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ABSTRACT

This paper explains that to educate all students is the shared responsibility of partnerships within higher education and between higher education and the schools. The Partnership for Excellence in Teacher Education (PETE) incorporates this "whole village" approach into the design and implementation of school-based science and mathematics teacher education. It is guided by systematic renewal efforts in El Paso, Texas, and maintains a partnership linking the College of Education, the College of Science, the public schools, and parents and communities. Teams of mathematics, physics, and education faculty integrate activities and curriculum into local public schools. University classes are taught in public schools, with preservice teachers going into classrooms to teach content and practice pedagogy. College faculty observe student teachers' teaching performance and provide feedback. Student teachers keep reflective analysis logs. The integrated team-taught field model assumes that the program will increase students' mathematics and science content knowledge, pedagogical skills, and level of teaching performance and will change preservice teachers' negative perceptions toward mathematics and science learning and teaching. This paper describes how the mathematics and science blocks incorporate the "whole village" approach and work to change student's attitudes. (SM)

Keeping the Whole Village Together: Sharing Responsibility for the Learning of All Students

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Introduction

Educational institutions have long struggled with the fragmentation of teacher preparation – the separation of theory from practice and of content knowledge from pedagogy. Traditionally, pre-service teachers learned subject matter from content courses in arts and sciences and learned pedagogical theory from education courses. Only then were the student teachers sent into the "field" to practice what they had learned in the academy to "real students" in "the real world" (Patterson, Michelli, Pacheco, 1999). The effect has been that beginning teachers have been handed the challenge and responsibility to integrate the seemingly disparate and disconnected experiences into a framework for teaching and bringing it into the world of the classroom.

Grounded in the belief that preparing teachers to educate *all* students is the *shared responsibility* of partnerships within higher education and between higher education and the schools, frameworks and organizational constructs addressing the renewal of teacher education in collaboration with the schools have emerged. "Because this task of being an effective teacher is so complex and involves so many different kinds of knowledge and skills, success is dependent upon a broad and deep collaboration" (Pacheco, 2000). These frameworks and organizational constructs challenge the traditional fragmentation and organizational structure of teacher preparation programs by positing a "whole village approach" to teacher preparation.

One such holistic organizational construct is the idea of "centers of pedagogy" – dynamic organizational structures and processes that support educational renewal through bringing together in new ways the components of teacher education with the realities of schooling (Patterson, Michelli, Pacheco, 1999). These structures combine the knowable (the known components of teacher education and the realities/responsibilities of schooling) with the unknowable (new types of linkages among the components of teacher education and the changing realities/responsibilities of schooling).

[1] The Partnership for Excellence in Teacher Education (PETE) is supported by the National Science Foundation (NSF-DUE-9453612).

The Partnership for Excellence in Teacher Education

Although a center for pedagogy has not yet been established, the Partnership for Excellence in Teacher Education (PETE) incorporates a "whole village approach" into the design and implementation of school-based teacher education in science and mathematics. This approach, guided by the systemic renewal effort in El Paso, is designed to establish and maintain a three-way partnership for teacher preparation: the College of Education, The College of Science, and the public schools. In addition to these three partners, a critical fourth partner is necessary for the renewal, parents and communities. As field-based courses develop, pre-service teachers confront the issue of drawing "parents into the life of the school in significant ways" (Pacheco, 2000).

The Partnership for Excellence in Teacher Education is a National Science Foundation Collaborative for Excellence in Teacher Preparation (CETP) project that brings key educational stakeholders, who have historically contributed to teacher education and its fragmentation, to work together to meet the challenge of preparing teachers in mathematics and science and increasing the mathematics and science literacy of all pre-service teachers. Faculty and administrators from the Colleges of Education and Science and the administrators and teachers in the public schools *share organizational structures and the responsibility* for pre-service teachers (1) learning mathematics and science deeply, (2) learning how to teach mathematics and science in ways that foster the learning of K-12 students, (3) learning about and working with parents and community to develop school-community partnerships, and (4) continuing successful careers in the schools.

