U.S. Department of Education

Washington, D.C. 20202-5335

APPLICATION FOR GRANTS UNDER THE

NATIONAL PROFESSIONAL DEVELOPMENT PROGRAM
CFDA # 84.365Z
PR/Award # T365Z110204
Grants.gov Tracking#: GRANT10865452

Closing Date: MAY 09, 2011

PROJECT ABSTRACT

Name of the IHE: University of Northern Colorado

Title of the Program: Mathematics and Science Teaching to English Learners (MAST-EL)

Consortia LEA Partners:

1. Archuleta Elementary School, Denver Public Schools, Denver, CO
2. Dunn Elementary School, Poudre School District, Fort Collins, CO
3. Centennial Elementary School, Greeley-Evans Weld County School District 6, Greeley, CO
4. Dos Rios Elementary School, Greeley-Evans Weld County School District 6, Greeley, CO

Project Description:

The University of Northern Colorado (UNC) and its four consortia partner schools propose a five-year project for the National Professional Development Program The goal of Mathematics and Science Teaching for English Learners (MAST-EL)*)* is to prepare pre-service elementary teachers to deliver high-quality mathematics and science instruction to K-5 English learners (ELs) in Colorado schools. In order to do this we will:

1. Prepare and graduate a cohort of 30 MAST-EL Scholars (UNC Elementary Education and English-as-a-Second Language dual endorsed majors) to effectively teach mathematics and science to K-5 ELs and support them through their first year of teaching.
2. Engage and mentor 32 MAST-EL classroom teachers in how to effectively teach mathematics and science to ELs.
3. Develop long-term relationships with administrators and teachers at four partner schools where exemplary mathematics and science teaching for ELs is modeled and researched.
4. Increase K-5 EL achievement in mathematics and science as a result of the implementation of culturally and linguistically responsive teaching and assessment practices.

Objectives, Activities and Expected Outcomes:

Goal 1:

1.1 In fall of Year 1, the MAST-EL Planning Team will invite and provide over 40 elementary education freshmen majors (pre-service teachers) at UNC with MAST-EL Professional Learning Community (PLC) activities to build their awareness and understanding of the nature and needs of ELs, specifically in mathematics and science.

1.2 In spring semester of Year 1, the MAST-EL Management Team will select 30 elementary education majors participating in the MAST-EL PLC (Obj. 1.1) to become MAST-EL Scholars and receive extensive content and pedagogical support as well as a scholarship to become dual endorsed in English as a Second Language (ESL) as they develop their understanding about teaching and learning mathematics

MATHEMATICS AND SCIENCE TEACHING FOR ENGLISH LEARNERS (MAST-EL)

INTRODUCTION

The University of Northern Colorado (UNC) and its four consortia partner schools propose a five-year project for the National Professional Development Program. The goal of Mathematics and Science Teaching for English Learners (MAST-EL) is to prepare pre-service elementary teachers to deliver high-quality mathematics and science instruction to K-5 English learners in Colorado schools. In order to do this we will:

- Prepare and graduate a cohort of 30 MAST-EL Scholars (UNC Elementary Education and English-as-a-Second Language dual endorsed majors) to effectively teach mathematics and science to K-5 English learners (ELs) and support them through their first year of teaching.
- Engage and mentor 32 MAST-EL classroom teachers in how to effectively teach mathematics and science to English learners (ELs).
- Develop long-term relationships with administrators and teachers at four partner schools where exemplary mathematics and science teaching for ELs is modeled and researched.
- Increase K-5 EL achievement in mathematics and science as a result of the implementation of linguistically responsive teaching.

MAST-EL addresses three Competitive Preference Priorities and one Invitational Priority. UNC is a novice applicant (Competitive Preference Priority 1), that will utilize, develop, and improve data-based decision-making tied to effective classroom instructional practices for ELs (Competitive Preference Priority 2), that will prepare pre-service elementary education teachers in the STEM areas of mathematics and science (Competitive Preference

Priority 3), and that will improve our dual endorsed elementary/ESL teacher education program in order to better prepare new teachers to equitably and appropriately educate ELs (Invitational Priority 2). MAST-EL involves a collaboration of ESL/bilingual education faculty in the Department of Hispanic Studies in the College of Humanities and Social Sciences, science methods faculty in the School of Biological Sciences and School of Chemistry and Biochemistry in the College of Natural and Health Sciences, mathematics methods faculty in the School of Teacher Education in the College of Education and Behavioral Sciences, and faculty and staff in the Mathematics and Science Teaching (MAST) Institute at UNC with Archuleta Elementary School (Denver Public Schools, Denver), Dunn Elementary School (Poudre School District, Fort Collins), and Centennial and Dos Rios Elementary Schools (Greeley-Evans District 6, Greeley). Letters of support from district superintendents are attached to this proposal.

CHALLENGES IN EDUCATING ENGLISH LEARNERS

The population of ELs in Colorado K-12 schools, 83.3% of whom are Spanish-speaking, has increased 260% in the last ten years. This contrasts with a total K-12 increase of only 15.6% during the same time period in Colorado (Medina, 2010). In addition to large growth in numbers of EL students in Colorado, there is also a large achievement gap in mathematics and science. On the 2009 National Assessment for Education Progress (NAEP), fourth grade ELs in Colorado had an average score of 216 in mathematics (43% scoring below a basic level) and 116 in science (68% scoring below a basic level). This contrasts with the average fourth grade score of 246 for non-ELs in mathematics (12% scoring below basic) and 159 for non-ELs in science (18% below the basic level). Thus, there is an achievement gap of 30 points in mathematics and 40 points in science between ELs and non-ELs in Colorado in fourth grade on the NAEP (U.S. Department of Education, 2009).

On the 2010 Colorado Student Assessment Program (CSAP) in mathematics, only 9% of ELs in ESL programs scored "proficient" or "advanced," whereas the state average was 76%. Seventy-five percent of ELs in ESL programs scored "unsatisfactory" on the mathematics CSAP. The state average for "unsatisfactory" on the mathematics CSAP was 8%. On the 2010 CSAP in science, only 6% of ELs in ESL programs tested at the "proficient" or "advanced" level in science compared to the state average of 47%. Forty-four percent of ELs in ESL programs scored "unsatisfactory" in science compared to the state average of 13% (Colorado Department of Education, 2010). ELs at the elementary level need access to strong mathematics and science programs, well-prepared science and mathematics teachers, and reform-oriented teaching that focuses on inquiry, problem-solving, engaged thinking, and connections to language, home, and cultural experiences in order to improve their achievement in mathematics and science (Lee & Buxton, 2010; Rosebery & Warren, 2008).

