finally, because my study included parents, the chapter concludes with a section on the role that parents play in student achievement (see Section 2.4.1).

5.4 Summary of Chapter 3: Research Methods

Chapter 3 describes methods for gathering quantitative and qualitative data. Quantitative information was collected by assessing students' and parents' perceptions of the science learning environment. Despite the fact that numerous learning environment research instruments have provided a better understanding of the social climate of schools and classrooms, various researchers have felt a need to develop a single instrument that incorporated the best elements of past instruments. Thus, based of previous studies, Fraser, Fisher and McRobbie (1996) developed a new learning instrument called What Is Happening In This Class? (WIHIC).

As stated earlier, the WIHIC questionnaire was used in conjunction with the Test Of Science-Related Attitudes (Fraser, 1981). The WIHIC was modified in order to facilitate understanding among five- and six-year old students who participated in this study, along with members of a self-contained English Speakers of Other Languages (ESOL) class, and parents. The modified version of the WIHIC questionnaire had two forms to measure students' and parents' perceptions of the actual classroom environment, and another two forms to measure students' and parents' preferred classroom environment.

Given that I wanted to facilitate understanding and to reduce administration time among five- and six-year old students who participated in this study, along with members of a self-contained English Speakers of Other Languages (ESOL) class, and parents, only 20 out of the original 56 WIHIC items were chosen. Out of the original seven scales, only five were investigated in my study: Student Cohesiveness, Teacher Support, Involvement, Cooperation, and Equity. Two forms were used to measure the students' and parents' perception of actual classroom environment, while the other two were used to measure students' and parents' preferred classroom environment. The WIHIC was carefully translated into Spanish to cater for students

and parents whose English was limited. A sample of 176 kindergarten students and 78 parents completed the WIHIC questionnaire.

The Test of Science-Related Attitudes (TOSRA) has been carefully developed and extensively field-tested and has been shown to be highly reliable (Fraser, 1981). A modified version of (TOSRA) was used for the purpose of exploring associations between students' attitudes to science and students' or parents' perceptions of the learning environment in my study. Once again, due to the young age of the students (five to six years old), the number of questions were reduced from 70 to 24. Out of the seven original conceptual categories, only three were investigated in my study: Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, and Enjoyment of Science Lessons. The three categories selected seemed to be the most appropriate ones to measure attitudinal aims for kindergarten students. Attitude to Scientific Inquiry measures attitude to scientific experimentation and questioning as a way to obtain information about our natural world. Adoption of Scientific Attitudes measures 'scientific attitudes' like eagerness to modify/change opinions after acquiring new information. And finally, Enjoyment of Science measures contentment with science learning experiences at school or in the classroom.

Qualitative information was collected by the use of interviews and focus groups. I conducted four sets of interviews for my study. The first two interviews involved students. One student interview was conducted in Spanish and the second interview was conducted in English. The second set of interviews involved parents. One parent interview was conducted in Spanish and the second interview was conducted in English. The focus groups and interviews were useful ways of obtaining particular information such as: differences between students' and parents' perceptions of the actual and preferred learning environment; and associations between achievement and attitudes and students' and parents' perceptions of the learning environment science. The parents who participated in the interviews were the parents of the students who participated in the student interviews. All interviews were conducted at different times and dates.

A focus of my study was examining the reliability (consistency in measurement) and validity (including independence of different scales within a questionnaire) of the

modified What Is Happening In This Class? (WIHIC) questionnaire and Test Of Science-Related Attitudes (TOSRA). These questionnaires were used in this study to investigate differences between kindergarten students' and their parents' perceptions of the learning environment (actual and preferred) and, finally, to examine associations between kindergarten students' outcomes (achievement and attitudes) and students' and parents' perceptions of the learning environment in a science classroom. Additionally, statistical analyses were used to examine the internal consistency reliability (Cronbach alpha coefficient) and discriminant validity (mean correlation with other scales) for two units of analysis for the WIHIC (actual and preferred) modified TOSRA. For the actual form of the WIHIC for the student sample, ANOVA was used to test the ability of each scale to differentiate between the perceptions of students in different classes.

To examine differences between students and their parents in their perceptions of actual and preferred classroom environment, effect sizes, and *t* tests for matched pair were calculated for each WIHIC scale. To examine the relationship of kindergarten students' achievement and attitudes to students' and parents' perceptions of the learning environment in a science classroom, simple correlation and multiple regression analyses were calculated.

5.5 Summary of Chapter 4: Results

Chapter 4 presented the analyses and results of the quantitative and qualitative data-collection methods used during the study. Three research questions were investigated:

Research Question #1: Can valid and reliable questionnaires be developed in English and Spanish to assess:

- kindergarten students' actual and preferred learning environment?
- their parents' actual and preferred learning environment?

Research Question #2: Are there differences between kindergarten students and their parents in their perceptions of:

- actual learning environment in a science classroom?
- preferred learning environment in a science classroom?

Research Question #3: Are there associations between kindergarten students' achievement and attitudes and:

- students' perceptions of the learning environment in a science classroom?
- their parents' perceptions of the learning environment in a science classroom?

