PROMOTING SCIENCE AMONG ENGLISH LANGUAGE LEARNERS (P-SELL) IN A HIGH-STAKES TESTING POLICY CONTEXT

Motivated by the looming crisis of a high-stakes testing policy environment in science starting nationally in 2007 under the *No Child Left Behind Act* and in Florida's 2004 high-stakes testing of science; by ongoing concerns about the low science achievement among English language learning (ELL) students in the nation, Florida, and the Miami-Dade County Public Schools (M-DCPS); and by our prior work that has demonstrated science achievement gains through professional development efforts in a more limited testing environment (e.g., Okhee Lee, PI, Grant No. REC-0089231; Constance Thornton, Co-PI, Grant No. USP-0084898), the University of Miami (Lee, PI, and Secada, Co-PI) and M-DCPS (Thornton, Co-PI) have joined to craft a new initiative for elementary school teachers across their careers, *Promoting Science among English Language Learners* (P-SELL). We will examine and improve elementary school teachers' conceptions and practices in teaching science to ELL students within an environment increasingly driven by high-stakes testing in science. The four major research and development areas are: (1) teachers' conceptions and practices at the starting point, (2) randomized study of professional development for preservice through practicing teachers, (3) policy contexts, and (4) change over time in teachers and ELL students. The results will fill gaps in the research literature and help districts adapt and use our professional development program, so that their teachers can better teach science to ELL students in the forthcoming high-stakes testing environment.

Rationale and Related Research

After almost a decade of high-stakes testing in mathematics, reading, and language arts, policy is now shifting to incorporate science and social studies. Florida, for example, is pilot testing its high-stakes science test during 2002-03 and 2003-04 before the scores affect school accountability in 2004-05.

Policy makers and some analysts promote high-stakes testing as one way of reaching what has historically been a dual challenge for schools: high achievement in the academic areas and educational equity for this nation's increasingly diverse student population (Darling Hammond, 1996; McLaughlin, Shepard, & O'Day, 1995; Orfield & Kornhaber, 2001). The inclusion of all students in such tests, as required by the *No Child Left Behind Act*, ensures that all students have at least nominal opportunities to encounter the same content so that they can pass these tests.

Science educators have watched, with mounting concern, how earlier policies involving high-stakes testing (in mathematics, especially) were implemented and how educators reacted to them. We have observed the resistance to testing by many parents, students, teachers, and other educators (Barksdale-Ladd & Thomas, 2000; McNeil, 2000). We have read reports of schools shifting their curricular focus to teaching to the test, thereby gutting student exposure to non-tested academic content and sacrificing reasoning and higher-order thinking for rote memorization (Calkins, Montgomery, & Santman, 1998; Gordon & Reese, 1997; Kohn, 2000; Passman, 2001; Wideen, 1997). But, not all the reported impacts of high-stakes testing have been negative. In writing, for example, the introduction of high-stakes testing led to its being taught with resulting achievement gains; in science, which is seldom taught in elementary school, there are strong reasons to believe that the introduction of high-stakes testing will have similar outcomes. Furthermore, high-stakes testing has been used by some schools as an impetus toward a curriculum that focuses on important content, where teachers work together to cover similar content during the school year and collaborate across grades to ensure better content coverage throughout students' academic careers, and where professional development has been used to help teachers keep their focus (Borko & Elliot 1999; Bridge, Compton-Hall & Cantrell, 1997; Jones & Johnston, 2002; Porter, Chester, & Schlesinger, in press).

Considerations such as these raise a host of important research questions at the intersection of high-stakes testing and the teaching and learning of science for ELL students. These questions entail policy considerations and issues of professional development, teaching practices, and student achievement. In discussing relevant research, we deliberately focus on the literature that addresses science education with minority students, specifically ELL students, and briefly mention key studies in the general literature.

Research area 1: Teachers' conceptions and practices at the starting point.
Question: What conceptions and practices do elementary school teachers, across their careers from preservice through expert, possess for teaching science (a) to ELL students and (b) in the context of newly evolving high-stakes testing environments?
(Key personnel: Lead – Lee, Carlo, Cuevas; Support – Buxton, Clachar)

By teachers' conceptions we mean the combination of teacher knowledge (of science, how to teach science and/or ELL students, student reasoning) and beliefs (about testing, expectations of ELL students, what it means to know science, the curriculum) that support their classroom practices.

Effective instructional practices in science for ELL students. With ELL students, English language and literacy development is integral to subject area instruction (August & Hakuta, 1997; Chamot & O'Malley, 1994; Lee & Fradd, 1998). ELL students frequently confront the demands of academic learning through a yet unmastered language. Content area instruction provides a meaningful context for English language and literacy, while language processes provide the medium for understanding academic content (Casteel & Isom, 1994; Lee & Fradd, 1996; Stoddart, Pinal, Latzke, & Canaday, 2002).

Hands-on and inquiry-based science provides opportunities for students to develop scientific understanding, engage in inquiry, and construct shared meanings more actively than traditional textbook-based instruction, for a number of reasons: (a) hands-on activities are less dependent on formal mastery of the language of instruction and, thus, reduce the linguistic burden on ELL students; (b) collaborative, small-group work provides structured opportunities for developing English proficiency in the context of authentic communication about science knowledge, and (c) hands-on activities exploring natural phenomena make science concepts more accessible to students with limited science experience than do approaches based on decontextualized textbook knowledge (Lee, 2002; Rosebery, Warren, & Conant, 1992).

By engaging in science inquiry, ELL students acquire English language and literacy and learn mathematics. That is, students develop English grammar and vocabulary, as well as familiarity with scientific genres of writing (Lee, Deaktor, et al., under review; Schleppegrell & Achugar, 2003). Furthermore, science inquiry bridges authentic, communicative language activities and hands-on, contextualized exploration of natural phenomena, while promoting students' communication of their understanding in a variety of formats, including written, oral, gestural, and graphic (Baker & Saul, 1994; Casteel & Isom, 1994). As part of science instruction, ELL students also learn mathematics as they measure properties of objects and events (e.g., weight, length, and speed), use statistics and probability concepts for data analysis and interpretation, and learn how to record and present data in multiple formats. Thus, students become precise and accurate in taking measurements, applying mathematical concepts, identifying patterns and anomalies in data, using multiple representational formats for data displays, and reasoning quantitatively.