Pre-service teachers do not receive adequate instruction in effective ways to teach ELs in linguistically responsive ways in mathematics and science (Bruno, Solis, & Mosqueda, 2011; Castro, 2010; Lucas & Grinberg, 2007; Sleeter, 2008). Only 20% of teacher education programs across the country require a stand-alone course that is focused exclusively on ways to teach ELs and less than a third require a field experience with ELs (U.S. Government Accountability Office, 2009). When teacher education programs do require specific courses such as a multicultural education course or an ESL-infused science methods course results are very mixed and short-term, and do not fundamentally change the deficit attitudes pre-service teachers have about working with ELs (Bruno et al., 2011; Hollins & Torres Guzman, 2005; Sleeter, 2008).

Although 43% of all in-service teachers have ELs in their classrooms, in-service teachers only receive an average of four hours of training in ESL strategies (Zehler et al., 2003 cited by

the National Research Council, 2010). Elementary in-service teachers continue to struggle with incorporating reform-oriented practices in content areas while simultaneously teaching language, even after professional development opportunities (De Jong & Harper, 2005; Franklin, 2011; Lucas, Villegas & Freedson-Gonzalez, 2008; Stoddart, Solis, Tolbert, & Bravo, 2010).

Although there have been five NSF funded projects that developed curricular materials and strategies that integrated science and language that were effective in raising achievement scores for English learners (Stoddart et al., 2010), these kinds of materials and strategies for integrating language and content instruction and teaching in linguistically responsive ways have not been systematically incorporated into science or mathematics methods courses, elementary practicum, or elementary student teaching, nor have they been incorporated into a coherent vision for teacher education or the professional development of teachers (Bruno et al., 2011; Franklin, 2011; Hollins & Torres Guzman, 2005; Lee & Buxton, 2010). It is not enough for pre-service or in-service teachers to have general pedagogical techniques that apply to all content areas; instead, teachers need to have content specific techniques in mathematics and science in order to raise the achievement scores of children (National Research Council, 2010). The concept of pedagogical content knowledge (Ball & Hill, 2009; Shuman, 1987) -- expanded by us to include a focus on English learners -- frames instruction that needs to take into account the specialized content of second language acquisition, mathematics, and science; the language and cultural background that ELs bring to their learning; and the techniques and strategies that teachers use to teach mathematics and science to ELs at the elementary level.

MAST-EL develops the capacity of pre-service teachers to teach language, mathematics and science to ELs because it infuses the concept of pedagogical content knowledge and linguistically diverse instruction into seven different teacher education program courses: a

mathematics content course, three methods courses, two practica courses, and student teaching (See Table 1). UNC coursework for dual endorsed majors over four years will (1) connect science and mathematics content courses with (2) ESL, science and mathematics methods courses that focus on how to effectively teach science and mathematics to ELs with (3) applied and reflective assessment-driven classroom practice and mentoring in exemplary and highly diverse partner schools that work with families in after-school mathematics and science programs. Once it is fully implemented, MAST-EL will substantially improve UNC's ESL/Elementary Education endorsement and, therefore, affect all future graduates. For this reason, it addresses Competitive Preference Priority 1, 2, and 3 and Invitational Priority 2.

Table 1: Sequence of Courses Taken by Dual Endorsed Students at UNC

Year 1	Year 2	Year 3	Year 4
-Culture course -Spanish -Math content -Science content	-Culture course -Math content -Science content -Second Language Acquisition	-ESL methods -ESL practicum -English linguistics -Science content -Math content	-Math methods -Science methods -Practicum -Student teaching

UNC, the largest teacher education program in Colorado, graduates an average of 300 undergraduate elementary education majors a year, 50-60 of whom are also endorsed in ESL. In the dual endorsement program, students complete their elementary education requirements with 18 additional hours of ESL coursework in culture (MAS 100, MAS 275), second language acquisition (TESL 350), English linguistics (TESL 380), methods and assessment (TESL 400), 90 hours of field experience with ELs (TESL 401-2), a year of Spanish, and student teaching in

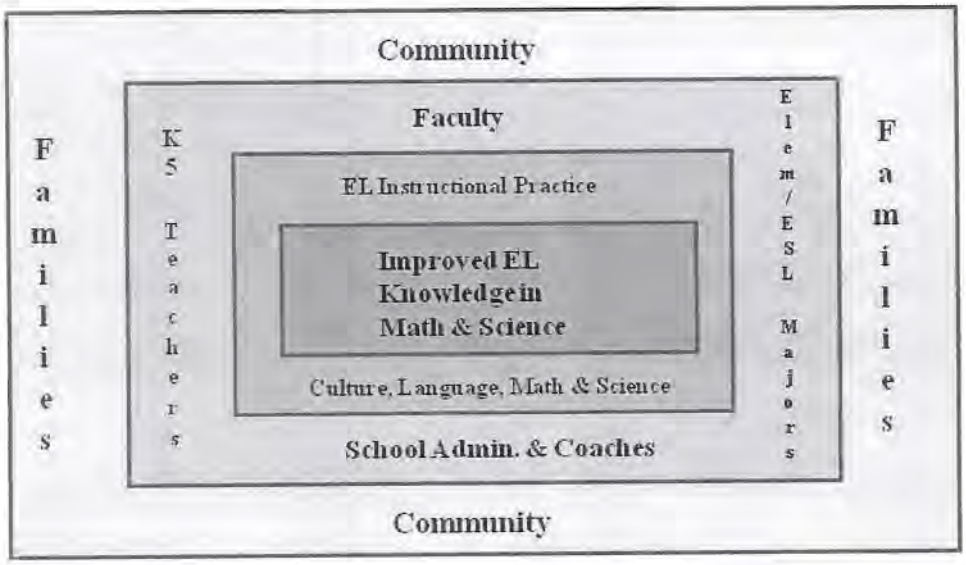
linguistically diverse classrooms. For elementary licensure, students take 13 credits in science content courses, 12 credits in mathematics content courses, 6 credits in methods courses (3 in mathematics and 3 in science), a practicum (90 hours), and student teaching (16 weeks). Both the ESL and Elementary Education endorsements at UNC are nationally accredited by the National Council for the Accreditation of Teacher Education (NCATE). At UNC, approximately 25% of our dual endorsed students are also Latino.

The ESL/Elementary Education dual endorsement model at UNC is accredited, has a strong enrollment, and graduates a large number of students every year, but data indicate that our dual endorsed students are not being prepared to effectively teach math and science to ELs at the elementary school level. Research by Harding-Dekam, Franklin, Hamilton and Romero (2010) indicates that during student teaching dual endorsed teacher candidates struggle with implementing effective practice in math and science in linguistically diverse classrooms. Our pre-service teachers have not adequately developed their linguistically diverse pedagogical content knowledge for teaching mathematics and science to ELs because they have not had the opportunity to observe and be mentored by exemplary elementary teachers of mathematics and science in ways that allow them to learn how to integrate science and mathematics content with linguistically responsive teaching strategies. In the MAST-EL Model, UNC ESL, Science and Mathematics faculty, in-service teachers, and pre-service teachers will work together in partner schools to prepare exemplary teachers. Figure 1 illustrates the components of the MAST-EL Model.

