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ABSTRACT

The Louisiana Collaborative for Excellence in the Preparation of Teachers (LaCEPT) was formed to respond to the National Science Foundation (NSF) proposal to implement changes to improve teacher preparation in science and mathematics. The program was designed to encourage improvement in curriculum and instruction in science and mathematics for preservice teachers by making funds available. This paper focuses on one university and examines factors influencing educational reform. Two departments in the process of making changes were analyzed. Areas examined exemplify possible impediments to systemic change such as administrative leadership, financial support, planning, and dynamic faculty dedicated to change. Data were developed using several data collection strategies. Structured interviews with deans, department chairs, faculty, and students were conducted. Committee meetings and faculty meetings were observed. Interviews were conducted during the planning stage and again during the implementation process. Interviewees were those directly concerned with the implementation of reforms. The key to systemic reform centered on administration, from the department chairman to the president. The talent, dedication, and successful teaching of a few faculty were insufficient for implementing systemic reform. Dynamic faculty are necessary, but administrative leadership, planning, and incentives must be present for the entire faculty to adopt change. Contains 14 references. (PVD)

Administrative Impediments to Reform and Curricular Change in Science/Mathematics for Preservice Teachers

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Administrative Impediments to Reform and Curricular Change in Science/Mathematics for Preservice Teachers

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Abstract

A case study at one university examines factors influencing reform of science/mathematics curriculum and instruction for preservice elementary teachers. The key to systemic reform centered around administration, from the department chairman to the president. The talent, dedication, and successful teaching of a few faculty were insufficient for implementing systemic reform.

Introduction

"Few elementary school teachers have even a rudimentary education in science and mathematics, and many junior and senior high school teachers of science and mathematics do not meet reasonable standards of preparation in those fields." This quote from *Science for All Americans* (Rutherford & Ahlgren, 1989) concisely states a problem that the National Science Foundation (NSF) attempted to address in the form of grants for teacher preparation to institutions of higher education. The NSF program solicitation and guidelines for Collaboratives for Excellence in Teacher Preparation in 1991 called for the establishment of pilot programs to improve teacher education in science and mathematics at institutions of higher education across the nation. Each participant institution was to serve as an experimental site to demonstrate success or failure of strategies for systemic change in science and mathematics instructional techniques and curriculum.

Society not only expects increasing competency from students in the area of problem solving but also demands higher-level learning for more students than ever before (Lanier, 1993). The continuing crisis in science and mathematics education mandates reform in science and mathematics teaching and assessment. Louisiana educators have recognized that reform is critical if these improvements are to be achieved.

A 1990 pilot program of the National Assessment of Educational Progress (NAEP) brought to light the extent of the problem in the performance of Louisiana students in science and

mathematics. In 1992 Hungerford, Cooney, Crisler, and Kepner reviewed Louisiana's programs for preparation of teachers. Several areas were found deficient. Graduating teachers were found to be lacking knowledge of new instructional technologies, assessment methods, content knowledge, and new teaching methodologies. Recommendations by Hungerford et al. included the following:

> (a) innovative teaching methods modeled by the faculty in the disciplines;
> (b) changes in the content and context for courses in the disciplines to conform to the recommendations made by the National Science Foundation, 1993), the National Research Council (NRC,1993), the National Council of Teachers of Mathematics (NCTM, 1989), the National Science Teachers Association (NSTA, 1989), and the American Association for the Advancement of Science (AAAS, 1990);
> (c) integration of technology such as calculators and computers into the curriculum; and,
> (d) integration of alternative assessment strategies with instructional activities. (LaCEPT Research Component, 1993)

Louisiana Collaborative for Excellence in the Preparation of Teachers (LaCEPT), a statewide program, was formed to respond to the NSF proposal to implement the needed change in teacher preparation. LaCEPT received NSF funding for a five year program to form collaborative projects among colleges and universities in the state to institutionalize statewide reform of teacher education in mathematics and science (LaCEPT proposal, p. 5) beginning May, 1994. Teacher preparation institutions in Louisiana formed collaboratives within the framework of LaCEPT to propose projects for planning and implementing reform of the preservice teacher programs. This paper focuses on one university and the problems which were encountered in reforming teaching and assessment. Two departments in the process of making changes exemplify possible impediments to systemic change--administrative leadership, financial support, planning, and dynamic faculty dedicated to change.

Related Literature

There are many impediments to changing curriculum and instruction in institutions of higher education. Lindquist (1978), in his classical case studies of change in higher education, provided examples and analyses of how change occurs. In all instances, the administrative level was the integral part in the successful implementation of change. He notes that institutions of higher education, despite being centers for innovative ideas, are particularly resistant to change.