Professional development for effective instruction. Elementary school teachers are expected to teach all subjects, while develop their ELL students' English language and literacy skills. Many—some would say, most—elementary school teachers have difficulty teaching ELL students conventionally, let alone teaching new content or adopting reform-oriented practices (National Center for Education Statistics, 1999; Tikunoff, 1983). Even teachers who incorporate reform activities in their instruction negotiate the potentially competing agendas of reform-oriented practices and accountability demands (Cohen & Hill, 2000; Knapp, 1997; Lee & Luykx, under review), so that what is measured in high-stakes assessments strongly influences what school personnel teach (Secada & Lee, under review).

Rosebery and Warren's work with elementary and middle school teachers of ELL students provides powerful examples of teachers developing their own knowledge of science through scientific inquiry, and other social and private processes that are remarkably similar to those that scientists engage in (Rosebery &

Puttick, 1998; Warren & Ogonowski, 1998). However, only their early work provides direct evidence of how these teachers start to engage in the kinds of scientific inquiry that lie at the core of science (Rosebery, Warren, & Conant, 1992; Warren, Rosebery, & Conant, 1989). To date, their work has not included evidence that engaging in these scientific processes translates into students' higher achievement on standardized tests. To be fair to Warren and Rosebery, standardized tests of science do not accurately measure what they study, that is, student reasoning as revealed by careful analyses of classroom discourse. But in a policy climate in which high-stakes tests dominate the teaching landscape, it is important for *some* research, such as what we propose, to include standardized achievement in its portfolio of outcome measures.

There is a dearth of research on teacher beliefs involving ELL students' learning of science and on teacher practices in a high-stakes science testing environment. In their study contrasting elementary teachers in highly effective versus typical schools in mathematics and science, Secada and Lee (under review) found that teachers in highly effective schools tended to state that they valued their students' informal strategies for doing science, looked for and found potential to do science in their low-achieving students, and/or relied on their similar ethnic backgrounds to encourage students to engage in classroom tasks. They also reported relying on the state or district curriculum to determine content coverage more than teachers in typical schools. Research needs to do a better job of explicating the broad contours of teachers' conceptions and practices, how they *interact* with one another, and how they are affected by external social forces.

Research area 2: Professional development intervention.

Question: What components of our professional development intervention are critical for improving teachers' conceptions and practices, so that they make better use of their already existing competencies?
(Key personnel: Lead – Lee, Secada, Thornton; Support - Buxton, Faber, Carlo, Clachar, Cuevas, Schumm)

From the American and cross-national literatures on expert teaching, we know that teacher growth is not accidental (Richardson & Placier, 2001). Rather, it has to be planned purposefully and takes place in a social setting with other, more expert peers (Garet, Porter, Desimone, Birman, & Yoon, 2001; Good & Brophy, 1986; Hiebert, Gallimore, & Stigler, 2002; Hiebert & Stigler, 2000; Lewis & Tsuchida, 1997). This finding seems to be true across the teachers' career paths, from preservice through expert status.

Opportunities for professional growth to address teaching science to ELL students are necessary, but demanding. The literature indicates some difficulties involved in implementing initiatives that integrate subject area instruction with English language and literacy. Many teachers assume that ELL students must acquire English before learning subject matter, are unaware of linguistic influences on student learning, do not consider "teaching for diversity" as their responsibility, or purposefully overlook linguistic differences and accept inequities as a given condition (August & Hakuta, 1997; Bryan & Atwater, 2002; Cochran-Smith, 1995; García, 1999; Luykx, Cuevas, Lambert, & Lee, in press). In science education, recent initiatives help teachers of ELL students promote content learning and English proficiency simultaneously through the development of instructional materials (Fradd, Lee, Sutman, & Saxton, 2002) and implementation of professional development activities (Amaral, Garrison, & Klentschy, 2002; Hampton & Rodriguez, 2001; Lee & Fradd, in press; Merino & Hammond, 2001; Stoddart et al., 2002).

Based on this emerging literature, we will develop and implement a professional development intervention with preservice through expert elementary school teachers on how they teach science to ELL students (see pp. 9-10 for description about the intervention). To provide effective science instruction, teachers need opportunities to develop their own deep and complex understandings of science concepts, recognize how students' misconceptions cause learning difficulties (Kennedy, 1998; Loucks-Horsley, Hewson, Love, & Stiles, 1998), engage in science inquiry themselves to be able to foster student initiative in inquiry (National Research Council, 2000), and learn how to enable students to share and negotiate ideas and construct collective meanings about science (Lemke, 1990).

In addition to ensuring that ELL students acquire the necessary communicative language functions used for social communication, teachers must also create classroom conditions that promote ELL students' development of general and content-specific academic language functions, such as describing, explaining, comparing, and concluding (O'Malley & Valdez Pierce, 1996; Wong-Fillmore & Snow, 2002). Additionally, they must be able to view language within a human development perspective. Such an understanding enables them to formulate developmentally appropriate expectations about language comprehension and production over the course of students' learning of English. Finally, teachers need to be able to apply this knowledge to the teaching of general and content-specific academic language. The amalgamation of these three knowledge sources should result in teaching practices that engage students of all levels of English proficiency in academic language learning; that engage students in learning activities that have multiple points of entry for students of differing levels of English proficiency; that provide multiple modes for students to display learning; and that ensure that students participate in a manner allowing for maximum language development at their own level.

Research area 3: Policy contexts.

Our work on context focuses on the elementary school as a social setting in which teachers work, learn, and teach science and on the larger policy context involving district, state, and federal mandates and initiatives that intersect at science education, the education of ELL students, and high-stakes testing in science.

Question 3a: How do the school-level contexts within which teachers work support and/or constrain the development of their teaching of science to ELL students?
(Key personnel: Lead – Secada, Eitle; Support - Schumm)

In schools that maintained a strong academic press for student achievement and provided students with strong supportive learning environments, student achievement in mathematics and reading increased relative to schools that lacked either or both (Bryk, Camburn, & Seashore Louis, 1999; Bryk, Sebring, et al., 1998; Newmann & Associates, 1996), and social class-based achievement gaps in mathematics and science narrowed (V. Lee & Smith, 2001). In these schools, teachers have strong professional communities that focus on the quality of the content of instruction (see also the cross-national studies of mathematics and science by Hiebert, Gallimore, & Stigler, 2002; Hiebert & Stigler, 2000; Lewis & Tsuchida, 1997; Ma, 1999). Studies involving schools that enroll large numbers of ELL students (Garcia & Lee, in press; Thomas & Collier, 1995) have had similar findings, and mention purposeful language development as a key feature of the school's instructional program, although science is seldom the focus in the literature.