The project has four major goals:

- To establish an ongoing partnership for the reform of science and mathematics teacher preparation among the College of Education and the College of Science at The University of Texas at El Paso and the El Paso Community College, and the three major public school districts in El Paso.
- To redesign the teacher preparation curricula for selected education, mathematics, and science courses to reflect current research on teaching and learning.
- To recruit and retain promising students in the teaching profession, with particular attention to students from under-represented groups.
- To establish mechanisms for the enhancement of teaching by education, mathematics, and science college faculty and K-12 teachers, emphasizing learning about and implementing new techniques in pedagogy.

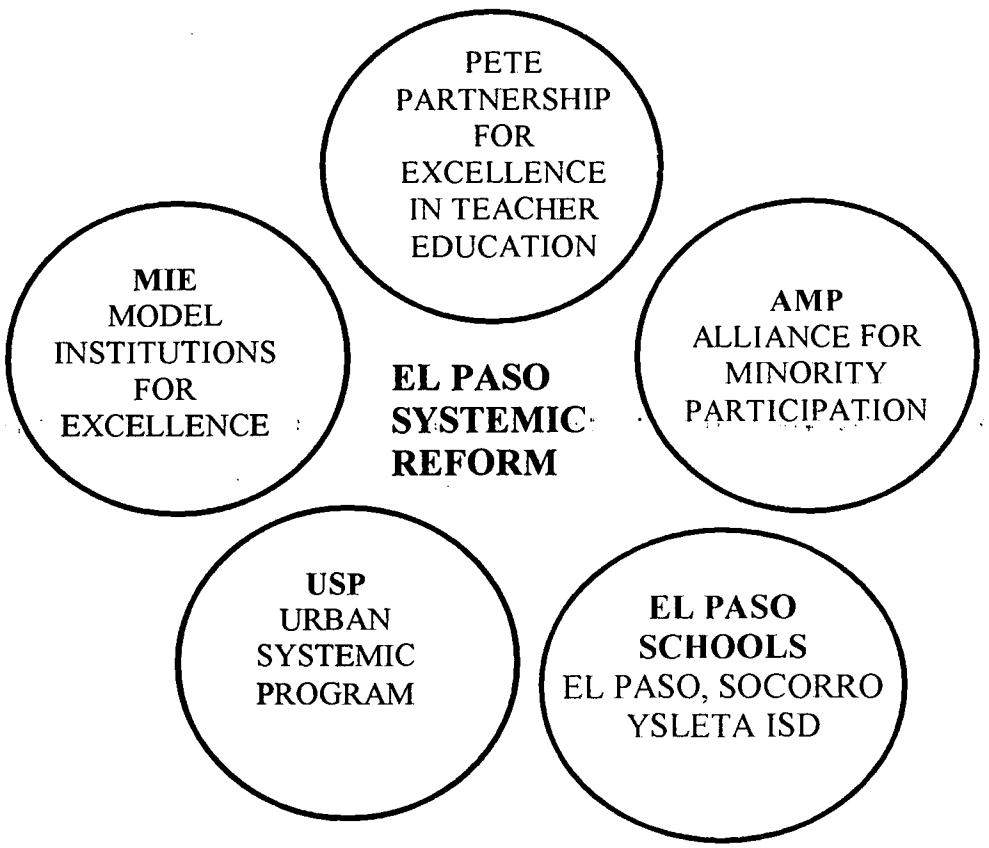
PETE's "whole village approach" can not be understood without a description of the context of the network of educational reform in which it exists. The Partnership for Excellence in Teacher Education (PETE) is part of a larger systemic reform effort in education (K-16) across the El Paso region that was initiated in 1992 with the formation of the El Paso Collaborative for Academic Excellence. In early 1992, the President of the University of Texas at El Paso brought together the key stakeholders in the educational community of El Paso – the superintendents of the three largest school districts (representing 130,000 students), the present of the El Paso Community College, the heads

of the two chambers of commerce, the Mayor and the County Judge, and the lead organizer of the most active and effective grass-roots community organization in the region. Together, they launched the El Paso Collaborative, which is a community-wide systemic reform effort aimed at improving the academic achievement of *all* students in El Paso, K-16 through improving the existing teacher force in El Paso. The Partnership for Excellence in Teacher Education focuses on developing excellence in preservice teacher preparation in mathematics and the science and is designed to complement and extend the initial efforts of the El Paso Collaborative.