The partner school concept is critical to the success of MAST-EL model and to preparing pre-service teachers who can effectively teach mathematics and science to ELs. Without applied practice and mentoring in partner schools that have teachers who model exemplary assessment-

based practice, pre-service teachers cannot learn what they need to do to improve the achievement of their ELs (Zimpher & Jones, 2010). For this reason, MAST-EL provides a half-time science and mathematics instructional coach, housed in each partner school, to work with classroom teachers to assure that they are exemplary teachers in mathematics and science by the end of the grant period and to help supervise the UNC pre-service teachers who will be completing practica and student teaching in these schools.

Figure 1: MAST-EL MODEL



Our four partner schools are linguistically diverse. Archuleta Elementary School with bilingual education and ESL programs has 29 classroom teachers and 10 specialists, serving 689 students, 60% of whom are ELs. Centennial Elementary School in Greeley has 35 teachers serving 690 students, 56% of whom are ELs. Dos Rios Elementary School in Greeley serves 535 students, 22% of whom are ELs, with 33 teachers. Dunn Elementary School in Fort Collins has 18 classroom teachers and serves 410 students, 22% of whom are ELs. Across all four partner schools, there are 1016 ELs in K-5 classrooms. Thirty-seven partner school teachers are either

certified or endorsed in ESL, but all need more support in teaching mathematics and science to ELs. Reflective practice and classroom-based action research are required for the development of linguistically diverse pedagogical content knowledge in mathematics and science. MAST-EL will provide monthly and summer opportunities to engage in instructional dialogues that develop linguistically diverse pedagogical content knowledge of pre-service, in-service, instructional coaches, and university faculty.

PROJECT DESIGN

Participants in MAST-EL are 30 Scholars (UNC dual endorsed elementary education/ESL majors), 4 science and mathematics instructional coaches, 32 Classroom Teachers, and 1016 K-5 ELs from Archuleta, Centennial Elementary, Dos Rios, and Dunn Elementary Schools.

In Year 1, 40 freshmen elementary education/ESL majors from UNC will be recruited and invited to participate in a year long professional learning community (PLC) in order to introduce them to basic concepts about the nature and needs of ELs in mathematics and science. From this pool of freshmen majors, 30 MAST-EL Scholars will be selected to participate in the four remaining project years. Mathematics and science instructional coaches from the four partner elementary schools will serve on the MAST-EL Management Team along with UNC's ESL, mathematics, and science education faculty to select pre-service scholars. Selection criteria for MAST-EL Scholars include being a U.S. citizen, having declared a dual endorsement major, being enrolled full time, having completed less than 30 credits with GPA of 2.5/4.0, having completed a self-evaluation cultural checklist from a MAS 100 (Culture course), having two letters of recommendation that describe the potential scholar's interest in and aptitude for

teaching linguistically responsive mathematics and science, and having submitted an essay that states why the potential scholar will be a successful mathematics and science teacher of ELs.

Topics for the eight first year professional learning communities (PLCs) include demographic information about immigrants and refugees (Garcia et al., 2008), programs for ELs in schools (Garcia et al., 2008), educational and cultural values (Valencia, 2011; Zentella, 2005), racism and stereotyping in the U.S. (Pedraza & Rivera, 2005), bicultural identity and patterns of school adjustment (Pedraza & Rivera, 2005; Valencia, 2011), and school achievement data of ELs including that of mathematics and science (Lee & Buxton, 2010). MAST-EL Scholars will also have opportunities to interact informally with immigrant and refugee community members. MAST-EL Scholars will take one culture class and Spanish language classes required for the ESL endorsement as well as mathematics and science content courses. If needed, they will also receive group tutoring from UNC's Office of Academic Support and Advising 2-4 times each month during the academic year to support their understanding of mathematics, science and/or ESL coursework.

Five to eight MAST-EL Teachers (up to 32 K-5 classroom teachers) from each of the four partner schools will also be selected by the MAST-EL Management Team in the spring semester of Year 1. Selection criteria include being a U.S. citizen, being a full-time elementary teacher for at least three consecutive years, having a documented interest (e.g. courses, workshops) in ESL, science and/or mathematics, having written support from the principal, and submitting a written letter of interest in and commitment to participate in the MAST-EL Project.

MAST-EL Teachers (and the 30 selected MAST-EL Scholars) will participate in 24 PLCs starting in PY2. Potential topics (repeated more than once for different grade levels and as teacher and scholar knowledge develops) include using the new WIDA English language

development standards, the new Colorado standards in mathematics and science, teaching mathematics and science topics in the elementary curriculum (e.g. number sense, place value), immigrant school failure and achievement (Genesee, Lindholm-Leary, Saunders, & Christian, 2006; Valencia, 2011), using community-based funds of knowledge in mathematics and science (Gonzalez, Moll, & Amanti, 2005; Rosebery & Warren, 2008), child misconceptions of mathematics and science (Ball & Hill, 2009; Lee & Buxton, 2010), using multicultural children's literature and multicultural curriculum to support learning (Rosebery & Warren, 2008); teaching academic discourse in mathematics and science (Rosebery & Warren, 2008; Schleppegrell, 2004; Sunal, Sunal, & Wright, 2010), teaching academic vocabulary (Rosebery & Warren, 2008), and using the first language to support the learning of mathematics and science in English (Echevarria, Vogt, & Short, 2010; Genesee et al., 2006; Lee & Buxton, 2010; Short, Vogt, & Echevarria, 2011). PLCs will be supported with video study of mathematics and science classroom teaching episodes, the study of mathematics and science classroom assessment data, the study of mathematics and science academic language use in oral and written language samples, and action research and other types of teacher research.

MAST-EL Scholars and Teachers will also participate in 4 summer institutes with UNC faculty and partner school instructional coaches. All participants will share, explore, practice, reflect, and plan how to effectively support K-5 ELs to learn mathematics and science. The focus and activities for each summer institute will be determined from need assessments conducted during the PLCs by the MAST-EL Management Team. Scholar and Teacher classroom teaching videos, science and mathematics student work samples, and action research projects and other types of teacher research will also be shared during the summer institutes. Teachers and Scholars will have the option to receive UNC credit for their participation and completion of assignments.

Teachers will also be given an opportunity to take a three-credit graduate course in second language acquisition and at the end of the project take the Linguistically Diverse Education PLACE test to receive Highly Qualified status as an ESL teacher.

