DOCUMENT RESUME

ED 472 716 SE 067 142

AUTHOR	Ohana, Chris
TITLE	Preservice Teacher Cohorts and Their Implications for Mathematics and Science Education. Research Monograph.
INSTITUTION	National Inst. for Science Education, Madison, WI.
SPONS AGENCY	Wisconsin Univ., Madison. Graduate School.; National Science Foundation, Arlington, VA.
REPORT NO	No-19
PUB DATE	2000-03-00
NOTE	34p.
CONTRACT	RED-9452971
AVAILABLE FROM	National Institute for Science Education, University of Wisconsin-Madison, 1025 W. Johnson Street, Madison, WI 53706. Tel: 608-263-9250; Fax: 608-262-7428; e-mail: niseinfo@macc.wisc.edu; Web site: http://www.nise.org
PUB TYPE	Reports - Research (143)
EDRS PRICE	EDRS Price MF01/PC02 Plus Postage.
DESCRIPTORS	*Preservice Teacher Education; *Cohort Analysis; *Educational Change; Elementary Secondary Education; *Group Dynamics; Mathematics Education; Professional Development; Science Education; Teacher Education

ABSTRACT

Recent reform efforts in preservice teacher education have promoted the concept of preservice teacher cohorts. Cohorts may serve to develop a greater sense of community and also facilitate an improved understanding of the connections between university studies and school practice. This monograph examines the potential ability of preservice teacher cohorts to improve the preparation of preservice teachers in mathematics and science. Research on cohorts that include mathematics- and/or science-focused cohorts is summarized. While some progress is apparent, there are many areas in mathematics and science preparation that are largely unaffected by the new structure. There may also be effects that are undesirable. Both the literature and the site visits highlight the need for program developers to attend to both design and purpose. It is concluded that more research is needed to document the effects of preservice cohorts on teacher preparation. (Author/KHR)

Reproductions supplied by EDRS are the best that can be made from the original document.

ED 472 716

National Institute for Science Education

University of Wisconsin-Madison · National Center for Improving Science Education

Research Monograph No. 19

Preservice Teacher Cohorts and Their Implications for Mathematics and Science Education

Chris Ohana

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

P. White

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

- [x] This document has been reproduced as received from the person or organization originating it.
- [ ] Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Funded by the
National Science Foundation

BEST COPY AVAILABLE

SE067142

ERIC

National Institute for Science Education (NISE) Publications

The **NISE** issues papers to facilitate the exchange of ideas among the research and development community in science, mathematics, engineering, and technology (SMET) education and leading reformers of SMET education as found in schools, universities, and professional organizations across the country. The **NISE** Occasional Papers provide comment and analysis on current issues in SMET education including SMET innovations and practices. The papers in the **NISE** Research Monograph series report findings of original research. The **NISE** Conference and Workshop Reports result from conferences, forums, and workshops sponsored by the NISE. In addition to these three publication series, the **NISE** publishes Briefs on a variety of SMET issues.

The research reported in this paper was supported by a grant from the Exxon Education Foundation for the author's work as a Fellow of the National Institute for Science Education. At UW-Madison, the National Institute for Science Education is housed in the Wisconsin Center for Education Research and is a collaborative effort of the College of Agricultural and Life Sciences, the School of Education, the College of Engineering, and the College of Letters and Science. The collaborative effort is also joined by the National Center for Improving Science Education, Washington, DC. Any opinions, findings, or conclusions are those of the author and do not necessarily reflect the view of the supporting agencies.

ERIC

Research Monograph No. 19

Preservice Teacher Cohorts and Their Implications for Mathematics and Science Education

Chris Ohana

National Institute for Science Education
University of Wisconsin-Madison

March 2000

ERIC

About the Author

Chris Ohana is an assistant professor of elementary education at Western Washington University. Her research interests focus on the relationship of policy, theory, and practice in science and mathematics education, especially as they are manifested in preservice teacher education.

Acknowledgements

The author thanks the following individuals for their helpful comments on earlier drafts of this manuscript: Andrew Porter, Jean Moon, Jackie Blount, Janet Sharp, Anne Foegen, and Kim Koeppen. The author also appreciates the generous and helpful assistance from representatives at the three universities visited for this report. Results were previously presented at the 1999 annual meeting of the National Association for Research on Science Teaching in Boston, MA.

Contents

Abstract

Recent reform efforts in preservice teacher education have promoted the concept of preservice teacher cohorts. Cohorts may serve to develop a greater sense of community and may also facilitate an improved understanding of the connections between university studies and school practice. This monograph examines the potential effects of preservice cohorts to improve the preparation of preservice teachers in mathematics and science. It first summarizes research on cohorts in education. It then describes the results of three site visits to preservice teacher programs that include mathematics- and/or science-focused cohorts. While some progress is apparent, there are many areas in mathematics and science preparation that are largely unaffected by the new structure. There may also be effects that are undesirable. Both the literature and the site visits highlight the need for program developers to attend to both design and purpose. More research is needed to document the effects of preservice cohorts on teacher preparation.

Introduction

Many schools of education are exploring the use of preservice teacher cohorts (e.g., American Association of Colleges for Teacher Education, 199 1). Cohorts hold promise for preparing teacher education students to take an active role in school communities by providing them a stronger voice in controlling their experiences and in the development of their professional norms (Goodlad, 1990; Holmes Group, 1986). Because of the intense relationships developed over time, cohorts may provide the opportunity for preservice students, teachers, and faculty to engage in more reflective conversations bridging theory and practice (McBee, 1998; Stoddart, 1993; Winitzky, Stoddart, & O'Keefe, 1992).