In their review of the school organizational literature on achievement in mathematics and science, Gamoran, Secada, and Marrett (2000) argued that, as schools shift their instructional focus from conventional to newer curricula or to reform practices, externally imposed mandates that demand immediate action derail the slow process of building a professional community of teachers. Reports on how high-stakes testing has been implemented in mathematics bear a similarity to the conditions discussed by Gamoran et al.

In a study of how schools and districts might support teaching for understanding in mathematics and science, Gamoran and associates argued that successful efforts entail the strategic use of human, intellectual, social, and financial resources to support change and to help teachers who would otherwise resist change (Gamoran, Anderson, et al., 2003). Challenges to such strategic use of resources are stronger in inner-city schools, where many ELL students reside (Hewson, Kahle, Scantlebury, & Davies, 2001; Settlage & Meadows, 2002; Spillane, Diamond, Walker, Halverson, & Jita, 2001). Since resources and funding tend to be limited in inner-city schools, provision of instructional supplies is critical to support teacher growth and classroom practices. Elementary-aged ELL students attending these schools need hands-on and inquiry-based science instruction, which requires supplies.

School-wide efforts involving all teachers present both advantages and limitations. On the one hand, teachers from the same school or grade level who participate in professional development activities can develop common goals, share instructional materials, and exchange ideas and experiences arising from a common context (Garet et al., 2001; Kennedy, 1998). On the other hand, school-wide implementation inevitably includes teachers who are not interested in or even resist participation, unlike programs comprised of volunteer teachers seeking opportunities for professional growth (Blumenfeld, Fishman, Krajcik, & Marx, 2000; Fishman et al., in press; Lee & Luykx, under review; Supovitz & Zeif, 2000).

Our research examines the likelihood of multiple scenarios taking place, with the resources or supportive structures necessary for the professional development intervention in teaching ELL students science along with mathematics and literacy at inner-city schools. Since the research involves all teachers from grades 3 through 5 in the participating schools, rather than a self-selected group of volunteer teachers, the results have implications for further large-scale implementation (i.e., scaling up) of the intervention with non-volunteer teachers at inner-city schools.

Question 3b: How do the policy environments (e.g., classrooms are nested in their schools; schools, in their district; and the M-DCPS, within the policy context of the state of Florida) support or constrain teachers promoting student understanding of science?
(Key personnel: Lead – Eitle, Secada; Support - Bessell, Lee, Thornton)

Policy is not written on a blank slate. It is interpreted at each level of its implementation so that, sometimes, policies get implemented in ways that are directly opposite the intents of the original policy makers. Research on the impact of testing on how teachers teach is consistent in showing that teachers report changing their instructional methods in response to high-stakes testing (Barksdale-Ladd & Thomas, 2000; Jones & Johnston, 2002; Yarbrough, 1999). However, the research is mixed regarding whether these changes has a positive (Borko & Elliot 1999; Bridge et al., 1997; Jones & Johnston, 2002; Porter et al., in press) or negative effect (Calkins et al., 1998; Gordon & Reese, 1997; Kohn, 2000; Passman, 2001; Wideen et al., 1997) on teaching quality and student achievement. Few studies have focused on science teaching; Wideen et al., 1997, is the exception.

Florida mandates high-stakes assessments (Florida Comprehensive Assessment Test, FCAT) in reading and mathematics from grades 3 through 5 and in writing at grade 4 at the elementary school level. Beginning the 2004-05 school year, science will be added to the above three subjects in creating a formula that assigns a school grade ranging from A to F, according to the “Florida A+ Plan.” Schools graded F are given two years of probation under the looming threat of state takeover and provision of student vouchers while the school is reorganized by the state. During the 2002-03 school year, over 90% of 336 M-DCPS schools failed to meet the standards under the *No Child Left Behind Act*. Starting in 2002-03, third-graders were retained based on FCAT reading scores; retention rates are over 50% at many of the inner-city schools in Miami-Dade, especially those enrolling large numbers of ELL students. Equity in the accountability of schools and individual students has become a political battle in the state.

With the state’s English-only policy, ELL students are offered limited opportunity for instruction in their home languages in subject areas such as science. Currently, ELL students are held accountable for school and individual performance on state-wide assessments two years after their school enrollment. The state hopes that by the 2004-05 school year, science instruction will be made available to ELL students. Schools are expected to make various kinds of structural changes and modifications to meet student needs.

We will study the Florida and M-DCPS policy environments for how supportive they are of our intervention. Our analytic framework follows Porter (1988, also used by Clune and Desimone) with its five dimensions: specificity, consistency/alignment, authority, power, and stability. Policy environments will be supportive of the intervention to the extent that (a) they are specific in calling for what the professional development is trying to accomplish, (b) the various policy levers in the environment are consistent with one another in reinforcing those goals, (c) they have authority in a Weber sense, (d) they have power (i.e., rewards and sanctions attached to them), and (e) they are stable over time.

Research area 4: Change over time in teachers and ELL students.

Question 4a: How do elementary school teachers' conceptions and practices involving school science, their ELL students as learners of science (in relation to their home language, culture, and SES), science teaching, assessment, and high-stakes testing change over time?
(Key personnel: Lead – Swaminathan, Bessell; Support – Lee, Secada, and the rest)

The goal of professional development efforts is to help preservice and practicing teachers to become expert teachers. There is an old literature—dating back to the 1970s—that contrasts how beginning (novice) teachers differ from their more experienced (expert) peers. Usually, expert teachers have a wide repertoire of knowledge, routines, and strategies that they can call on when teaching. Their knowledge of teaching is better organized, more elaborated, and more flexible, compared to that of beginning teachers (Ball, 1990; Comiti & Ball, 1996; Carpenter et al., 1996, 1999; Fennema et al., 1996; Ma, 1999).

Effecting changes in teachers' conceptions and practices in subject area instruction is a demanding and arduous process (Richardson & Placier, 2001). Through extensive professional development opportunities, many teachers have learned to reflect on their own practices, assess the impact of these practices on student learning, and generate and sustain new ideas for effective practices (Franke, Carpenter, Levi, & Fennema, 2001; Wilson & Berne, 1999). Most teachers, however, have limited opportunities for professional development due largely to limited funding and resources (Elmore, 1996; Garet et al., 2001). Without professional development or when working alone, teachers often blend a repertoire of standards-based practices with existing traditional practices (Cohen & Hill, 2000; Knapp, 1997).