In order to ascertain parents' and students' perceptions of the learning environment, 172 kindergarten students in 6 classes and 78 parents responded to the modified WIHIC actual and preferred versions, which assessed Student Cohesiveness, Teacher Support, Involvement, Cooperation, and Equity. Also a modified version of the TOSRA was used to assess Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, and Enjoyment of Science Lessons.

5.5.1 Findings for Research Question #1

The methods used to test Research Question #1 included factor analysis with varimax rotation for the purpose of investigating the factor structure of the modified version of the WIHIC. The internal consistency reliability, discriminant validity, and ability to differentiate between classrooms were investigated for the actual and preferred forms of the WIHIC for the student sample and parent sample. And finally, the internal consistency reliability and discriminant validity of the modified version of TOSRA were checked. The main findings for Research Question #1 are summarized below:

Finding 1: The student WIHIC displayed satisfactory factorial validity.

Finding 2: Item 8 "The teacher's questions help me understand" loaded greater than 0.40 on the two scales of Teacher Support and Equity and Item 5 "The teacher helps me when I have trouble doing work" loaded less than 0.40 on its own scale of Teacher Support.

Finding 3: The WIHIC demonstrated satisfactory internal consistency reliability for students and parents in both its actual and preferred forms.

Finding 4: Raw scores on the student and parent version of the actual and preferred forms of the WIHIC did not exhibit good discriminant validity. The parents' results might be due to the small sample of parents who participated in the questionnaire survey (78 parents).

Finding 5: The student actual form of each WIHIC scale can differentiate significantly between the perceptions of students in different classrooms.

Finding 6: TOSRA scales exhibit satisfactory internal consistency reliability and discriminant validity.

The results for Finding 4 suggest that the desirability in future research of further investigating the independence of WIHIC scales when used with larger samples of Kindergarten students and their parents.

Although an important contribution of this study was the painstaking translation of the WIHIC and TOSRA into Spanish, the smallness of the sample of students who chose to respond to the Spanish version meant that it was not possible to generate meaningful validation statistics for the Spanish questionnaires.

5.5.2 Findings for Research Question #2

The methods used to test Research Question #2 included effect sizes and *t* tests for paired samples for determining the differences between the actual and preferred scores separately for students and for parents, as well as directly comparing students' and parents' scores, on the modified WIHIC scales for the individual as the unit of analysis. A sample size of 172 students was available for comparing students' actual and preferred scores, and a sample of 78 parents for comparing parents' actual and preferred scores. For direct comparisons of students' and parents' scores, 78 matched pairs of students and parents were used.

Finding 7: Both students and parents prefer a more positive learning environment than was perceived to be actually present.

Finding 8: The magnitudes of differences between actual and preferred learning environment scores are larger for students than for parents.

Finding 9: Parents perceive a more favorable actual environment than students perceive.

Finding 10: Students prefer a more favorable environment than parents prefer.

5.5.3 Findings for Research Question #3

The methods used to test Research Question #3 included simple correlation and multiple regression analyses for determining associations between kindergarten students' achievement and attitudes and either students' and parents' perceptions of the learning environment. The sample of 172 students was available for investigating associations between attitudes and environments, but only my own class of 28 students provided achievement data.

Finding 11: Teacher Support, Involvement, Cooperation, and Equity each showed a significant simple correlation with one of three achievement measures.

Finding 12: Multiple regression analyses revealed no significant associations between student achievement measure and the set of modified WIHIC scales as a whole (perhaps because of the small sample size).

Finding 13: Higher levels of Equity in the classroom were significantly correlated with Adoption of Science Attitudes.

Finding 14: Higher levels of Teacher Support and Equity in the classroom were significantly correlated with Attitude to Scientific Inquiry. Only Equity was significantly related to Attitude to Scientific Inquiry when the other WIHIC scales were mutually controlled.

A limitation of the analyses for achievement-environment associations is that the sample size was only 28 students and therefore statistical power was low.

5.5.4 Findings Based on Qualitative Investigation

I used qualitative methods for my study for the purpose of describing as accurately and as comprehensively as possible all relevant aspects of the situation observed. Because I wanted my observations to accurately reflect the situation observed, I chose interviews and focus groups in order to acquire in-depth understanding. While trying to be sufficiently involved in order to gain the insight information that I was seeking, and remaining as inconspicuous as possible, I conducted four interviews. One set of interviews involved students and one set involved parents. One student interview was conducted in Spanish and the second interview was conducted in English. The second set of interviews involving parents, followed the same pattern as the students, the first interview was conducted in Spanish and the second interview was conducted I English. Some patterns emerging from the interviews are summarized below:

Finding 15: The students who participated in the interviews (English and Spanish versions) were satisfied with their current science class.

Finding 16: The parents who participated in the interviews (English and Spanish versions) were satisfied with their child's current science class.

Finding 17: Parents were dissatisfied with student overcrowding in their child's kindergarten class.

Finding 18: Parents felt that each kindergarten teacher should have a paraprofessional in his/her classroom.

Finding 19: Some Spanish-speaking parents encountered language difficulties (language barrier/language deficit) when helping children with homework.

Finding 20: Some students felt that the teacher didn't like them because they didn't do their homework or their school-work.