UNC faculty, project evaluators, and instructional coaches from each of the four partner schools will form the MAST-EL Management Team. The MAST-EL Management Team will plan and execute activities of the grant. As mentioned above, the activities include (a) selecting MAST-EL scholars and developing support mechanisms for MAST-EL UNC Scholars to complete their elementary education and ESL dual endorsement degree program (Year 1 – Year 4), (b) planning and teaching monthly MAST-EL Professional Learning Communities for Scholars and Teachers at each partner school during the academic years of Year 2 – Year 5, and (c) planning and teaching MAST-EL Summer Institutes for all Scholars and Teachers during the summers of Year 1 – Year 4. MAST-EL Management Team members, meeting quarterly during the project, will collect and review Scholar, Teacher, and K-5 EL data in order to inform subsequent activities. With extensive input from MAST-EL Teachers, the MAST-EL Management Team will oversee the development of 60 additional science and mathematics afterschool activities for students and their families.

Goals and Objectives

Goal 1: Prepare and graduate a cohort of 30 MAST-EL Scholars (UNC Elementary Education and ESL dual endorsed majors) to effectively teach mathematics and science to K-5 English Learners (ELs) and support them through their first year of teaching.

Objectives:

1.1 In fall of Year 1, the MAST-EL Management Team will invite and provide over 40 elementary education freshmen majors (pre-service teachers) at UNC with MAST-EL

Professional Learning Community (PLC) activities to build their awareness and understanding of the nature and needs of ELs, specifically in mathematics and science.

1.2 In spring semester of Year 1, the MAST-EL Management Team will select 30 out of the 40 elementary education/ESL majors to become MAST-EL Scholars and receive a scholarship and content and pedagogical support to become dual endorsed in ESL as they develop their understanding about teaching and learning mathematics and science for ELs.

1.3 MAST-EL Scholars must maintain a 3.0/4.0 GPA for the required academic year in their content courses in mathematics, science, culture, and language, as well as the content course work they complete in their four MAST-EL Summer Institutes.

1.4 MAST-EL Scholars must maintain a 3.0/4.0 GPA for the required academic year in their pedagogical and practicum courses in mathematics, science, ESL, and student teaching, as well as in the course work associated with the four MAST-EL Summer Institutes.

1.5 A group of five to eight MAST-EL Scholars will be assigned to a MAST-EL PLC at each partner school at the end of their freshmen year. All MAST-EL Scholars must participate in at least 7 of the 8 MAST-EL PLC meetings during the academic years 2-5.

1.6 Eighty percent of MAST-EL Scholars show an increase in confidence when teaching mathematics and science to ELs.

1.7 Eighty percent of MAST-EL Scholars will effectively teach mathematics and science to English learners as defined by their student teaching performance indicators (Year 4), which includes EL student data in mathematics and science and UNC faculty assessment, and classroom observation of the Scholar's first year of teaching.

Goal 2: Engage and mentor up to 32 MAST-EL Teachers (classroom teachers) in how to effectively teach mathematics and science to English Learners.

Objectives:

2.1 In spring semester of Year 1, classroom teachers at partner schools apply and are selected to be a MAST-EL Teacher where they will receive extensive content and pedagogical support so they can effectively teach mathematics and science to ELs.

2.2 MAST-EL Teachers will have a 25% gain in knowledge of the role culture, cultural identity, and language play in learning mathematics and science.

2.3 MAST- EL Teachers will have a 25% gain in their mathematics and science content knowledge.

2.4 MAST-EL Teachers will have a 25% gain in their pedagogical content knowledge in ESL, mathematics, and science, enabling them to enlarge their repertoire of pedagogical methods, skills and knowledge congruent with content and WIDA standards.

2.5 Eighty percent of MAST-EL Teachers will show an increase in confidence when teaching mathematics and science to ELs.

2.6 Eighty percent of MAST-EL Teachers will effectively teach math and science to English learners.

2.7 Of those MAST-EL teachers who are not already endorsed in ESL, 75% will complete the Linguistically Diverse Education PLACE test, required for state certification in ESL.

Goal 3: Develop long-term relationships with administrators and teachers at four partner schools where exemplary mathematics and science teaching for English learners is modeled and researched.

Objectives:

3.1 Eighty percent of the administrators and teachers will be satisfied with the MAST-EL partnership.

3.2 Seventy-five percent of partner school administers will approve an agreement with UNC allowing MAST-EL Scholars, Teachers, and UNC faculty to continue to observe, plan, practice, and reflect on teaching mathematics and science to ELs after the grant ends.

3.3 Sixty additional mathematics and science activities will be provided to partner school students and families over the 5-year project (4 schools x 3 activities x 5 years = 60 activities).

Goal 4: Increase K-5 English Learner achievement in mathematics and science as a result of the implementation of culturally and linguistically responsive teaching practices.

Objectives:

4.1 Students of MAST-EL Teachers will increase by 25% their math and science knowledge.

4.2 Students of MAST-EL Scholars' student teaching experience will increase by 25% their mathematics and science knowledge.

PROJECT PERSONNEL

There are 11 MAST-EL MANAGEMENT TEAM Personnel, including 5 UNC faculty, four instructional coaches, and two project evaluators. Faculty qualifications are indicated in Table 2. Coaches and Evaluators will be discussed in the Management Plan section. The Executive PD, PD, and Co-PDs are all permanent faculty or instructors at UNC and have extensive knowledge in the critical areas of ESL, Mathematics Pedagogy or Science Pedagogy. Dr. Elizabeth Franklin, a faculty member in ESL and Bilingual Education in Hispanic Studies, speaks Spanish fluently, has been a chair of Elementary Education, a chair of Curriculum and Instruction, and a director of a School of Modern Languages and Cultural Studies. She has extensive experience working with pre-service and in-service teachers in linguistically diverse schools and has published articles in this area. Ms. Lori Reinsvold, staff on the Math and Science

Teaching Institute at UNC, Drs. Youngjin Song (School of Chemistry and Biochemistry) and Teresa Higgins (School of Biological Sciences) bring strong backgrounds in science, science pedagogy, and working with teachers and children in linguistically diverse schools. Dr. Song speaks Korean as her first language. Ms. Reinsvold also brings extensive experience serving as project director on federal and state grants. Dr. Jenni Harding-Dekam, an Associate Professor of Mathematics Education, directs a teacher education program at UNC, and has researched the instruction of student teachers working in linguistically diverse schools.

Table 2: Qualifications of Project Personnel

Key Personnel	EL Research	Cultural & Linguistic Training	Knowledge of a Second Language	Knowledge of Math & Science Content and Strategies	Professional Development Activities for Teachers
Dr. Franklin (Exec PD)	X	X	X		X
Ms. Reinsvold (PD)	X			X	X
Dr. Dekam (Co-PD)	X	X		X	X
Dr. Song (Co-PD)	X	X	X	X	X
Dr. Higgins (Co-PD)	X			X	X

MANAGEMENT PLAN

The MAST-EL Management Team consists of the Executive PD, PD, three Co-PDs, four partner school instructional coaches, and two project evaluators. The Management Team oversees grant operations, reviews and selects applicants to the program, and reviews yearly evaluation reports in order to make necessary changes and revisions. During Year 1,

Management Team members will review and select evaluation instruments to measure teacher growth in mathematics and science content knowledge, confidence in teaching mathematics and science to ELs, pedagogical content knowledge in mathematics and science, and knowledge about the role that culture, identity, and language play in K-5 EL achievement. Management Team members will review rubrics used in classroom observations of MAST-EL Teachers and Scholars, develop questionnaires to determine teacher change in attitudes, and develop a survey used with parents, administrators, teachers, and scholars to assess satisfaction with the project.