An emerging body of science education literature indicates that professional development helps teachers enhance their conceptions and practices in integrating science with literacy for ELL students (Hampton & Rodriguez, 2001; Stoddart et al., 2002). In prior NSF-funded research, Lee and her colleagues (Hart & Lee, in press; Lee & Fradd, in press; Luykx et al., in press) found that elementary teachers emphasized literacy as part of science instruction with ELL students at the beginning of a professional development effort. The longer teachers participated in this effort, the more strongly they emphasized the importance of literacy, the more enhanced their knowledge of both science and literacy instruction, and the more effectively they provided language-based scaffolding in their classrooms.

Question 4b: How do ELL students' conceptions of and achievement in science change over time? How do ELL students' evolving fluency in English and use of mathematics support science learning?
(Key personnel: Lead – Swaminathan, Bessell; Support – Lee, Secada, and the rest)

Students learn science in a complex setting that includes (a) the science curriculum and its task demands, (b) the teacher, his/her instruction, and what (s)he demands of student work, and (c) interactions among students that involve scientific activities such as evidence-based arguments and justifications, and hypothesis generating and testing (Lehrer, Carpenter, Schauble, & Putz, 2000; Lehrer & Schauble, in press; Lehrer, Schauble, & Petrosino, in press; Metz, 2000; Warren & Rosebery, 1995; Warren et al., 2001). There is ample evidence, dating back to the development of *Finding Out/Desubrimiento* (Cohen, 1991; DeAvila, Duncan, & Navarette, 1987a, 1987b) that ELL students can engage in scientific sense making, learn important science, and score well on science achievement tests (Fradd et al., 2002; Rosebery, Warren, & Conant, 1992; Warren & Rosebery, 1995). Recent curriculum development and teacher professional development studies that integrated science learning with English language and literacy learning for ELL students show promise for improved achievement (Amaral, Garrison, & Klentschy, 2002; Fradd et al., 2002; Hampton & Rodriguez, 2001). Lee, Deaktor, et al. (under review) report that achievement in science and literacy improved for all students after their professional development intervention, and the achievement gaps among demographic subgroups narrowed on several measures of science and literacy. The research on ELL students' learning of science has been implemented outside of state approved (or mandated) curricula.

Teachers and other educators who will be under the pressure of high-stakes testing are more likely to question, if not reject outright, claims that students can learn and achieve well while engaging in tasks similar to those found in the research.

The science standards documents (AAAS, 1989, 1993; NRC, 1996) focus on (a) *understanding* of science concepts and "big ideas" (patterns of change, systems, models, and relationships) to explain natural phenomena; (b) *inquiry* as students ask appropriate questions, design and implement investigations, draw valid conclusions, and report findings; and (c) *discourse* as students develop theories, make arguments based on evidence, and communicate scientific ideas using oral, written, and graphic forms of representation (see Lee & Paik, 2000; Raizen, 1998). The advent of high-stakes testing in science will provide the state's mandated operationalization of these goals through the science content and inquiry practices that are found on the tests. Earlier work on the nature and development of ELL students' learning of science will need to be validated against these new curricula.

Since science for ELL students also involve English language arts and mathematics, we refer to the standards documents promulgated by the professional organizations in these fields. The International Reading Association [IRA], the National Council of Teachers of English [NCTE] (1994) and Teachers of English to Speakers of Other Languages [TESOL] (1997) refer to academic language functions such as formulating hypotheses, collecting and interpreting data, and communicating results (Casteel & Isom, 1994; Lee & Fradd, 1998). Science also employs non-technical terms that have meanings unique to scientific contexts (e.g., matter, force, energy, space). In mathematics, the Mathematical Sciences Education Board (Steen, 1989), National Council of Teachers of Mathematics, 1989, 1991, 2000), and National Research Council (1989) recommend practices that can be found in various NSF-funded elementary and middle-school mathematics curricula (e.g., *Mathematics in Context*, *Investigations*) and the corpus of research reported by DeAvila, Lee and Fradd, and Rosebery and Warren.

We are not arguing that all of elementary school science should be integrated with other subject areas, since there are well known problems with constructing curriculum in such a manner. Instead, we note that both language and mathematics provide support for and, in their own turn, are developed by ELL students who engage in the kinds of scientific tasks recommended by the various reform documents (AAAS, 1989, 1993; NRC, 1996). A goal of our research is to document and better understand how this phenomenon of mutually supportive knowledge development among these subjects takes place.

Design

Research Sites and Participants

In M-DCPS, the ethnic makeup of the 370,000 students in the district during the 2002-03 school year was 57% Hispanic, 30% black (including 7.4% Haitian according to the district data on students' home language), 11% white non-Hispanic, and 2% Asian and Native American students. District-wide, 70% of elementary students were in free or reduced lunch programs, and 25% were designated limited English proficient. We work closely with the M-DCPS district administrators in science, mathematics, and bilingual/ESOL education (see the letter of support from Mercedes Toural, M-DCPS Deputy Superintendent). District administrators will ensure that the research activities are aligned with state and district policies, which will increase the buy-in of the participating schools and teachers.

All the 12 schools in the research will enroll large numbers of ELL students, 6 containing predominantly Spanish-speaking and 6 containing predominantly Haitian-Creole speaking students (in addition to large numbers of African American students) in inner-city schools. We do not expect difficulties recruiting schools in the research, because (a) statewide science assessments will count toward accountability, and schools will be searching for resources and opportunities for improving science instruction; (b) the M-DCPS will play a key role in the research; (c) students' assessment results can be used by participating schools for their school improvement plans; and (d) the research team members have close working relationships with the school district offices and various schools (e.g., Okhee Lee, PI, regularly receives requests from elementary schools about how to participate in her ongoing research).

For our school-wide initiative, we will ask every third- through fifth-grade teacher in each school to participate in the research. At each grade level, the research will involve approximately 35 teachers (4 or 5 teachers per grade level from 8 schools) in the experimental group and approximately 18 teachers (from 4 schools) in the comparison group. From all three grade levels, the research will involve over 100 teachers total in the experimental group and over 50 teachers total in the comparison group. We focus on elementary students at grades 3 through 5, considering that at these grade levels, literacy becomes an important means of learning academic content beyond simply learning to read and write (Ruddell & Ruddell, 1994), while academic learning also becomes more cognitively demanding (NCTM, 2000; NRC, 1996). Additionally, in Florida, the FCAT reading test is used for high stakes to retain students who fail.