Shymansky and Kyle (1992) reiterate Lindquist's findings of higher education's resistance to change by observing that reforming science and mathematics education is a difficult and lengthy process because so many parties must be involved. hey pose the question, "How can reform occur when there appears to be such inertia in the system at all levels?"

McClurg, Stepans, and Beiswenger (1996) in a longitudinal study of a teacher education program in elementary science found that administrative support is the seminal ingredient for development and successful implementation of an innovative project. Open communication of a cohesive team was noted as a key factor for preventing or solving conflicts which inevitably occur. McClurg et al. further suggest that administrative support in the form of tenure, promotion, and merit pay be incentives for continued success of this project and others.

Instruction by graduate students and science college teaching are vital areas of concern. Graduate students preparing to teach science in grades K-8 deserve a spotlight in the national reform initiatives. Because of their impact after graduation, future teachers need preparation in the scholarship of teaching and pedagogical practice. This is one area which may be overlooked when considering college reforms that potentially influence the scientific literacy of American youth.

Reform of college science teaching practices is a formidable undertaking. Suggestions of pedagogical instruction for university teachers who are involved in research pursuits do not accept changing their agenda enthusiastically. An interview respondent admits, "So unfortunately for the students, we haven't spent the needed amount of time thinking about these courses.

That's my personal opinion." Another reflects that, " . . . since we are a research department most of us think of ourselves as scientists first and maybe teachers second and so we don't keep up with educational development."

The Louisiana program was designed to encourage improvement in curriculum and instruction in science and mathematics for preservice teachers by making funds available. Departments with an interest collaborated with other departments and wrote proposals and received funds based on the merits of their proposals. Systemic changes were to include reforming science and mathematics content and pedagogy outlined by the National Research Council (1990), the National Council for Teachers of Mathematics (1991), and in *Benchmarks for Scientific Literacy (1993)*. Guidelines established in these sources also served to guide teacher preparation programs. Content area courses in mathematics and science were to emulate methodology taught in the colleges of education. The premise that "teachers teach as they were taught" is utilized by providing excellent models for preservice teachers.

The curriculum content material conforms to standards so that preservice teachers have thorough grounding in areas of their professional domain. Chiappetta and Fillman (1996) report that very few biology teachers are aware of literature which could facilitate understanding connections among the fundamental unifying ideas of biology.

Decision making for content selection can be more wisely chosen by teachers who have been prepared for their professions in institutions which stress "currere"(Pinar, 1974). "Currere" enables individuals to recognize an unfolding awareness during the educational experience allowing them to create personal meaning. Teachers evolve intellectually in such preservice programs and are better equipped for elements in the educational environment.

The standards based reform mathematics and science courses were primarily, but not exclusively, targeting preservice teachers. A secondary goal of the project was to exhibit how standards based reform teaching could enhance the learning for all students. In implementing the various projects, master teachers with broad experience in standards based reform teaching

were often utilized to instruct new methodologies to preservice teachers and college faculty.

The focus of this paper is on the progress of reform and the impediments encountered which deterred its implementation at one university. As part of a larger case study of the progress of change at several universities in Louisiana, this paper addresses the question: What are some impediments to systemic implementation of curricular changes in science/mathematics for preservice teachers?

Methods

The research design was that of a multiple-case study. This paper is the analysis of the data from two departments and the impediments encountered. Data were developed using several data collection strategies. Structured interviews with deans, department chairs, faculty, and students were conducted. Committee meetings and faculty meetings were observed. Case study methods were used in this research because of their appropriateness for the nature of the subject of institutional change. Merriam (1988) suggests that a case study is the ideal design for understanding and interpreting observations of educational phenomena. This paper is a preliminary observation and interpretation of data from one study site.

Data collection took place over two semesters during the second year of a collaborative project. Interviews were conducted during the planning stage and again during the implementation process. Interviews were taped and transcribed soon after the site visits. Particular questions were asked consistently by the interviewer so that specific answers could be referred to in the analysis. There was overlap of questions between administration and classroom instructors but in addition there were specific questions designed to deal with administrative perceptions. A total of seventeen interviews were conducted. The interviewees were those directly concerned with implementation of reforms.

Results and Conclusions

Several factors contributed to determination of which curricula were to be reformed. Dynamic faculty who are dedicated to excellent teaching is integral in every department if reform

is to be successful. Active strong support of the department chair, however, was the key to the institutionalization of change. Although funding is important and can facilitate change, leadership and aggressive promotion by administrators are essential for institutionalizing change. Dynamic faculty are necessary, but for the change to promulgate throughout the department, administrative leadership, planning, and incentives must be present for the entire faculty to adopt change.