The **Executive Project Director,** Dr. Elizabeth Franklin, will direct the grant, chair quarterly Grant Management Team meetings, oversee budget expenditures and data collection and analysis, and provide direction as well as participate in Summer Institutes and PLCs at partner schools during Years 2-5 of the grant. Dr. Franklin will also advise 15 of the MAST-EL Scholars, plan the Year 1 PLCs for undergraduate majors, supervise six of the MAST-EL Scholars during their ESL practicum and student teaching, and mentor them during their first year teaching experience. She will provide leadership on ways to analyze oral and written mathematics and science language samples.

Project Director, Lori Reinsvold, will direct the day to day operations of the grant, prepare expenditure reimbursement for grant participants, oversee all communications with partner schools, organize and maintain data storage and retrieval, advise 15 Scholars, and advise all partner school MAST-EL Teachers seeking graduate credit or Highly Qualified status. She will oversee the additional support from UNC's Office of Academic Support and Advising that may be needed by students for content courses. Ms. Reinsvold will participate in all PLCs at Centennial Elementary School, attend three additional PLCs at other partner schools, and be responsible for planning and organizing eight PLCs and one Summer Institute over the grant

period. She will supervise six MAST-EL Scholars during their mathematics and science practicum and student teaching and mentor them during their first year of teaching experience.

The first **Co-Project Director,** Dr. Jenni Harding-Dekam, is responsible for reviewing and selecting during the first year of the project the mathematics teaching instruments, parents' satisfaction instruments, and other instruments to be used in the grant evaluation. Dr. Harding-Dekam will also be responsible for teaching the mathematics methods course, the ethno-mathematics content course, supervising six MAST-EL Scholars during student teaching, and mentoring the Scholars during their first year of teaching. Dr. Harding-Dekam will attend all eight PLCs at Dunn Elementary School and three additional PLCs at the other three partner schools during Year 2-4 of the grant. She will also plan eight PLCs and one Summer Institute and provide leadership on video study of teaching episodes.

The second **Co-Project Director,** Dr. Youngjin Song, will teach the science methods course for MAST-EL Scholars and during Year 1 choose science instruction assessment instruments and other instruments to be used for the grant evaluation. Dr. Song will attend all eight PLCs at Dos Rios Elementary School and three additional PLCs at other partner schools during Years 2-4 of the grant. She will plan eight PLCs and one Summer Institute, supervise six MAST-EL Scholars during their practicum and student teaching, and mentor them during their first year of teaching. Dr. Song will also provide leadership for qualitative analyses of teaching videos.

The third **Co-Project Director,** Dr. Teresa Higgins, will teach a science content course and supervise six MAST-EL Scholars during their mathematics and science practicum, student teaching, and first year of teaching. She will also attend all eight PLCs at Archuleta Elementary School and three additional PLCs at other partner schools during Years 2-4 of the grant. She will

plan eight PLCs and one Summer Institute. Dr. Higgins will also select science instruction evaluation instruments and oversee the planning of the afterschool science and mathematics activities taught by MAST-EL Scholars during the grant period.

Four **Instructional Coaches** will be hired 40% time at each partner school to provide instructional coaching to 5-8 MAST-EL Teachers at their partner school, attend quarterly MAST-EL Team Management meetings, participate in and help plan all PLCS at their partner school, supervise MAST-EL practicum and student teachers at their partner school and help MAST-EL Scholars plan their afterschool mathematics and science activities.

One of our **Project Evaluators,** Dr. Mariana Enríquez, brings close to 20 years research and evaluation experience focused primarily on education issues. As a Mexican native she is bilingual in English and Spanish. Mariana has extensive experience in all facets of evaluation and research projects and is skilled in the development of qualitative and quantitative data collection instruments, paying special attention to cultural competence issues. She has evaluated US Department of Education and National Science Foundation projects and served as Director of Education Research for the Center for Research Strategies (Denver) and Senior Evaluator for Mid-continent Research for Education and Learning (Aurora, CO). Dr. Enriquez has participated in evaluation and research projects focused on the intervention of history teachers, parent involvement, closing the achievement gap for middle and high school students, and after-school programs for elementary through middle school students. Dr. Antonio Olmos-Gallo, our second **project evaluator**, brings his statistical and data analysis expertise to this proposal. He has lead evaluation work for Denver Public Schools, Sheridan School District, University of Denver, and Mental Health Center of Denver. He is bilingual in English and Spanish. A timeline of activities, objectives and responsibilities is found in the following table.

Objective	MAST-EL Activity	Year 1 7/11–6/12	Year 2 7/12 – 6/13	Year 3 7/13 -6/14	Year 4 7/14 –6/15	Year 5 7/15–/16
1.6, 1.7, 2.2-2.6, 3.1, 3.2, 4.1, 4.2	Develop and adapt instruments to evaluate participants. *Personnel: Song (20%), Harding-DeKam (20%), Higgins (20%), Reinsvold (5%), Evaluators (10%.)*					
1.1	Provide EL focused PLC to elementary education/ESL majors (Aug–May). *Personnel: Song (30%), Harding-Dekam (30%), Higgins (30%), Franklin (30%), Reinsvold (10%).*					
1.2, 2.1	Select Scholars and Teachers (Jan–Apr). *Personnel: Song (5%), Harding-Dekam (5%), Higgins (5%), Franklin (10%), Reinsvold (10%), 4 School Coaches (5%), 4 School Administrators (not grant funded).*					
1.3-1.7, 2.2-2.6, 4.1, 4.2	Observe classroom instruction and provide feedback to participants (Aug-May). *Personnel: Yr 2-5 Song (20%), Harding-Dekam (20%), Higgins (20%), Franklin (20%), Reinsvold (20%). Yr 1-5: 4 School Coaches (each 75%).*					
1.2, 1.5, 1.6,	Provide 8 PLC/yr at each school to evaluate EL science,					

Objective	MAST-EL Activity	Year 1 7/11–6/12	Year 2 7/12 – 6/13	Year 3 7/13 -6/14	Year 4 7/14 –6/15	Year 5 7/15–/16
1.7, 2.1-2.6, 3.1, 3.2, 4.1, 4.2	mathematics and EL data, reflect on practice, and plan instructional strategies (Aug-May). *Personnel: Yr2-4- Song (55%), Harding-Dekam (55%), Higgins (50%), Reinsvold (25%/year). Yr 2-5- Franklin (40%/year, 4 Instructional Coaches (each 30%), 4 Administrators (not grant funded). Yr 5- Song (75%), Harding-Dekam (75%), Higgins (70%), Reinsvold (35%).*					
1.3-1.7, 4.1, 4.2	Scholars enroll in culture, language, mathematics, and science, content group tutoring, ESL, mathematics and science methods, practicum, and student teaching courses as part of their degree requirements (Aug-May). *Personnel: Reinsvold (10%/year).*					
1.3-1.7, 2.2-2.6, 3.1, 3.2, 4.1, 4.2	Participants take part in 4, 5-day Summer Institutes in to explore, understand, reflect, and plan to teach mathematics and science effectively to ELs. (Jun).					