The research will also involve all preservice elementary teachers (over 200) at the University of Miami (UM) School of Education in multiple cohorts during the study. The UM is committed to teacher preparation programs (see the letter of support from Luis Glaser, the UM Provost). Jeanne Schumm, a project member, is chair of the UM Department of Teaching and Learning and Co-PI for a comprehensive 5-year Teacher Quality Enhancement project funded by the U.S. ED.

Research Design

In designing this study, we are chastened by the *Success for All* evaluation in which an initial $30,000 incentive per school had to be increased to $70,000 to recruit 60 schools into the randomized field study (Slavin, 2002, pp. 17-18). Our design involves 12 schools, reflecting tradeoffs among costs, statistical power and sample size, the depth to which non-evaluation research questions can be pursued, and assuring the quality of professional development and classroom implementation—all within the constraints of a limited budget.

Four of the six schools in each language group will be randomly assigned to the experimental group; the other two schools will be assigned to the comparison group. In the experimental group, each cohort of third- through fifth-grade teachers will participate in the professional development intervention for three years and one year follow-up without the intervention to test sustainability. In the comparison group, each cohort of teachers will receive financial support to purchase science supplies during the first two years. After serving two years in the comparison group, each cohort of teachers will receive the intervention to test replicability. Providing the intervention for the comparison group, in addition to being ethical, will enhance the interest of the participating schools and teachers to commit themselves to this multi-year project (see Table 1).

Table 1. Practicing Teacher Participation

	Year 1	Year 2	Year 3	Year 4	Year 5
Teachers in the Experimental Schools					
Grade 3	T. Cohort 1 Intervention Y1	T. Cohort 1 Intervention Y2	T. Cohort 1 Intervention Y3	T. Cohort 1 Follow-up	
Grade 4		T. Cohort 2 Intervention Y1	T. Cohort 2 Intervention Y2	T. Cohort 2 Intervention Y3	T. Cohort 2 Follow-up
Grade 5			T. Cohort 3 Intervention Y1	T. Cohort 3 Intervention Y2	T. Cohort 3 Intervention Y3
Teachers in the Comparison Schools					
Grade 3	T. Cohort 1 Comparison Y1	T. Cohort 1 Comparison Y2	T. Cohort 1 Intervention Y1	T. Cohort 1 Intervention Y2	
Grade 4		T. Cohort 2 Comparison Y1	T. Cohort 2 Comparison Y2	T. Cohort 2 Intervention Y1	T. Cohort 2 Intervention Y2
Grade 5			T. Cohort 3 Comparison Y1	T. Cohort 3 Comparison Y2	T. Cohort 3 Intervention Y1

Preservice teachers will be randomly assigned to one of the 12 schools participating in the study. During their programs, it is very likely that they will be exposed to both treatment conditions, either by talking to one another during their classes or by changing teachers and schools. Year 1 results for each cohort of preservice teachers will be minimally affected by these threats; the analysis of subsequent years' data will study the influence of these confounding variables (Campbell & Stanley, 1963; Cook & Campbell, 1979).

The design in this research meets a high standard for the development of scientific knowledge (Shavelson & Towne, 2002). We propose to *affect* teachers' conceptions and practices. The proposed intervention is based on a careful, theoretical analysis of ELL students' understanding and inquiry in science, teachers' conceptions and practices related to the teaching of science, and elementary schools as organizations that respond to and filter policy (in this case, high-stakes testing of science). By specifying the mechanisms by which policy may influence teachers' conceptions and practices, we will be able to target the intervention—our professional development efforts—on those mechanisms. The ability to specify the mechanisms by which something happens, to create an intervention that affects the phenomenon, to predict outcomes, and to replicate one's results are all hallmarks of rigorous science. The cumulative results of our efforts over five years of research will meet these criteria.

Intervention

The intervention includes the *combination* of instructional units and professional growth opportunities, rather than examining the effect of each separately, since effective instruction requires the provision of both. The intervention with practicing teachers will consist of the instructional units (Fradd et al., 2002) and teacher workshops (Lee et al, Luykx, under review). The intervention with preservice teachers will consist of university courses (including the use of the instructional units) taught by the key project personnel, as well as field experiences and associate teaching with teachers participating in the research.

The intervention and its associated research address challenges facing science instruction for ELL students at inner-city schools. One is maintaining a balance between sufficient depth and adequate coverage of science content as expected by state standards and high-stakes assessments in science. Another challenge involves providing hands-on and inquiry-based science for inner-city elementary students, who most need such instruction, in limited resources and instructional time allocated for science. Still another challenge involves integrating science with literacy and mathematics, which is critical not only for the educational needs of ELL students but for the demands placed on elementary teachers who must teach multiple subject areas in the limited instructional time of a school day. A final challenge involves coordination and allocation of time, resources, and financial support for the professional development intervention and classroom practices.

Instructional units. Instruction focuses on key topics in physical and earth/space sciences to assist elementary teachers who are generally uncomfortable in these areas. The instructional units include measurement and matter culminating in the water cycle (grade 3), weather, force and motion, and electricity (grade 4), and the ecosystem and the solar system (grade 5). Each unit takes 8 to 10 weeks of instruction. Although the instructional units at each grade level do not constitute the entire science curriculum mandated by the state standards, they comprise major portions of the curriculum. The force and motion and the electricity units will be developed in response to requests by teachers as essential for the 4th-grade curriculum; during project Year 1, we will develop and pilot test these units to be consistent with the project goals and to be ready for use beginning Year 2. The other units were developed and rigorously tested in our previous research. They are correlated with the national standards in science, with a focus on science inquiry and students' common misconceptions (AAAS, 1989, 1993; NRC, 1996). Based on standards for literacy (IRA/NCTE, 1994) and ESOL (TESOL, 1997), the units highlight activities and strategies to foster literacy with all students, especially English proficiency with ELL students. Mathematical concepts and skills are highlighted as essential for science inquiry.