Finding 21: Some parents felt that the teacher had too many students in the class.

Finding 22: Most students felt that the teacher didn't have time to help them.

Finding 23: Some parents felt that the teacher needed a helper to work with students who don't speak English.

Finding 24: Parents felt that it would be beneficial if students had more opportunities to work cooperatively in groups/teams.

Finding 25: Students stated that they liked their learning environment because, even though they did not have as much time with the teacher as they would like/need, the teacher was fair and treated everyone the same.

Finding 27: Parents felt that the teachers cared about their child and was fair.

Although qualitative data collection was an important part of my study, it was limited in scope compared with quantitative data collection.

5.6 Distinctive Contributions Made by the Study

This study is significant as it validated a revised version of an extensively-used questionnaire, namely, the What Is Happening in This Class? (WIHIC), to economically evaluate very young kindergarten students' and their parents' perceptions of an actual and preferred classroom learning environment. Few learning environment instruments have ever been used at the kindergarten level. Also including parents in learning environment research is unique. Furthermore, because my study took place in a school district where Spanish is spoken by a large number of the student population, it was advantageous that I developed a version of the WIHIC in Spanish. Other researchers and teachers are likely to find this new version that accommodates two languages useful, economical, and supportive in

assessing young students', as well as parents', classroom environment perceptions. However, because only a small number of students elected to respond to the Spanish version, its validation will have to wait until it is used in future research with a larger sample.

Finally, because my study involved parents, it could guide future studies that examine the important role that parents/families play in their child's education. Maccoby (1992) declared that parents play a central role in young children's socialization and learning.

5.7 Limitations of the Study

This study was conducted for the purpose of developing a valid questionnaire in English and Spanish to assess students' and parents' actual and preferred learning environments, to investigate differences between kindergarten students' and their parents' in their perceptions of the actual and preferred learning environment in a science classroom, and to examine associations between kindergarten students' achievement and attitudes and either students' or their parents' perception of the learning environment in a science classroom.

After teaching kindergarten for over 13 years, I still encountered difficulty in studying such young children because of their difficulties in comprehending questionnaire items. Although the WIHIC was modified in order to facilitate understanding among five- and six-year old students who participated in this study, along with members of a self-contained English Speakers of Other Languages (ESOL) class and parents, some difficulties arose among both students and parents in trying to differentiate between the actual and preferred versions of the questionnaire. In addition, the TOSRA presented some difficulties in that the questionnaire gave the students too many alterations from which to choose for their responses.

A practical constraint encountered was the relative smallness of the sample size of students (172) participating in the study. A larger sample would have increased the statistical power and enhanced confidence in the findings.

A practical difficulty encountered was the smaller sample size of parents (78) who agreed to participate in the study compared with the number of students (172). A larger sample could have altered the results. This means that future research is still needed with larger samples of parents and kindergarten students before the independence of WIHIC scales can be established for this population.

Additionally, the very small sample size of students (16) who responded to the Spanish version of the WIHIC was too small to permit meaningful factor analysis to be conducted and therefore for the Spanish version to be validated as part of my study.

Because it was feasible to collect achievement data only for my own class of 28 students, analyses of achievement-environment associations had low statistical power. In particular, although multiple regression analysis was conducted for achievement to provide parallel analyses to those conducted for attitude outcomes, it was not possible to obtain meaningful results for such a small sample size.

Studying my own class for the qualitative data-gathering (interviews) might have influenced some of these results. I might have been biased in certain ways. Students might have responded differently in interviews conducted by the teacher-researcher than in interviews conducted by an external person.

Because my students are not typical (self-contained ESOL class) in the sense that they differ in their background knowledge, maturational stage, ethnicity, race, and their parents' educational background compared with other groups of students, my findings might not be generalizable to other students

Finally, the scope of my qualitative data gathering was limited compared with the scope of my quantitative data gathering. More extensive use of qualitative data collection might have yielded greater insights.

5.8 Future Directions

Kindergarten is a significant stage in children's early school careers. Developing meaningful experiences for young students, creating positive attitudes toward learning, generating ideal learning environments and creating opportunities for growth is a continuing challenge for teachers. My study modified an economical questionnaire in the English and Spanish languages to assess kindergarten students' and their parents' perceptions of the actual and preferred learning environment. I believe that teachers and administrators could find this questionnaire useful for various practical purposes. My personal quest to aid my own students, school, and community has brought me great elation because other educators have already used my modified versions of the WIHIC and TOSRA to assess their kindergarten and elementary students. Moreover, researchers are likely to find this version of the WIHIC useful in various lines of classroom environment research identified by Fraser (1998a) at the kindergarten level.

It was previously noted that children entering kindergarten especially in the United States, come from increasingly diverse racial, ethnic, cultural, social, economic and language backgrounds. I believe that my study needs to be repeated with different and bigger student samples, in the hope of producing more dependable and generalizable results. In particular, the independence of WIHIC scales when used with kindergarten students and their parents needs to be further investigated in future research involving larger samples. Also, a larger parent sample would help to validate the parent questionnaires, while a larger student sample responding to the Spanish version of the WIHIC could permit meaningful validation of the Spanish version.