While PETE focuses on the renewal of teacher education in science and mathematics and extends the work of the College of Education and the teacher education program, four on-going initiatives and/or partners focus on other aspects of the renewal of education in the region. (See Exhibit 1: El Paso Systemic Reform)

Exhibit 1. El Paso Systemic Reform

El Paso Collaborative for Academic Excellence



The El Paso Urban Systemic Program provides training to *existing* K-12 teachers in standards-based instruction in science, mathematics and literacy. This effort is funded by the National Science Foundation and is designed to facilitate systemic change that supports all students in reaching high standards in mathematics and science achievement. The Alliance for Minority Preparation (AMP) is a bridge program for science, engineering and mathematics students and is funded by NSF and is designed to increase the number of students who go on to careers in research in science, engineering and mathematics. Another NSF project is the Model Institutions for Excellence (MIE) that focuses on improving the quality of science, engineering, and mathematics undergraduate programs and increasing the number of traditionally under-represented students who graduate in those fields and go on to graduate programs. At the district level and the school level the three El Paso Independent School Districts work collaboratively with each initiative in partnership-specific ways. With the Urban Systemic Program (USP), districts have work with the university and community college to set high standards for graduation. In addition, USP provides programmatic activities to increase the capacity of the schools to meet the demands of reaching high standards. Students from the three school districts participate in AMP activities during the summer and students who enrolled at the university participate in a required summer orientation supported by MIE in which students become acquainted with the university and its science, engineering and mathematics programs.

At the university and public school level, the Colleges of Education and Science and the partner schools work closely on integrating the learning of mathematics and science with learning how to teach mathematics and science. PETE works through the teacher education program to (1) implement linked and blocked courses in mathematics, science and education that have been redesigned to incorporate standards-based instruction; (2) conduct field-based courses in partnership schools in which university faculty and public school teachers mentor and supervise student teachers and (3) design degree programs that meet the needs of the schools and the Texas educational system.

Three sets of linked and blocked courses for students who plan to teach grades K-8 have been established: a campus based block, a mathematics-oriented block and a science-oriented block. In each block of courses students are required to engage in clinical practice in the partner schools. In all, students spend approximately 620 clock hours of field experience in partnership professional development schools while completing 33 hours of required coursework. In the field setting, university faculty and teachers mentor and supervise the students in the schools. To facilitate the design and implementation of the blocks, the Colleges of Education and Science worked to revise the elementary and middle school degree plan to require all students to take more mathematics and science. (See Exhibit 2. Elementary and Middle School Teacher Education Blocks)

Exhibit 2. Elementary and Middle School Teacher Education Blocks

Campus Block	Block I	Block II
• EDPC 3300 – Developmental Variations • ENGL 4354 – Writing Processes of Children • RED 4341 – The Diagnostic Teaching of Reading	• ELED 3302 – Principles and Practices of Learning in the Elementary School • ELED 3310 – Teaching Mathematics in the Elementary School • ELED 4393 – Internship in Elementary and Middle School I • Math 2303 – Properties of Real Numbers I	• ELED 3311 – Teaching Science in the Elementary School • ELED 4394 – Internship in the Elementary and Middle School II • PSCI 3304 – Physical Science II • SOSC 3330 – Integration and Alternative Representations of Basic Social Science Principles

Secondary school pre-service teachers enroll in two field-based blocks of courses.

Exhibit 3. Secondary School Teacher Education Blocks

Secondary Field-Based Block I	Secondary Field-Based Block II
• EDPC 3300 – Developmental Variations • RED 3342 – Reading and Study in the Content Areas • SCED 3311 – Curriculum Planning in the Elementary School • SCED 3317 – Multicultural Education in the Secondary School	• SCED 4691 – Student Teaching in the Secondary School • SCED 4367 – Teaching Mathematics in Secondary School • SCED 4368 – Teaching Science in Secondary School

To meet the needs of the schools and the Texas educational system four new secondary degrees have been established: BS Earth Science, BS Life/Earth Sciences, BS Natural Sciences and BS Physical Sciences.