Objective	MAST-EL Activity	Year 1 7/11–6/12	Year 2 7/12 – 6/13	Year 3 7/13 -6/14	Year 4 7/14 –6/15	Year 5 7/15–/16
	Personnel: Song (20%/year), Harding-Dekam (20%/year), Higgins (20%/year), Franklin (20%/year), 4 Administrators (each 100%/year), 4 Instructional Coaches (each 20%/year). Yr 1-2- Reinsvold (30%/year), Yr 3-4-Reinsvold (20%)					
3.1, 3.2, 4.1, 4.2	After-school activities for K-5 ELs and families (Jul–Jun). *Personnel: Higgins (5%), Reinsvold (5%).*					
1.2- 1.7, 2.1-2.6, 3.1, 3.2, 4.1, 4.2	Management Team meet quarterly to plan and evaluate all activities; (August, October, January, April). *Personnel: Song (5%/year), Harding-Dekam (5%/year), Higgins (5%/year), Franklin (10%/year), 4 Administrators (not grant funded), Evaluators (10%). Reinsvold (10%/year),*					
1.2-1.7, 2.1-2.6, 3.1, 3.2, 4.1, 4.2	Evaluation data is collected, analyzed, and reported to guide project activities. *Personnel: Yr 1-5- Evaluators (80%). Yr 1-4- Reinsvold (10%), Franklin (10%), Yr 5- Franklin (30%), Reinsvold (30%)*					

EVALUATION PLAN

Data Preparation. The analyses described below will be always preceded by data inspection and cleaning to determine the presence of outliers, missing observations, and potential data errors. In addition, distributional characteristics of the data (i.e., normality) will be determined before any potential statistical analyses are conducted. Whenever possible, we will try to combine analysis to reduce its number. In the cases when it is not possible, we will use family-wise procedures to reduce the potential for type I errors. Finally, in consultation with the management team, potential covariates will be collected whenever possible to both boost the power of the analyses, as well as to correct in the case of selection bias during the assignment, and try to match the groups as much as possible using techniques like propensity scores (Rosenbaum & Rubin, 1983)

General Evaluation Plan. There are multiple outcomes associated with the MAST-EL program, including the direct recipients of the program (MAST-EL Scholars and MAST-EL Teachers), which includes improvement in confidence in teaching mathematics and science to ELs, increase in the knowledge that culture, identity, and language play in learning math and science, increase in knowledge of mathematics and science, increase in pedagogical knowledge, and effectiveness in teaching. There are also outcomes to be observed on the students (science and mathematics achievement), parents (satisfaction), and administrators (satisfaction with the UNC partnership) associated with the program. To address all these outcomes, a mixed-method evaluation plan will be developed to: a) provide empirical evidence of the effects of the program in producing the intended results; b) provide evidence to project administrators and partners, on the effectiveness of the intervention; and c) support the improvement of Mathematics and Science teaching and learning across the grade levels under study. In addition, a number of

process evaluation data will be collected and are described after the outcomes evaluation section. A calendar of data collection is included at the end of the evaluation section. The evaluation approach for each outcome is described below.

Changes in MAST-EL Scholars. Three strategies will be used to study the impact of the program on MAST-EL Scholars. Two strategies will use quantitative data, and one will use mixed, quantitative and qualitative data. These different strategies will allow the project team to study different aspects of impact of the program in the MAST-EL scholars. The first strategy, associated with **objective 1.6**, will assess the change in confidence when teaching mathematics and science to ELs. MAST-EL scholars will complete a self-efficacy questionnaire about their teaching mathematics and science to ELs at the beginning and at the end of each project year starting with year 2 of the project and throughout the life of the grant. The questionnaire will be identified or developed by the MAST-EL management team during the first year of the project. Improvements in confidence will be measured as a positive change in confidence over time, and as a function of the Scholar's level of participation in the MAST-EL activities. The second strategy, associated with **objective 1.7,** will address effectiveness in teaching math and science to ELs, and will use a mixed-methods approach. UNC faculty members will assess the student's Student Teaching Portfolio during the second semester of project year 4 (Scholars' student teaching experience) through an assessment protocol. UNC Scholars' supervisors will also assess effectiveness in teaching through a classroom observation rubric and the Scholars' students' achievement data in year 5 of the project, when the scholars are in their first year of teaching. The assessment protocol and the classroom observation rubric will be developed by the MAST-EL management team during the first year of the project. Improvement in teaching effectiveness will be measured as a positive change in effectiveness over time, and as a function

of the Scholar's level of participation in the MAST-EL activities. The third strategy will assess MAST-EL scholars' increase in knowledge of mathematics and science content and will use a quantitative approach. MAST-EL scholars will answer a Mathematics and Science test of knowledge at the beginning and at the end of the first project year, and once a year in years 2-4. The assessment tool will be a revised version of the test currently used at UNC to address mathematics and science knowledge. Improvements in mathematics and science will be measured as a positive change in scores from their pre- to their post-scores.

Changes in MAST-EL Teachers. Five strategies will be used to study the impact of the program on participating MAST-EL teachers. Three strategies will use quantitative data, and two will use mixed, quantitative and qualitative data. These different strategies will allow the project team to study different aspects of impact of the program in MAST-EL teachers. The first strategy, associated with **objective 2.1**, will assess the change in knowledge of the role of culture, cultural identity and language when teaching mathematics and science to ELs. MAST-EL teachers will answer a questionnaire about their knowledge of the impact of culture, cultural identity and language when teaching mathematics and science to ELs. The questionnaire, developed by the MAST-EL management team during the first year of the grant, will be administered at the beginning and at the end of each project year starting in project year 2. Improvements in Teachers' knowledge will be measured as positive changes over time and as a function of their level of participation in the MAST-EL activities. The second strategy, associated with **objective 2.2** will address change in content knowledge using a Mathematics and Science test. The test of knowledge will be administered to MAST-EL teachers at the beginning and end of project year 2, and once a year afterwards throughout the grant. The assessment tool will be a revised version of the test currently used at UNC to address mathematics and science