All units were developed by an interdisciplinary team of scientists, science educators, bilingual/ESOL educators, and district administrators in science and mathematics. In our previous research, teachers played a significant role in developing and revising the units by offering insights about the linguistic and cultural experiences of diverse student groups, the appropriateness of the science content for elementary students, and the feasibility of implementation in elementary classrooms. In this research, the units will be further refined to increase their face validity against the FCAT science; that is, they will be correlated with state benchmarks in science along with reading, writing, and mathematics. This refinement will increase the buy-in of schools and enhance the fidelity of implementation of the research, both of which are necessary to examine the questions in the research.

Schools in the experimental group will receive teachers' guides (including transparencies), class sets of student booklets, and class sets of supplies (including trade books related to the science topics in the units). Schools in the comparison group will receive financial support to purchase supplies during the first two years; then, the third and fourth grade teachers receive all instructional materials as they engage in the intervention during the final two years and the fifth grade teachers engage in the intervention for one year.

Workshops with participating teachers. Workshops will be structured to encourage active involvement of all teachers, e.g., by sharing questions and suggestions, and reflecting on their own beliefs and practices. Teachers will be encouraged to share insights about similarities and differences in the teaching and learning environments among the participating schools.

Decisions about relative areas of emphasis for teacher workshops will be made mutually by the teachers and project personnel. In previous research, we gained insights about teachers' needs and emerging strengths (Fradd & Lee, 1999; Hart & Lee, in press; Lee & Fradd, in press). Because elementary teachers are generally uncomfortable with science, the initial focus will be on science content, inquiry, and discourse. As they become more familiar with science, teachers will consider ways to relate science to mathematics and literacy for ELL students. Over the years, teachers are expected to progress toward generating and sustaining ideas for effective instructional practices (Franke et al., 2001). Variations in teachers' abilities and experience in the integration of science, mathematics, and literacy with ELL students will raise challenges for professional development efforts.

A key theme in the workshops will involve analysis and reflection on students' ideas as expressed on their work samples and during classroom discourse. Teachers will learn to analyze alterative ways that students conduct science inquiry, solve problems, and construct meanings, as well as common misconceptions and learning difficulties. They will also learn to analyze students' assessment results as a major source of information for instructional decisions (Fishman, Marx, Best, & Tal, in press).

Each year, the teachers in the experimental group will participate in 4 full-day workshops in large groups and 2 meetings at each school site. During school-site meetings, teachers will discuss the implementation and adaptation of the intervention to meet their specific needs and concerns. During the first two years, project personnel will meet with the teachers in the comparison group at a half-day meeting at each school site to discuss expectations of science instruction for the research and the kinds of support they will receive from this project. The third and fourth grade teachers will participate in professional development opportunities during the final two years, and the fifth grade teachers will participate for one year.

University courses and field experiences with preservice teachers. The UM preservice elementary teachers complete 46 credits of course work, including reading, language arts, mathematics, and science, as well as requirements for ESOL endorsement (equivalent to 15 credits). Issues of diversity and equity are emphasized throughout the programs. Using the instructional units in this research, key project personnel (the course instructors in reading, language arts, mathematics, science, and ESOL) will teach according to the goals of this research. The teacher preparation programs also require 20–30 hours of classroom-based field experience for each course and one semester of associate teaching that the preservice elementary teachers will have with the practicing teachers in the research.

Data Collection

Many of the instruments to be used with teachers and students have been developed in our previous research and will be further field-tested and refined in this research. Mixed methods research will be used to combine large-scale sets of teacher and student data with more focused in-depth case studies obtained from purposefully selected schools, classrooms, teachers, and students. In addition, teacher- and student-level data on various FCAT assessments will be available through the M-DCPS Office of Information Technology.

Teachers. The instruments for classroom observations, questionnaires, and focus group interviews measure teachers' knowledge, beliefs, and practices in integrating science, mathematics, and literacy with ELL students (Research Questions 1 and 4a). Additionally, these instruments address teachers' perceptions of policy influences on instructional practices (Research Questions 1, 3b, and 4a), as well as teachers' feedback to the professional development intervention (Research Question 2). From previous research, internal consistency reliability estimates for these measures were deemed satisfactory (Hart & Lee, in press; Lee, Hart, & Cuevas, under review; Newmann, Secada, & Wehlage, 1995).

Data sources with *participating teachers* include observations, a questionnaire, and focus group interviews of all teachers, as well as case studies of selected teachers. Each teacher will be observed once during each semester; teachers in the experimental schools will be observed while a unit is being taught; teachers in the comparison schools, while a comparable topic is being taught. Observers will take field notes and use rating scales of instructional components. The questionnaire will be administered in the beginning and at the end of each year. Focus group interviews will be conducted at the beginning and at the end of each year. Teachers' feedback at formal and informal meetings will also be recorded. The teacher data will provide multiple indicators for the fidelity of the professional development intervention and classroom implementation. In addition to the data collection with all teachers, case studies of selected teachers will be conducted. These teachers will be selected for conceptually driven purposes, such as excellence and equity with their students, representative classrooms, bilingual classrooms. Extensive qualitative data will be collected through individual interviews, classroom observations, videotaping of the observed lessons, and samples of students' work.

Data collection with *preservice teachers* – who will be randomly assigned to schools – will involve observations, the questionnaire, and focus group interviews. Observations will involve micro teaching to peers in university courses, teaching lessons with elementary students during field experience, and associate teaching. At three points throughout the teacher preparation program, preservice teachers will complete the questionnaire and participate in focus group interviews. For consistency of data collection with all preservice teachers, specific courses will be designated for each data source.

Students. At each grade level, assessment instruments are designed to measure students' knowledge of science, literacy, and mathematics (Research Question 4b). From our previous research, internal consistency reliability estimates for these instruments were deemed satisfactory (Lee, Deaktor, et al., under review). Instruments for two fourth-grade units (force and motion, and electricity) will be developed in this research. Instruments will be administered to all students in both experimental and comparison schools and be made available in Spanish and Haitian Creole for use as necessary.

First, for each unit, a single test will be administered before and after the unit is taught to measure students' mastery of (a) key science concepts and big ideas of patterns, systems, models, and relationships and (b) science inquiry using relatively structured inquiry tasks (similar to NAEP performance tasks) and relatively open-ended inquiry tasks in which students generate questions and design investigations. The items require multiple choice, short-answer, and extended written responses. For comparison schools, the tests will be administered before and after comparable topics are taught.

Second, one science test, developed for each grade using public release items from the NAEP and TIMSS, will be administered to all students in both groups in the fall and spring of each academic year. The majority of multiple-choice items and a small number of short-answer and extended response items address key concepts presented in the instructional units in this research. These tests are used to examine students' achievement on assessment instruments other than the project-developed unit tests. NAEP and TIMSS samples of students also serve as another gross measure of comparison for the students in the research.