Furthermore, achievement testing among a much larger sample of students (n=28) than was used in my study is desirable in future research in order to provide dependable findings regarding the educationally important influence that the learning environment has on student achievement. In particular, the multiple regression analysis performed for achievement in my study needs to be replicated with a much larger sample before meaningful results can be obtained.

In future research in which larger samples of parents are involved, it would be desirable to investigate associations between student outcomes and the parent-perceived classroom environment (similar to the analyses of associations between student outcomes and student-perceived classroom environment that were performed in this study).

In addition, more extensive use of qualitative methods than those employed in my study is recommended in future research to provide greater insights into kindergarten learning environments.

The present study revealed sizeable gaps between the actual and preferred learning environment of kindergarten classrooms. In future research, therefore, it would be desirable to apply the methods of Yarrow, Millwater and Fraser (1997) in teachers' practical attempts to improve science classroom environments for kindergarten students by reducing the gap between actual and preferred environment.

Finally, schools teachers and parents need to become aware of the various studies, including my own, that link families to student performance. The family is critical to student achievement (Henderson & Berla, 1994). As parents and families become involved, hopefully the school will help to create a climate that makes all parents feel welcome in their child's world of learning. Epstein (1995) points out the need for teachers and schools to increase their understanding and respect for student and family diversity, thus creating a more caring school climate. It is my hope and desire that other researchers follow my lead and include parents in their future research.

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Appendix A

What Is Happening In This Class? (WIHIC) Questionnaire – Student Actual – English

NAME_____SCHOOL_____CLASS_____

What is Happening in this Science Class?

Student Actual Form

Directions: Listen to each statement below and circle

1. If you **ALWAYS** agree
2. If you **NEVER** agree
3. If you **SOMETIMES** agree

Remember that you are describing your **ACTUAL** science classroom

Student Cohesiveness		Always	Never	Sometimes
1.	I have friends in this class.	1	2	3
2.	I am nice to other kids in this class.	1	2	3
3.	I help other kids in this class when they have trouble with their work.	1	2	3
4.	Other kids in this class help me when I have trouble doing work.	1	2	3
Teacher Support				
5.	The teacher likes me.	1	2	3
6.	The teacher helps me when I have trouble doing work.	1	2	3
7.	The teacher talks to me.	1	2	3
8.	The teacher's questions help me understand.	1	2	3
Involvement				
9.	I share my ideas.	1	2	3
10.	My ideas are used during science class.	1	2	3
11.	Other kids discuss with me how to work out science problems.	1	2	3
12.	I explain how I work out problems.	1	2	3
Cooperation				
13.	I help other kids with the work the teacher gives them.	1	2	3
14.	Other kids and I work together like a team.	1	2	3
15.	I share my supplies with other kids.	1	2	3
16.	I learn from other kids in my science class.	1	2	3
Equity				
17.	The teacher helps me the same way he/she helps other kids.	1	2	3
18.	I am treated the same way as other students in my science class.	1	2	3
19.	I get the same chance to participate as other kids.	1	2	3
20.	The teacher likes my work as much as the other kids' work.	1	2	3

Appendix B

What Is Happening In This Class? (WIHIC) Questionnaire – Student Preferred – English

NAME_____SCHOOL_____CLASS_____

What Should be Happening in this Science Class?

Student Preferred Form

Directions: Listen to each statement below and circle

1. If you **ALWAYS** agree
2. If you **NEVER** agree
3. If you **SOMETIMES** agree

Remember that you are describing your **MOST WANTED** science classroom

Student Cohesiveness		Always	Never	Sometimes
1.	I would have friends in this class.	1	2	3
2.	I would be nice to other kids in this class.	1	2	3
3.	I would help other kids in this class when they have trouble with their work.	1	2	3
4.	Other kids in this class would help me when I have trouble doing work.	1	2	3
Teacher Support				
5.	The teacher would like me.	1	2	3
6.	The teacher would help me when I have trouble doing work.	1	2	3
7.	The teacher would talk to me.	1	2	3
8.	The teacher's questions would help me understand.	1	2	3
Involvement				
9.	I would share my ideas.	1	2	3
10.	My ideas would be used during science class.	1	2	3
11.	Other kids would discuss with me how to work out science problems.	1	2	3
12.	I explain how I would work out problems.	1	2	3
Cooperation				
13.	I would help other kids with the work the teacher gives them.	1	2	3
14.	Other kids and I would work together like a team.	1	2	3
15.	I would share my supplies with other kids.	1	2	3
16.	I would learn from other kids in my science class.	1	2	3
Equity				
17.	The teacher would help me the same way he/she helps other kids.	1	2	3
18.	I would be treated the same way as other students in my science class.	1	2	3
19.	I would get the same chance to participate as other kids	1	2	3
20.	The teacher would like my work the same way as the other kids' work.	1	2	3

Appendix C

What Is Happening In This Class? (WIHIC) Questionnaire – Student Actual – Spanish

NOMBRE_____COLEGIO_____CLASE_____

Que esta pasando en esta clase de ciencia?