knowledge. Improvements in mathematics and science will be measured as a positive change in scores from Teachers' pre- to their post-scores. Test scores collected will be analyzed as teachers' change of knowledge over time, and as a function of teachers' level of participation in the MAST-EL activities. The third strategy, associated with **objective 2.3** will address change in pedagogical content knowledge throughout the grant using a mixed-method approach. First, a pedagogical content knowledge test will be created to assess changes in pedagogical knowledge. Improvements in pedagogical knowledge will be measured as improvement in scores over time, and as a function of the teacher's level of participation in the MAST-EL activities. In addition to knowledge assessment, MAST-EL teachers' pedagogical improvement will be measured through classroom observations during their teaching. Observations will be guided by and recorded in a classroom observation rubric. Feedback will be provided to highlight improvements as well as areas for growth. The fourth strategy, associated with **Objective 2.4,** will address changes in confidence in MAST-EL teachers. MAST-EL teachers will complete a self-efficacy questionnaire about their teaching mathematics and science to ELs at the beginning and end of each project year starting with year 2 of the project and throughout the life of the grant. The self-efficacy instrument will be the same mentioned in objective 1.6. Improvements in confidence will be measured as a positive change in confidence over time, and as a function of Teachers' level of participation in the MAST-EL activities. The fifth strategy, associated with **Objective 2.5,** addresses effective mathematics and science teaching to ELs, and will use a mixed-methods approach. UNC faculty members will assess teaching effectiveness via classroom observations which will be guided by and recorded through a classroom observation rubric on effective teaching. This rubric will be the same as the one referred to for objective 1.7. Feedback will be provided to MAST-EL teachers to highlight improvements as well as areas for growth. In

addition to the classroom observations, effectiveness in teaching will be measured using data collected through the common classroom-based assessments in mathematics and science. Data from classroom observations and common classroom-based assessments will be collected two times a year starting in year two of the project and throughout the life of the grant.

Changes in satisfaction with MAST-EL partnership. Two strategies will be used to study the satisfaction of teachers, administrators and family members of the students impacted by the program. The first strategy will use mixed, quantitative and qualitative data, while the second strategy will use quantitative data. **Objective 3.1** addresses Scholars', Teachers', and administrators' satisfaction with the MAST-EL program, and will use a mixed-methods approach. MAST-EL Scholars, Teachers, and administrators will answer a survey to assess their satisfaction with the program at the end of each project year throughout the life of the grant. In addition to the satisfaction survey, annual focus groups will be conducted with MAST-EL Scholars and Teachers, and annual semi-structured interviews will be conducted with school administrators. Focus groups and interview data will be used to understand the project participants' satisfaction with the project as well as the impact of the MAST-EL project in their classrooms and schools. **Objective 3.3** addresses satisfaction with the MAST-EL program from family members of the students impacted by the program. An English and Spanish satisfaction survey will be identified or developed by the project evaluator to address satisfaction. The survey will be administered after each after-school student/family activity takes place throughout the life of the grant.

For the objectives described above (except for objective 3.3), we propose the use of Repeated Measures Analysis of Variance, since in all these cases we will have multiple measures of the outcome. Other options (i.e., Hierarchical Linear Models or HLM) were not considered

due to the small number of individuals to be included in the analysis. Significant results will be followed by post-hoc analysis to determine significance. In those cases, we will use Bonferroni corrections to reduce the potential for type I error. Regarding Objective 3.3, it is likely that individuals attending family activities will not be the same from year to year and not even from activity to activity; therefore, changes in satisfaction from year to year will not be submitted to statistical comparisons, but will be used to inform the development of those activities throughout the life of the project.

Changes in Students' Achievement. For objectives 4.1 and 4.2 addressing increase in K-5 English Learner achievement in mathematics and science, a hierarchical linear model (HLM) is proposed. The proposed model will have 3 levels: level 1 = repeated measures, level 2 = student, and level 3 = teacher, with the following information:

Level 3: Teachers	Group (20-30 individuals in treatment group, 20-30 individuals in the control group). Covariates: years of experience as teachers (0 for Pre-service); level of participation on MAST-EL (0 for control)
Level 2: Students	Approximately 25 students/classroom Covariates: Gender (M-F); Grade (3-4-5); Other covariates to be determined
Level 1: Repeated measure	3 Scores on math-science throughout the year Covariates: To be determined, but may include attendance

Using Optimal design (Spybrook, J., Raudenbush, S.W., Congdon, R., & Martinez, A., 2009), power estimates have been run to estimate the minimum effect size that can be detected. It was assumed a minimum of 3 observations per student, 25 students per classroom, and either 40

teachers (20 in the control group, 20 in the MAST-EL group), or 60 teachers (30 in the control group, 30 in the MAST-EL group), variability between students of 0.1, and variability among teachers of 0.12. Under these conditions, the study can detect a minimum medium ($\delta = 0.32$) effect size. Preliminary estimates suggest that the effect size that may be observed might be between medium ($\delta = 0.25$) and large ($\delta = 0.5$); thus, the present study provides enough power given the model to detect significant differences.

Process Evaluation Data. Data will be collected from a number of indicators to evaluate that the project is running as planned. This process evaluation will provide the MAST-EL Management Team with the data for data-based decision making of the project. In year 1 of the project, data will be collected from: 1) Pre-service teachers – data on recruitment, PLC and summer institute participation, development of after-school activities for families, and GPA records. 2) Recruitment of teachers from partner schools. 3) Management team data on PLC and quarterly meetings participation, and assignment of Scholars to partner schools. During years 2-5 of the project, data will be collected from: 1) Scholars – data on PLC and summer institute participation, development of after-school activities for families, and GPA records. 2) In-service teachers – data on PLC and summer institute participation, and development of after-school activities for families. 3) Management team data on PLC and quarterly meetings participation. In addition, during year 5 of the project data will be collected on Scholars on their dual endorsement certification and placement in instructional settings serving ELs, as well as data on teachers from partner schools who complete endorsement requirements in EL instruction as a result of their participation in the project.

Calendar of Data Collection.