A Whole Village Approach to Science and Mathematics Education: Two Examples

A "Whole Village Approach" is the basis for the science and mathematics education of pre-service teachers in the teacher education program at UTEP. The PETE collaborative has formed a unique learning community among the Colleges of Science and Education, the public schools and future teachers that is manifest in the linked and blocked courses that make up the Science Block and Mathematics Block in teacher education. A learning community is characterized by a vision of faculty, students, administrations and the larger community "working collaboratively toward shared, significant academic goals in environments in which [all involved] … have the opportunity and the responsibility to learn from and help teach each other" (Goodsell Love, 1999). Learning communities

- Provide an opportunity to integrate courses in an interdisciplinary manner.

- Help students form social networks among their peers.
- Increase student involvement.
- Improve student performance.
- Impact student retention.
- Provide opportunities for faculty development.
- Shift the focus to student learning outcomes.
- Allow educators to rethink the ways by which students are taught.
- Become a lens through which the experiences of students at a particular college can be understood.

Descriptions of two examples of the "whole village approach" in science and mathematics education are presented below. University faculty, teachers and principal share responsibility for the preparation of future teachers so that *all* students in public schools have the opportunity to be taught by qualified math and science teachers.

The Math Block: Properties of Real Numbers, Mathematics Methods, and Curriculum Development. The mathematics block combines three courses, one from the College of Science (Mathematics Department) and two from the College of Education. The university students are enrolled in the first semester of their senior year of their college program that is called Block I. The faculty members teach their classes in a local middle school with the exception of the computer work done Wednesday morning from 8:00-9:30 at the university campus. The classes are on Monday and Wednesday from 8:00-12:15 and all three faculty are there for the entirety of the allotted time. Each course represents one of the components from the theoretical model. The mathematics course (content) is taught using a project approach to learning. The mathematics methods course (pedagogical skills) reinforces this approach to teaching adding standards-based instruction, reflective analysis, and approaches to assessment. The curriculum course (performance) requires application of concepts and skills learned in the other courses. The courses have combined assignments with each instructor grading the assignment according to his or her expectations. Common assignments for all three courses include a videotape of the university student teaching, a reflective essay, written journals containing explanation of the student's thinking as they work through the mathematical problems and the teaching act, and a portfolio of their work from the semester as the final grade. The grading scale consists of a "minus", "check", and "check plus" assigned to each project with a redo option. An established number of "check pluses" is considered an "A" and so forth. The last hour of each Wednesday session, the university students move into classrooms in the middle school and the adjacent elementary school and teach mathematics lessons modeled by the university faculty. During this teaching segment the university faculty, along with the classroom teachers observe the teaching behavior and make notes concerning content and teaching skills. Suggestions for improvement are provided for each student. Before the university student receives the written feedback they have a short reflective period where they self analyze their teaching and plan for ways to improve the lesson as they perceived it. Then comparisons are made between their perceptions and the university and school faculty expectations. As the university students gain confidence in their teaching they take over the design of the lessons and

turn in lesson plans prior to their teaching. In addition on Mondays students from the Middle School classrooms come into the university room and are interviewed concerning their thinking. The field placement of these students is widespread through out the local school districts.

Strategies for changing students' perceptions.

A majority of the elementary pre-service teachers enter the blocks with previously developed negative perception and attitude toward learning and teaching of mathematics. In order to change this perception and make it more positive, we use the following strategies:

- Mathematically friendly teaching philosophy
- Conceptually rich instructional sequence
- Problem solving peer/students interviews.

Middle School Site. Since the school opened in 1987 it has played an important role for its community by implementing language acquisition programs and hiring Spanish speaking teachers to accommodate the large flux of students coming from Mexico. Student enrollment is 90.8 percent Hispanic. African American students comprise a 0.8 percent of the student body while 8 percent of the students are White. 85% of the students are considered disadvantaged. The school supports the pilot study by providing space and classroom time for student teachers to teach and learn mathematics. The placement at the school facilitates student intern's opportunity to modify and teach what they learned in their university mathematic courses to middle school students and get immediate feedback on their teaching performance.