Forma Actual del Estudiante

Direcciones: Escucha a cada declaracion abajo y circule:

1. Si usted SIEMPRE esta de acuerdo
2. Si usted NUNCA esta de acuerdo
3. Si usted A VECES esta de acuerdo

Recuerde que usted esta describiendo su clase actual de ciencia

Cohesivismo del Estudiante		Siempre	Nunca	A Veces
1.	Tego amigos en esta clase.	1	2	3
2.	Soy bueno con los otros ninos en esta clase.	1	2	3
3.	Ayudo a otros ninos en esta clase cuando tienen difucultades con su trabajo.	1	2	3
4.	Otros ninos en esta clase me ayudan cuando tengo problemas con el trabajo.	1	2	3
Apoyo del Maestro				
5.	Yo le caigo bien al maestro	1	2	3
6.	El maestro me ayuda cuando tengo dificultades haciendo el trabajo.	1	2	3
7.	El maestro me habla.	1	2	3
8.	Las preguntas del maestro me ayudan entender.	1	2	3
Participacion				
9.	Comparto mis ideas.	1	2	3
10.	Se usan mis ideas durante la clase de ciencia.	1	2	3
11.	Otros ninos discuten problemas de ciencia conmigo.	1	2	3
12.	Explico como resolver problemas.	1	2	3
Cooperacion				
13.	Trabajo con otros estudiantes en esta clase.	1	2	3
14.	Trabajo bien con otros ninos en un equipo.	1	2	3
15.	Comparto mis susministors con otros estudiantes asegun trabajamos.	1	2	3
16.	Aprendo de otros ninos en mi clase de ciencia.	1	2	3
Equidad				
17.	El maestro me ayuda de la misma manera en que el/ella ayuda a otros ninos.	1	2	3
18.	Soy tratado de la misma manera como otros estudiantes en mi clase de ciencia.	1	2	3
19.	Tengo las mismas oportunidades para participar como otros ninos.	1	2	3
20.	Al maestro le gusta mi trabajo de la misma manera como el trabajo de los otros ninos.	1	2	3

Appendix D

What Is Happening In This Class? (WIHIC) Questionnaire – Student Preferred – Spanish

NOMBRE_____COLEGIO_____CLASE_____

Que debe de pasar en esta clase de ciencia?
Forma Preferida del Estudiante

Direcciones: Escucha a cada declaracion abajo y circule:

1. Si usted SIEMPRE esta de acuerdo
2. Si usted NUNCA esta de acuerdo
3. Si usted A VECES esta de acuerdo

Recuerde que usted esta de describiendo su mas preferidia clase de ciencia

Cohesivismo del Estudiante		Siempre	Nunca	A Veces
1.	Tendria amigos en esta clase.	1	2	3
2.	Seria bueno con los otros ninos en esta clase.	1	2	3
3.	Ayudaria otros ninos en esta clase cuando tienen difucultades con su trabajo.	1	2	3
4.	Otros ninos en esta clase me ayudarian cuando tengo problemas con el trabajo.	1	2	3
Apoyo del Maestro				
5.	Yo le caeria bien al maestro	1	2	3
6.	El maestro me ayudaria cuando tengo dificultades haciendo el trabajo.	1	2	3
7.	El maestro me hablaria.	1	2	3
8.	Las preguntas del maestro me ayudarian entender.	1	2	3
Participacion				
9.	Compartaria mis ideas.	1	2	3
10.	Se usarian mis ideas durante la clase de ciencia.	1	2	3
11.	Otros ninos discutarian problemas de ciencia conmigo.	1	2	3
12.	Explicaria como resolver problemas.	1	2	3
Cooperacion				
13.	Ayudaria a otros ninos con el trabajo que le da el maestro.	1	2	3
14.	Trabajaria bien con otros ninos en un equipo.	1	2	3
15.	Compartiria mis susministros con otros estudiantes	1	2	3
16.	Aprenderia de otros ninos en mi clase de ciencia.	1	2	3
Equidad				
17.	El maestro me ayudaria de la misma manera en que el/ella ayuda a otros ninos.	1	2	3
18.	Seria tratado de la misma manera como otros estudiantes en mi clase de ciencia.	1	2	3
19.	Tendria las mismas oportunidades para participar como otros ninos.	1	2	3
20.	Al maestro le gustaria mi trabajo de la misma manera como el trabajo de los otros ninos.	1	2	3

Appendix E

What Is Happening In This Class? (WIHIC) Questionnaire – Parent Actual – English

NAME_____SCHOOL_____CLASS_____

What is Happening in this Science Class?