Project Yr 1: 7/2011 - 6/2012	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.
Pre-service teachers/ ~~MAST Eolars~~												
Recruitment			XX									
PLC attendance			XX	XX	XX	XX	XX	XX	XX	XX		
Summer Institute attendance												XX
After-school activities for families				XX				XX				XX
GPA records							XX					XX
Math & science knowledge		XX									XX	
Teachers												
Recruitment									XX			
Management team												
PLC attendance			XX	XX	XX	XX	XX	XX	XX	XX		
Qtly meetings participation		XX		XX			XX			XX		
Assignment of scholars to												XX

	partner schools												
Partner schools													
	Partnership satisfaction											XX	
Families													
	After-school satisfaction				XX				XX				XX
Project Yrs 2-5: 7/2012 - 6/2016		**Jul**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**	**Jan.**	**Feb.**	**Mar.**	**Apr.**	**May.**	**Jun.**
MAST-EL Scholars and Teachers													
	PLC attendance			XX	XX	XX	XX	XX	XX	XX	XX		
	Summer Institute attendance												XX
	After-school activities for families				XX				XX				XX
	GPA records (only Scholars)							XX					XX
	Knowledge of culture, identity & language		XX									XX	
	Math & science knowledge											XX	
	Pedagogical knowledge											XX	

	Confidence in teaching		XX								XX		
	Effectiveness in teaching (Scholars only in years 4 & 5)		XX								XX		
Management team													
	PLC attendance			XX	XX	XX	XX	XX	XX	XX	XX		
	Qtly meetings participation		XX		XX			XX			XX		
	Assignment of scholars to partner schools												XX
Partner schools													
	Partnership satisfaction											XX	
Families													
	After-school satisfaction				XX				XX				XX
Students of Scholars and Teachers													
	Test of math & science knowledge (only in year 5)		XX					XX				XX	

REFERENCES

Ball, D. & Hill, H. (2009). Measuring teacher quality in practice. In D. Gitomer (Ed.), *Measurement issues and assessment for teaching quality* (pp. 80-98). Los Angeles: Sage.

Bruno, M., Solis, J., & Mosqueda, E. (2011). Pre-service teacher efficacy and practices with responsive science pedagogy for English learners. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, Orlando.

Castro, A. (2010). Themes in the research on preservice teachers' views of cultural diversity: Implications for researching millennial preservice teachers. *Educational Researcher*, 39 (3), 198-210.

Colorado Department of Education, 2010 CSAP scores. (http://www.cde.state.co.us/cdeassess).

De Jong, E. & Harper, C. (2005). Preparing mainstream teachers for English-language learners: Is being a good teacher enough? *Teacher Education Quarterly,* 32 (2), 101-124.

Echevarria, J., Vogt, M. E., & Short, D. (2010). *The SIOP Model for teaching mathematics to English learners*. Boston: Pearson Allyn & Bacon.

Franklin, E. (2011). Teaching linguistically diverse students in a middle level science classroom: Perspectives and contradictions from an experienced teacher. Paper presented at AERA, New Orleans.

Garcia, O., Kleifgen, J. & Falchi, L. (2008). From English language learners to emergent bilinguals. *Equity Matters: Research Review No.1.* Teachers College, Columbia University.

Genesee, F., Lindholm-Leary, K., Saunders, W., & Christian, D. (Eds.). (2006). *Educating English language learners: A synthesis of research evidence.* Cambridge: Cambridge University Press.

Gonzalez, N., Moll, L., & Amanti, C. (2005). *Funds of knowledge: Theorizing practices in*

households, communities, and classrooms. Mahwah, NJ: Lawrence Erlbaum.

Harding-Dekam, J., Franklin, E., Hamilton, B., & Romero, D. (2010). Improving teacher education for diverse schools: A qualitative case study of twelve student teachers. Unpublished manuscript.

Hollins, E. & Torres-Guzman, M. (2005). Research on preparing teachers for diverse populations. In M. Cochran-Smith & K. Zeichner (Eds.), *Studying teacher education: The Report of the AERA Panel on Research and Teacher Education* (477-548). Mahway, NJ: Lawrence Erlbaum.

Lee, O. & Buxton, C. (2010). *Diversity and equity in science education: Research, policy, and practice.* New York, NY: Teachers College Press.

Lucas, T. & Grinberg, J. (2007). Responding to the linguistic reality of mainstream classrooms. In M. Cochran-Smith, S. Feiman-Nemser, and D.J.McIntyre (Eds.), *Handbook of research on teaching: Enduring questions in changing context* (Third Edition) (606-636). New York: Routledge.

Lucas, T., Villegas, A., & Freedson-Gonzalez, M. (2008). Linguistically responsive teacher education: Preparing classroom teachers to teach English language learners. *Journal of Teacher Education,* 59, 361-373.

Medina, B. (2010). Linguistically diverse learners in Colorado: A State of the state. Denver: English Language Acquisition Unit, Colorado Department of Education.

National Research Council. (2010). *Preparing teachers: Building evidence for sound policy.* Washington, D.C.: The National Academies Press.

Pedraza, P. & Rivera, M. (Eds.). (2005). *Latino education: An agenda for community action research.* Mahwah, NJ: Lawrence Erlbaum.

Rosenbaum, P. R. & Rubin, D. B. (1983). The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika*, 70, 41–55.

Rosebery, A. & Warren, B. (Eds.). (2008). *Teaching science to English language learners: Building on students' strengths.* Arlington, VA: National Science Teachers Association.

Schleppegrell, M. (2004). *The Language of schooling: A functional linguistics perspective.* Mahwah, NJ: Lawrence Erlbaum.

Short, D., Vogt, M., & Echevarria, J. (2011). *The SIOP model for teaching science to English learners.* Boston: Pearson Allyn & Bacon.

Shuman, L. (1987). Knowledge and teaching. *Harvard Educational Review,* 57 (1), 1-22.

Sleeter, C. (2008). Preparing white teachers for diverse students. In M. Cochran-Smith, S. Feiman-Nemser, & D. J. McIntyre (Eds.), *Handbook of research on teachers: Enduring questions in changing context* (559-582). New York: Routledge.

Spybrook, J., Raudenbush, S.W., Congdon, R., & Martinez, A. (2009). Optimal Design for Longitudinal and Multilevel Research: Documentation for the Optimal Design Software V.2.0. Available at www.wtgrantfoundation.org

Stoddart, T., Solis, J., Tolbert, S. & Bravo, M. (2010). A framework for the effective science teaching of English language learners in elementary schools. In D. Sunal, C.S. Sunal, & E. Wright (Eds.), *Teaching science with Hispanic ELLs in K-16 classrooms* (151-181). Charlotte, NC: IAP.

Sunal, D., Sunal, C., & E. Wright. (Eds.). (2010). *Teaching science with Hispanic ELLs in K-16 classrooms.* Charlotte, NC: IAP.

U.S. Department of Education (2009), Institute of Educational Services, National Center for Educational Statistics, National Assessment for Educational Progress (NAEP), 2009

Mathematics Assessment & Science Assessment.

U.S. Government Accountability Office. (2009). *Teacher Preparation: Multiple Federal Education Offices Support Teacher Preparation for Instructing Students with Disabilities and English Language Learners but Systematic Departmentwide Coordination Could Enhance this Assistance.* Washington, D.C.: Judith Wilde. Http://www.gao.gov.

Valencia, R. (Ed.). (2011). *Chicano school failure and success* (Third Edition). New York: Routledge.

Zentella, A. (Ed.). (2005). *Building on strengths: Language and literacy in Latino families and communities.* New York: Teachers College Press.

Zimpher, N. & Jones, D. (2010). *Transforming teacher education through clinical practice: A national strategy to prepare effective teachers.* Report of the Blue Ribbon Panel on Clinical Preparation and Partnerships for Improved Student Learning. NCATE (www.ncate.org).