In one department in the study, the need to alter teaching techniques and content had been recognized by some of the faculty and reforms had begun previous to project funding. The department chair and many innovative faculty had attended workshops and were working to improve instruction and to conform to the standards. LaCEPT funds were welcomed by the department as a way to expedite reforms already begun by the department chair and innovative faculty. With the NSF funds came support from higher administrative levels. The department was able to purchase new materials, to give the faculty freedom to suggest and create new courses, and to experiment with new ways of teaching without penalty. In addition, funds could be used for bringing in consultants and speakers and for faculty attendance at workshops, seminars, and professional meetings. All of these activities encouraged departmental faculty by stimulating interest and providing instruction for implementing new curriculum.

By the time NSF funds became available through LaCEPT, this department was well on its way to institutionalizing reformed curriculum and instruction at least in the minds of the chair and certain innovative faculty. The funds were used to expedite and facilitate reform, not to begin it. Support of the department chair was an essential factor in successful implementation of department wide reform. However, when queried about rewards associated with teaching activities, one faculty member responded, " . . . the university reward system, as we call it. What we do to plan courses and teach courses for teachers is not particularly valued by the . . . administration, in terms of tenure, promotions, raises; . . . I don't think that the administration values what we do." In spite of lack of active support at higher administrative levels, advocacy by the department chair seemed to be key to instituting reform departmentally. It is the departmental guidance which seemed to

exert the most influence in determining the tone for change in the individual subject areas.

In a second department at the same institution, interest in reform ensued only when funding became available. With the funds, plans were made to reform one course. However, when funding was discontinued, " . . . we sort of just stopped," according to one faculty member, and the course was never instituted. Several faculty members indicated that without funding, the department would not have considered any changes in the traditional instructional techniques. Without the active participation and promotion of the department chair, the faculty or singularly innovative faculty member was stifled in expending effort in an activity which was of little interest to the department or the department chair. The emphasis in this department was on scientific research rather than on teaching or education research. Merit and tenure were based on production of scientific research. Little recognition was awarded to excellence and innovation in teaching.

Both of the above departments were in the same university under administration of the same dean. The dean, although voicing support of the departments' participating in the teaching reform project, offered participants little incentive. Administrative support was, in his own words, "hands off." When funding decreased many changes were instituted piecemeal or discontinued. The administration did nothing to pick up the slack and see that reform efforts continued. When asked if participation in the NSF grant would affect promotion and tenure, one faculty member said, "I wish it did! No, the administration has been very supportive, but when it comes to . . . grant money brought into the university, somehow the [education] grants don't seem to count as much as the research grants in pure [science/mathematics]."

Disparity between the two departments' approaches to institutional change was apparent. Lindquist (1978) posits four change strategies based on assumptions about what motivates people: (1) rational planning, (2) social interaction, (3) human problem solving, and (4) political power. Upon close examination of the interviews, each of these assumptions about human motivation was shown to exert influence. However, the influence by each type of motivation was not equally distributed in the two departments. In the first department where change was more

successful, rational planning and social interaction were apparent. The political power of the department chair was exerted in promotion of change. Human needs of teaching faculty were gratified in the classroom by reform methodology. The participating faculty and their students communicated the message of satisfaction with other faculty in such a way that the receivers (other faculty) were stimulated and encouraged to become participants in reform. In addition, planning for implementation of reform included inservice professional development activities such as attendance at professional meetings, seminars presented by respected leaders in the field, and collaborative workshops with expert teachers to school faculty in the standards and methods.

In the second department, only the political power and financial considerations seem to have motivated the faculty. The political power in the department was passive and was not applied to promote change. Financial support appeared to be the only motivation for change among the faculty. In planning reform, allowances for communicating change to the faculty were insufficient. Without the financial support, with little administrative support, and little provision for professional development, the change process lost its attractiveness. The department had insufficient motivation to reform the curriculum, making systemic change improbable.

Institutions of higher education are often decades behind current thinking in the practice of teaching because of the various levels of communication and motivations involved in changing. Reforming the curriculum of a science or mathematics department even in these times of urgency and availability of funding will be slow without the proper attention to, not only to what to change, but also how to change an institution and the people involved.

In Louisiana the mandate for systemic curricular change in science/mathematics for preservice teachers is still in progress. Learning to deal with impediments must be addressed within each department if success is to be a reality.

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