Finally, one grade-appropriate prompt for expository writing in science will be administered to all students in both groups every fall and spring. This prompt is consistent with the statewide writing assessment called "Florida Writes!" A student's writing sample provides a measure of the student's level of English literacy and ability to explain science concepts in writing. This will provide two measures of English writing, one from the project and one from the FCAT.

Policy contexts. To examine the influences of policy contexts on the intervention and classroom practices (Research Question 3), we will collect (a) state and district data on teacher and student demographics and achievement scores on state assessments disaggregated by demographic characteristics of schools, teachers, and students; (b) state and district policy documents, (c) interviews with district administrators and school principals, (d) our observations of school-level policies and practices, and (e) the questionnaires and focus group interviews with teachers (i.e., teachers' perceptions of high-stakes tests and accountability, and of state and district policy influences on science, mathematics, and ESOL instruction).

Data Analysis

A key aspect of the research is a longitudinal design with cohorts of preservice and practicing teachers and their ELL students. Using quantitative and qualitative methods, patterns of change in teachers' knowledge, beliefs, and practices, as well as student achievement, will be analyzed. Then, relationships between teacher change and student achievement over time will be examined. Data at multiple levels of the schools, teachers, and students will be analyzed using multi-level modeling techniques (e.g., hierarchical linear modeling, structural equation modeling). Similarities and differences among linguistic groups of students, teachers, and schools will be analyzed. The research will examine how the conditions at inner-city schools in a large urban school district—low-income, high student mobility, high teacher attrition, and high-stakes assessments and accountability—influence the intervention and classroom practices.

Differences between the experimental and comparison schools, teachers, and students will provide important information on how the implementation of high-stakes testing affects schools without supports in place (comparisons) in contrast to those with supports in place. The test of sustainability of the intervention in the experimental schools and replicability in the comparison schools will provide further evidence for the implementation and impact of the intervention within the high-stakes testing policy environment.

Teachers. Several cautions need to be observed in analysis and interpretation of teacher data. First, although the intervention involves both instructional units and professional growth opportunities, effects of each component will not be examined separately because the two are integrally related. Second, because the research uses a longitudinal design, attrition of both preservice and practicing teachers over the years is inevitable. However, the growth curve analyses (described below) do not require that attriters be excluded from the analysis. Multiple imputation and maximum likelihood estimation found in statistical modeling packages (e.g., hierarchical linear model, structural equation model) incorporates partially complete data when estimating model parameters. This method of handling missing data has been demonstrated to be far superior (i.e., produce less bias and greater power) relative to standard missing data procedures, such as list-wise or pair-wise deletion (Enders & Bandalos, 2001; Graham & Schafer, 1999; Schafer & Graham, 2002).

In addition to the analysis of pre- and post-data each year, the research will focus on the analysis of longitudinal data. Teacher change across multiple measurement periods over the years will be examined using multivariate growth curve modeling approaches. The primary goal of this analysis is to examine the rate of growth trajectories across multiple time points. The utility of latent growth curve model procedures (Muthen, 1997) will be explored; however, given the small sample size, the latent growth curve methods may not be appropriate in this context. For the case studies of selected teachers, data will be analyzed using qualitative methods (Erickson, 1986; Miles & Huberman, 1994; Strauss & Corbin, 1990) and case studies (Yin, 1993, 1994). Software programs for qualitative data analysis (e.g., ATLAS, N*UDIST) will also be utilized.

Students. Several cautions need to be observed in analysis and interpretation of student data. First, student mobility greater than 40% in many of the inner-city schools in Miami-Dade will be a source of missing data. Second, the retention of third-grade students who fail on the FCAT reading test will be another source of missing data. Third, analysis and interpretation should consider students' developmental effect during third, fourth, and fifth grades, although this three-year span might not be significant compared to the expected impact of the intervention. Finally, analysis and interpretation should consider diverse student groups' acculturation into the mainstream during the three-year span.

Scoring rubrics have been developed to assess students' science understanding and inquiry on project-developed unit tests (Lee, Deaktor, et al., under review). For the NAEP/TIMSS tests, NAEP and TIMSS scoring rubrics are used. For expository writing samples, two scoring rubrics assess "content" (specific knowledge and understanding of science) and "form" (conventions, organization, and style/voice).

Analysis will focus on three questions regarding the impact of the intervention on (a) overall achievement in the experimental group relative to the comparison group; (b) narrowing achievement gaps among demographic subgroups in terms of ethnicity, home language, English language proficiency, socioeconomic status, exceptional student education status, and gender; and (c) performance on NAEP/TIMSS tests between the two treatment groups and in comparison with national and international samples of students. First, student achievement across multiple measurement periods over the three-year span will be examined using the multivariate procedures and latent growth curve model. Multiple imputations and maximum likelihood estimation will be employed to handle missing data with all students including those who leave and enter throughout the intervention. The primary goal of this analysis is to examine the rate of growth trajectories across multiple time points for each achievement outcome variable. Second, growth curve models will be used for each outcome variable to examine variations in the impact of the intervention among demographic subgroups. The results will indicate whether achievement gaps exist among demographic subgroups at each of the data points (i.e., intercepts) and whether achievement gaps have narrowed or widened (i.e., rates of growth). Finally, for the comparisons with NAEP and TIMSS samples of students, the percentage of correct responses for each item (i.e., item difficulty index, p value) will be obtained.

To examine the relationship between teacher change and student achievement, a piece-wise growth model will be used (Muthén, 1998). Student growth parameters (i.e., slopes and intercepts) are estimated separately for each year, so that the impact of teacher change can be examined during each of the three years. This is necessary, as students are not nested within the same teacher for the entire three-year period. Teacher-level predictor variables will be identified that quantify the amount of teacher change over multiple years, respectively. These teacher change variables will be correlated with the appropriate student growth parameters to determine whether or not change in teacher outcomes is concurrently related to change in student outcomes.