Parent Actual Form

Directions: Listen to each statement below and circle

1. If you **ALWAYS** agree
2. If you **NEVER** agree
3. If you **SOMETIMES** agree

Remember that you are describing your child's **ACTUAL** science classroom

Student Cohesiveness		Always	Never	Sometimes
1.	My child has friends in this class.	1	2	3
2.	My child is nice to other kids in this class.	1	2	3
3.	My child helps other kids in this class when they have trouble with their work.	1	2	3
4.	Other kids in this class help my child when he/she has trouble doing work.	1	2	3
Teacher Support				
5.	The teacher likes my child.	1	2	3
6.	The teacher helps my child when he/she has trouble doing work.	1	2	3
7.	The teacher talks to my child.	1	2	3
8.	The teacher's questions help my child understand.	1	2	3
Involvement				
9.	My child can share his/her ideas.	1	2	3
10.	My child's ideas are used during science class.	1	2	3
11.	Other kids discuss with my child how to work out science problems.	1	2	3
12.	My child explains how he/she works out problems.	1	2	3
Cooperation				
13.	My child helps other kids with the work the teacher gives them.	1	2	3
14.	Other kids and my child work together like a team.	1	2	3
15.	My child shares his/her supplies with other kids.	1	2	3
16.	My child learns from other kids in his/her science class.	1	2	3
Equity				
17.	The teacher helps my child the same way he/she helps other kids.	1	2	3
18.	My child is treated the same way as other students in his/her science class.	1	2	3
19.	My child gets the same chance to participate as other kids.	1	2	3
20.	The teacher likes my child's work the same way as the other kids' work.	1	2	3

Appendix F

What Is Happening In This Class? (WIHIC) Questionnaire – Parent Preferred – English

NAME_____SCHOOL_____CLASS_____

What Should be Happening in this Science Class?
Parent Preferred Form

Directions: Listen to each statement below and circle

1. If you **ALWAYS** agree
2. If you **NEVER** agree
3. If you **SOMETIMES** agree

Remember that you are describing your child's **MOST WANTED** science classroom

Student Cohesiveness		Always	Never	Sometimes
1.	My child would have friends in this class.	1	2	3
2.	My child would be nice to other kids in this class.	1	2	3
3.	My child would help other kids in this class when they have trouble with their work.	1	2	3
4.	Other kids in this class would help my child when he/she has trouble doing work.	1	2	3
Teacher Support				
5.	The teacher would like my child.	1	2	3
6.	The teacher would help my child when he/she has trouble doing work.	1	2	3
7.	The teacher would talk to my child.	1	2	3
8.	The teacher's questions would help my child understand.	1	2	3
Involvement				
9.	My child would share his/her ideas.	1	2	3
10.	My child's ideas would be used during science class.	1	2	3
11.	Other kids would discuss with my child how to work out science problems.	1	2	3
12.	My child would explain how he/she works out problems.	1	2	3
Cooperation				
13.	My child would help other kids with the work the teacher gives them.	1	2	3
14.	Other kids and my child would work together like a team.	1	2	3
15.	My child would share his/her supplies with other kids.	1	2	3
16.	My child would learn from other kids in his/her science class.	1	2	3
Equity				
17.	The teacher would help my child the same way he/she helps other kids.	1	2	3
18.	My child would be treated the same way as other students in his/her science class.	1	2	3
19.	My child would get the same chance to participate as other kids.	1	2	3
20.	The teacher would like my child's work the same way as the other kids' work.	1	2	3

Appendix G

What Is Happening In This Class? (WIHIC) Questionnaire – Parent Actual – Spanish

Nombre_____COLEGIO_____CLASE_____

Que esta pasando en esta clase de ciencia?
Forma Actual de Padre

Direcciones: Escucha a cada declaracion abajo y circule:

1. Si usted SIEMPRE esta de acuerdo
2. Si usted NUNCA esta de acuerdo
3. Si usted A VECES esta de acuerdo

Recuerde que usted esta describiendo la clase actual de ciencia para su hijo(a).

	Cohesivismo de Padre	**Siempre**	**Nunca**	**A Veces**
1.	Mi hijo(a) tiene amigos en esta clase.	1	2	3
2.	Mi hijo(a) es bueno(a) con los otros ninos en esta clase.	1	2	3
3.	Mi hijo(a) ayuda a otros ninos en esta clase cuando tienen dificultades con su trabajo.	1	2	3
4.	Otros ninos en esta clase ayudan a mi hijo(a)cuando tienen problemas con el trabajo.	1	2	3
Apoyo del Maestro				
5.	Mi hijo(a) le cae bien al maestro.	1	2	3
6.	El maestro ayuda a mi hijo(a) cuando tiene diffucultades con el trabajo.	1	2	3
7.	El maestro le habla con mi hijo(a).	1	2	3
8.	Las preguntas del maestro le ayudan a mi hijo(a) a aprender.	1	2	3
Participacion				
9.	Mi hijo(a) ccomparte sus ideas.	1	2	3
10.	Las ideas de mi hijo(a) se usan durante la clase de ciencia.	1	2	3
11.	Otros ninos discuten problemas de ciencia con mi hijo(a).	1	2	3
12.	Mi hijo(a) explica come resolver problemas.	1	2	3
Cooperacion				
13.	Mi hijo(a) ayuda a otros ninos con el trabajo que le da el maestro.	1	2	3
14.	Mi hijo(a) trabaja bien con otros ninos en un equipo.	1	2	3
15.	Mi hijo(a) comparte susministros con otros estudiantes.	1	2	3
16.	Mi hijo(a) aprende de otros ninos en su clase de ciencia.	1	2	3
Equidad				
17.	El maestro ayuda a mi hijo(a) de la misma manera en que el/ella ayuda a otros ninos.	1	2	3
18.	Mi hijo(a) es tratado(a) de la misma manera como otros estudiantes en su clase de ciencia.	1	2	3
19.	Mi hijo(a) tiene las mismas oportunidades para participar como otros ninos.	1	2	3
20.	Al maestro le gusta el trabajo de mi hijo(a) de la misma manera como el trabajo de los otros ninos.	1	2	3