The Science Block: Physical Science, Science Methods, and Critical Pedagogy. The science block combines three courses, one from the College of Science and two from the College of Education. The physical science course is taught by a nuclear physicist, one education course is taught by a science methods instructor, and the third course is a social science course taught by an education professor. The university students are in their final semester of college program which is called Block II. The faculty members teach their classes in a local elementary school and the faculty are there for a minimum of six hours a week. The sample of university students is voluntary and all participants are well aware of the research, expectations, and freedom to leave this science block and transfer to another group of classes. The classes are on Tuesday and Thursday from 8:30-11:30 and Tuesday afternoon from 1:30-3:30.

The physical science course is taught using a hands-on active inquiry approach to learning. The science methods course reinforces this approach to teaching adding standards-based instruction, reflective analysis, and approaches to assessment. The course includes journal writing and pre- and post- videotaped segments of each university student teaching in classrooms. The actual teaching is balanced between the faculty depending on the expertise concerning lesson topics. The last hour of each Tuesday and

Strategies for changing students' perceptions

The approach is similar to the mathematics block teaching. The majority of the elementary pre-service teachers enter the blocks with previously developed negative perceptions and attitudes toward learning and teaching of science and little awareness of what they have learned in their science courses. In order to change this perception and make it more positive, we use the following strategies:

- Science friendly teaching philosophy
- Conceptually rich instructional sequence
- Close collaboration with the school site and teachers

The same philosophical background as the mathematics block is the base of the science block We use the following instructional sequence in the science block.

1. Posing a problem (the teacher poses to the class one challenging, rich, multistep problem/activity/project, which aims at high-order thinking skills development).
2. Small group work on the problem. This runs anywhere from 20 minutes to 1 hour depending on the project.
3. Written analysis of their work on data sheets or in science journals.
4. Application in the classroom of the teaching using standards-based inquiry-based science kits or other inquiry-based science lessons..
5. Reflective analysis of their teaching.
6. Whole class discussion (the whole class then decides which approach or approaches seem best. The teacher keeps asking questions if students seem to need help in making a decision. The teacher guides the students to correct reasoning patterns if all solutions prove to be incorrect).

To develop an understanding of how lessons fit into the classroom, how the classroom fits into the school, and how the school fits into the community, student interns examine, reflect and discuss the overarching issues in education in their critical pedagogy course. It is this course that student interns learn about working with and dealing with parents and see how the school is deeply connected (or not) to the community in which it resides

The Elementary School Site. The school was build 30 plus years ago and has only had three principals to date. The student population is 98% Hispanic and 85% disadvantaged. A large percentage of the students are first generation Americans, their families recently immigrated from Mexico. Most of the teachers had started teaching in this school and had been there for several years. Few of the teachers had been back to school or pursued new information on teaching and learning. The principal and the teachers met and decided on ways to change the climate of the school. They all agreed that they needed to recommit to progressive education. The campus became an open campus where parents can come and work in the schools, meet, and communicate concerns openly. The school took on the commitment of working with large groups of interns from the university and piloted the on-site teaching of university courses. The school and program soon

learning from the school, the teachers were learning from the interns, and the university faculty were learning from all concerned.

The school provides a science lab for the university courses and designated a classroom for university use. Science was rarely taught at the school until the science block moved in. Involvement with the program was voluntary and at first there were only a few teachers working with the project. Currently all teachers are including science in the weekly lessons and there is 100% participation in the program.

Summary

Adopting a "whole village approach" has challenged the traditional fragmentation and organizational structure of teacher education in science and mathematics. The establishment of partnerships within higher education and between higher education and the public schools has required the Colleges of Education and Science to work together with the schools to develop organizational structures that support the sharing of the responsibility for the learning of all students in science and mathematics. The Partnership for Excellence in Teacher Education has combined the known components of teacher education and the realities/responsibilities of schooling with new types of linkages among the components and the changing realities/responsibilities of schooling to create a holistic and systemic approach to the renewal of education.

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