Policy contexts. Data will be analyzed primarily using qualitative methods in terms of major themes and patterns to identify factors that facilitate or hinder the intervention and classroom practices (Erickson, 1986; Miles & Huberman, 1994; Strauss & Corbin, 1990). Data about how supportive the Florida and M-DCPS policy environments are of our intervention will be analyzed in terms of the five dimensions (i.e., specificity, consistency/alignment, authority, power, and stability) in the analytical framework proposed by Porter (1988). Additionally, we will trace how policies interact, how they are interpreted at various levels, and how a new balance gets established among them. We will also examine how policies influence teachers' conceptions and practices, and the interactive influences of science and ESOL policies on the intervention and classroom practices. Eventually, results from multiple sources of documents, multiple perspectives of participants, and our observations of school-level policies and practices and classroom-level practices will allow triangulation of data. The results will also provide the context to interpret teacher and student outcomes for the other questions in the research.

Work Plan

The first year of the project will be devoted to selection of schools, revision of the instructional units and instruments, and intervention with third-grade classrooms in the experimental group. In subsequent years, project activities will heavily involve the intervention and data collection. Later years will be devoted to longitudinal data analysis. Writing manuscripts and reports will occur throughout the project. Because of the project's interdisciplinary nature, all key personnel will be involved throughout various phases of the project (see Table 2; also see key personnel working on each of the research questions on pages 2-7).

Table 2. Work Plan

Year	Project Activities	Responsible Persons
Year 1 Summer	Selection of schools into treatment groups Revision/refinement of instruments Revision/refinement of instructional units for grade 3	All key personnel Computer instructional designer
Year 1 Academic year	*Experimental group*: Grade 3 intervention Preservice teacher intervention Revision/refinement of instructional units for grade 4	All key personnel Computer instructional designer Post-docs, doctoral students
Year 2	*Experimental group*: Grades 3 and 4 intervention Preservice teacher intervention Revision/refinement of instructional units for grade 5	All key personnel Computer instructional designer Post-docs, doctoral students
Year 3	*Experimental group*: Grades 3, 4, and 5 intervention *Comparison group*: Grade 3 intervention Preservice teacher intervention	All key personnel Post-docs, doctoral students
Year 4	*Experimental group*: Grade 3 follow-up, Grades 4 and 5 intervention, and longitudinal data analysis with Cohort 1 teachers and students *Comparison group*: Grades 3 and 4 intervention Preservice teacher intervention and longitudinal analysis	All key personnel Post-docs, doctoral students
Year 5	*Experimental group*: Grade 4 follow-up, Grade 5 intervention, and longitudinal data analysis with Cohort 2 teachers and students *Comparison group*: Grades 4 and 5 intervention Preservice teacher intervention and longitudinal analysis Products, including professional development manuals, instructional units, instruments, and sample lessons with student work	All key personnel Computer instructional designer Post-docs, doctoral students

Dissemination

During this project's life span, we will help other districts use our professional development program and/or adopt their own policies, so that their teachers can better teach science to ELL students in the forthcoming high-stakes testing environment. We will publish our results in peer-reviewed journals as well as present our program at major research conferences and professional organization meetings in the areas of science education, mathematics education, ESOL/bilingual education, educational policy, teacher education, urban education, diversity and equity, assessment, and research methods. We will seek non-traditional forms of dissemination—(cable) television, the internet, and popular media targeted across language groups participating in this study—so that parents, too, can learn about the importance of science for ELL students. We will also network with PIs involved in other NSF research and development projects (e.g., Centers for Learning and Teaching [CLT], Interagency Education Research Initiative [IERI], Mathematics and Science

Partnership [MSP], Research on Learning and Education [ROLE]) to inform existing NSF initiatives of TPC-supported research.

In addition to a chain of research produced during this project's life span, at the end of five years, we will have in place, both at UM and in M-DCPS, a set of practices for placing preservice elementary school teachers in the classrooms of teachers who are accomplished in teaching science to ELL students. We will have a self-sustaining professional development program that teachers at other schools can access to negotiate the high-stakes testing environment while they teach their ELL students better. And we will have artifacts—curriculum guides, professional development manuals, samples of lessons with underlying student work, and instruments with teachers and students—that will help other school districts around the nation launch their own initiatives and find appropriate support for their own teachers as they find themselves entering the new policy context of high-stakes testing in science.

Project Personnel

Key project personnel from UM make up an interdisciplinary team, and they represent diverse ethnic/racial and linguistic backgrounds. Okhee Lee (PI) and Cory Buxton have conducted extensive research on science teaching and learning with students from culturally and linguistically diverse students, including ELL students. Walter Secada (Co-PI) and Gilbert Cuevas have engaged in research on mathematics instruction with diverse groups of students, including ELL students. Maria Carlo's research examines science vocabulary and concept development during reading with Spanish-speaking students, while Arlene Clachar's research examines language acquisition and writing process with native speakers of Creole from African American and Caribbean backgrounds. The key personnel also include Jeanne Schumm in content area reading and professional development schools; Shepard Faber in physics; Tamela Eitle on high-stakes assessments and educational policies; Hariharan Swaminathan in research design and psychometrics; and Ann Bessell in program evaluation. All are productive researchers in their respective fields (see Biographical Sketches). They are committed to the project sufficiently to carry out the project successfully (see the budget and budget justification).

Key project personnel from M-DCPS include Constance Thornton (Co-PI), Administrative Director for the Division of Mathematics and Science Education, and one science administrator working full time on this project. Through their participation in the revision of the instructional units and teacher workshops, expert teachers from our previous research will serve as mentor teachers for both preservice and practicing teachers in this research. The district administrators and mentor teachers will be regular guest speakers for the UM teacher preparation programs.

Two post-doctoral associates and five doctoral students will be selected based on (a) disciplinary training in relevant fields and (b) representation of the language groups of students in the research. The research will provide unique opportunities to prepare them for professional careers.

Project personnel will be assisted by an advisory group of experts in various disciplines (see letters of support), including (a) Jane Kahle (chair of the advisory board, Miami University, Ohio) on equity and systemic reform in science education; (b) Andrew Porter (Vanderbilt University) on assessments, teacher professional development, and educational policies; (c) Eugene Garcia (Arizona State University) in bilingual education and language policy; (d) Humberto Campins (University of Central Florida) in astronomy, (e) Rosa Apodaca (National Fellow at the University of Pittsburgh's Institute for Learning) in district-level professional development initiatives, (f) Lourdes Rovira, M-DCPS Assistant Superintendent, (g) Joanne Urrutia, Executive Director, in the M-DCPS Division of Bilingual Education and World Languages, and (h) Michaelle Vincente, District Supervisor, in the M-DCPS Division of Bilingual Education and World Languages.