Appendix H

What Is Happening In This Class? (WIHIC) Questionnaire – Parent Preferred – Spanish

Nombre_____COLEGIO_____CLASE_____

Que esta pasando en esta clase de ciencia?
Forma Preferida de Padre

Direcciones: Escucha a cada declaracion abajo y circule:

1. Si usted SIEMPRE esta de acuerdo
2. Si usted NUNCA esta de acuerdo
3. Si usted A VECES esta de acuerdo

Recuerde que usted esta describiendo su mas preferida clase de ciencia para su hijo(a).

Cohesivismo de Padre		**Siempre**	Nunca	A Veces
1.	Mi hijo(a) tendria amigos en esta clase.	1	2	3
2.	Mi hijo(a) seria bueno(a) con los otros ninos en esta clase.	1	2	3
3.	Mi hijo(a) ayudaria a otros ninos en esta clase cuando tienen dificultades con su trabajo.	1	2	3
4.	Otros ninos en esta clase ayudarian a mi hijo(a)cuando tienen problemas con el trabajo.	1	2	3
Apoyo del Maestro				
5.	Mi hijo(a) le caeria bien al maestro.	1	2	3
6.	El maestro ayudaria a mi hijo(a) cuando tiene diffucultades con el trabajo.	1	2	3
7.	El maestro le hablaria a mi hijo(a).	1	2	3
8.	Las preguntas del maestro le ayudarian a mi hijo(a) a aprender.	1	2	3
Participacion				
9.	Mi hijo(a) ccompartiria sus ideas.	1	2	3
10.	Las ideas de mi hijo(a) se usarian durante la clase de ciencia.	1	2	3
11.	Otros ninos discutarian problemas de ciencia con mi hijo(a).	1	2	3
12.	Mi hijo(a) explicaria come resolver problemas.	1	2	3
Cooperacion				
13.	Mi hijo(a) ayudaria a otros ninos con el trabajo que le da el maestro.	1	2	3
14.	Mi hijo(a) trabajaria bien con otros ninos en un equipo.	1	2	3
15.	Mi hijo(a) compartiria susministros con otros estudiantes.	1	2	3
16.	Mi hijo(a) aprenderia de otros ninos en su clase de ciencia.	1	2	3
Equidad				
17.	El maestro ayudaria a mi hijo(a) de la misma manera en que el/ella ayuda a otros ninos.	1	2	3
18.	Mi hijo(a) seria tratado(a) de la misma manera como otros estudiantes en su clase de ciencia.	1	2	3
19.	Mi hijo(a) tendria las mismas oportunidades para participar como otros ninos.	1	2	3
20.	Al maestro le gustaria el trabajo de mi hijo(a) de la misma manera como el trabajo de los otros ninos.	1	2	3

Appendix I

Test of Science-Related Attitudes – Student – English

STUDENT'S
NAME_____ SCHOOL _____ CLASS_____

TEST OF SCIENCE-RELATED ATTITUDES

DIRECTIONS: This test contains a number of statements about science. You will be asked to think about these statements. There are no 'right' or 'wrong' answers. Your opinion is what is wanted.

For each statement, draw a circle around:

SA	If you STRONGLY AGREE with the statement;
A	If you AGREE with the statement;
N	If you are NOT SURE;
D	If you DISAGREE with the statement;
SD	If you STRONGLY DISAGREE with the statement.

Attitude to Scientific Inquiry	**Strongly Agree**	**Agree**	**Not Sure**	**Disagree**	**Strongly Disagree**
1.I would prefer to find out why something happens by doing the experiment rather than by being told.	SA	A	NS	D	SD
2.Doing experiments is not as good as finding out information from teachers.	SA	A	NS	D	SD
3.I would prefer to do experiments than to read about them.	SA	A	NS	D	SD
4.I would rather agree with other people than to do an experiment to find out for myself.	SA	A	NS	D	SD
5.I would prefer to do my own experiments than to find out information from a teacher.	SA	A	NS	D	SD
6.I would rather find out about things by asking an expert than by doing an experiment.	SA	A	NS	D	SD
7.I would rather solve a problem by doing an experiment than to be told the answer.	SA	A	NS	D	SD
8 It is better to ask the teacher the answer than to find it out by doing experiments.	SA	A	NS	D	SD

Adoption of Scientific Attitudes	**Strongly Agree**	**Agree**	**Not Sure**	**Disagree**	**Strongly Disagree**
9. I enjoy reading about things which disagree with my first ideas.	SA	A	NS	D	SD
10 .I dislike repeating experiments to check that I get the same results.	SA	A	NS	D	SD
11. I am curious about the world in which we live.	SA	A	NS	D	SD
12. Finding out about new things is unimportant.	SA	A	NS	D	SD

	Strongly Disagree	Agree	Not	Disagree Agree	Strongly Sure
13. I like to listen to people whose opinions are different from mine.	SA	A	NS	D	SD
14.I find it boring to hear about new ideas.	SA	A	NS	D	SD
15.In science experiments, I like to use new methods which I have not used before.	SA	A	NS	D	SD
16.I am willing to change my ideas when evidence shows that the ideas are poor.	SA	A	NS	D	SD

Enjoyment of Science Lessons	**Strongly Agree**	**Agree**	**Not Sure**	**Disagree**	**Strongly Disagree**
17. Science lessons are fun.	SA	A	NS	D	SD
18. I dislike science lessons.	SA	A	NS	D	SD
19. School should have more science lessons each week.	SA	A	NS	D	SD
20. Science lessons bore me.	SA	A	NS	D	SD
21. Science is one of the most interesting school subjects.	SA	A	NS	D	SD
22. Science lessons are a waste of time.	SA	A	NS	D	SD
23. I really enjoy going to science lessons.	SA	A	NS	D	SD
24. The material covered in science lessons is uninteresting.	SA	A	NS	D	SD

Appendix J

Test of Science-Related Attitudes – Student – Spanish

NOMBRE DEL
ALUMNO_____ ESCUELA _____ CLASE_____

PRUEBA DE ACTITUDES RELACIONADAS A CIENCIA

DIRECCIONES: Esta prueba contiene varia declaraciones sobre la ciencia. Se pederia que piense sobre estas declaraciones. No habra respuestas correctas o incorrectas. Tu opinion es lo que queremos.

Por cada declaracion encierra con un circulo alrededor de:

FA Si esta FUERTEMENTE DE ACUERDO con la declaracion;
A Si esta de ACUERDO con la declaracion;
NS Si NO ESTAS SEGURO;
D Si estas en DESACUERDO con la declaracion;
FD Si estas FUERTEMENTE EN DESACUERDO con la declaracion.

Actitud a la Encuesta Cientifica	**Fuertemente De Acuerdo**	**Acuerdo**	**No Estas Seguro**	**Desacuerdo**	**Fuertemente En Desacuerdo**
1.Preferiria descubrir el porque algo pasa al hacer el experimento en lugar de que te lo digan.	FA	A	NS	D	FD
2.Haciendo experimentos no es tan bueno como enterarse de la informacion por los maestros.	FA	A	NS	D	FD
3.Preferiria hacer experimentos que leer sobre ellos.	FA	A	NS	D	FD
4.Preferiria estar de acuerdo con otras personas en vez de hacer un experimento para descubrirlo por mi mismo.	FA	A	NS	D	FD
5.Preferiria hacer mis propios experimentos que enterarme de la informacion por un maestro.	FA	A	NS	D	FD
6.Preferiria enterarme sobre las cosas preguntandole a un experto que hacer un experimento.	FA	A	NS	D	FD
7.Preferiria resolver un problema haciendo un experimento que ser informado de la respuesta.	FA	A	NS	D	FD
8 Es major preguntarle al maestro por la respuesta que encontrarlo haciendo experimentos.	FA	A	NS	D	FD

Adopcion a las Actitudes Cientificas	**Fuertemente De Acuerdo**	**Acuerdo**	**No Estas Seguro**	**Desacuerdo**	**Fuertemente En Desacuerdo**
9. Disfruto leer sobre las cosas que estan en desacuerdo con mis primeras ideas.	FA	A	NS	D	FD
10 .No me gusta repetir los experimentos par verificar que llege a los mismos resultados.	FA	A	NS	D	FD
11. Estoy curioso sobre el mundo en el que vivimos.	FA	A	NS	D	FD
12.Descubrir cosas nuevas no es importante.	FA	A	NS	D	FD
13. Me gusta escuchar a las palabras cuyas opinions son diferente a las mias.	FA	A	NS	D	FD

	Fuertemente De Acuerdo	Acuerdo	No Estas Seguro	Desacuerdo	Fuertemente En Desacuerdo
14.Encuentro aburrido el oir sobre ideas nuevas.	FA	A	NS	D	FD
15.En los experimentos de ciencia, me gusta usar metodosnuevos que no he usado antes.	FA	A	NS	D	FD
16.Estoy dispuesto a cambiar mis ideas cuando la evidencia mustra que las ideas son pobres.	FA	A	NS	D	FD

El Placer de las Lecciones de Ciencia	Fuertemente De Acuerdo	Acuerdo	No Estas Seguro	Desacuerdo	Fuertemente En Desacuerdo
17. Las lecciones de ciencia son divertidas.	FA	A	NS	D	FD
18. Detesto las leccioines de ciencia.	FA	A	NS	D	FD
19. La escuela debe tener mas lecciones de ciencia cada semana.	FA	A	NS	D	FD
20. Las lecciones de ciencia me aburren.	FA	A	NS	D	FD
20. Ciencia es una de las asignatura mas interesante en la escueal.	FA	A	NS	D	FD
22. Lecciones de ciencia son una perdida de tiempo.	FA	A	NS	D	FD
23. Disfruto ir a las lecciones de ciencia.	FA	A	NS	D	FD
24. El material cubierto en las lecciones de ciencia no es interesante.	FA	A	NS	D	FD