Cohorts can serve to address issues in preservice preparation of mathematics and science teachers. Preservice teachers often have a naive or constricted view of the nature of science and mathematics (Raizen & Michelson, 1994). Their preparation in content is often lacking (Rutherford & Ahlgren, 1990; Shamos, 1995). Preservice cohorts can provide mutual support for understanding of science and mathematics content and pedagogy. Cohorts also extend the opportunity for preservice teachers to negotiate their own professional norms as teachers of mathematics and science.

Background

Definition and Components of Preservice Cohorts

The term "cohort" has several definitions. In its traditional context it often denotes an age group. "Cohort" in preservice teacher education describes a group that undergoes a course of study together, creates a shared purpose, and engages in other activities intended to bind the group together (Basom, Yerkes, Norris, & Barnett, 1994; Huey, 1996). There are several types of cohorts possible under this umbrella. A closed cohort is one in which all coursework is taken in a prescribed order at the same time; no new members are admitted to the group after its initial formation. In an open cohort, students take their core courses together but may have other courses that they take independently; no new members are admitted. In a fluid cohort, students may leave or join at different points (Huey, 1996; Yerkes, Basom, Norris, & Barnett, 1995).

Cohort students receive support from each other as they both study and apply pedagogy (Barone, Berliner, Blanchard, Casonova, & McGowan, 1996; Goodlad, 1990). Their experiences must be structured to enable and expect mutual support (Basom et al., 1994). Small preservice teacher programs would not have cohorts unless there were some direction and shared social or professional experiences. For example, a small liberal arts school may have a small group of students progressing together through a program. But a cohort is more than a small group. A cohort is constructed to work together as a group, share coursework, and share goals. Unless a small college program groups students to create a shared goal and shared experience, it is not a cohort in the sense intended here.

Many preservice cohort goals, outcomes, and techniques appear to be shared with cooperative learning theory. Johnson and Johnson (1991) defined the processes and characteristics of

ERIC

effective cooperative groups. Group processes include interdependence, interpersonal learning, cohesiveness, and the sharing of common goals. Using these processes, effective groups can accomplish their goals, maintain internal relations, adapt, and improve. These goals and processes are similar to those stated for preservice cohorts (AACTE, 1991; Barone et al., 1996; Bullough, Kauchak, Crow, Hobbs, & Stokes, 1997). Several authors suggest that attention should be paid to creating cohorts that can work and learn together through the development of a shared goal (Huey, 1996; Yerkes et al., 1995). Preservice cohorts can structure group goals and interactions that advance individual learning or the capacity to work effectively in a group (Huey, 1996). Despite the similarities between cooperative groups and preservice cohorts in both purpose and structure, program descriptions have made few direct references to the substantial literature in cooperative learning.

The size of the cohort varies both between and within programs. Davis (1993) offered the flexible suggestion that group size be small enough for each member to interact with each other, while "large enough to accomplish its task. Size depends on purpose" (p. 244). Goodlad (1990) recommended that a cohort of ten to fifteen students be assigned to an individual school. The limit on placements and space set a logistical limit for cohort size. Barone et al. (1996) suggested that cohorts should not exceed 25 students, in the belief that smaller class sizes will promote greater interaction and more support. In general, preservice cohorts seem to average about 20-25 students (e.g., Barone et al., 1996; Cabello & Eckmier, 1995; Huey, 1996).

The duration of the preservice cohort depends on the structure of the program. Bar-one et al. (1996), Cabello and Eckmier (1995), and Goodlad (1990) recommend that cohorts start with the first education courses and end with the cohort graduation. The length of the programs, however, differs substantially. In some fifth-year programs, the cohort is together for one or two semesters. In other programs, such as the experimental program in the California State University system (Cabello & Eckmier, 1995), the cohort is together for five years.

While some preservice cohorts have a subject focus, others do not. Most descriptions of preservice cohorts do not mention a content specialization (see, for example, Cabello & Eckmier, 1995; Sandoval, 1992), so it is assumed that cohorts in those programs are not content-specific. Since the purpose of this paper is to address the potential of cohorts in mathematics and science education, all of the sites visited were chosen because of their content focus in mathematics and/or science.

History of Presewice Cohorts

The concept of cohorts caught on quickly in preservice education. In a late 1980s study of a group of diverse preservice teacher education programs, Goodlad, Soder, and Sirotnik (1990) found nothing that resembled a cohort system. They found "buddy systems," in which students were paired with other students for support, but not cohorts.

The landscape has changed dramatically in the last nine years, and many schools of education offer cohorts as either a regular part of their preservice education program or as an alternative to their traditional programs (for reasons described below). There are now over 200 professional development school programs in the country (Abdal-Haqq, 1991), many of which employ preservice cohorts. Further evidence of a growing trend toward preservice cohorts is in the sixth Research About Teacher Education (RATE VI) from the American Association of Colleges for Teacher Education (AACTE, 1994). This data base resulted from surveys of 47 institutions of preservice teacher education. One survey item inquired about each program's progress in the utilization of student cohorts. Almost two-thirds of the faculty and staff surveyed reported moderate to excellent progress in the development of preservice cohorts.

Rationale for Preservice Cohorts

Cohorts have been promoted as a structure to remedy several problems in preservice education. They can provide experiences for preservice teachers that would help develop a sense of professionalism in learning to identify problems and create solutions in a collaborative environment. Cohorts could provide a supportive learning environment in which a synthesis between theory and practice is attempted. Students in a cohort could support and share with each other as they apply their knowledge of both pedagogy and subject matter in the classroom (Kasten, 1992). Research on the effects of cohorts is therefore necessary to understand to what extent cohorts promote greater understanding of content, pedagogy, and working in a school community. As cohort programs become more popular in preservice teacher preparation programs, a careful examination is needed of how, and whether, cohorts work and to what effect.

The *Standards for Professional Development Schools* from the National Council for Accreditation of Teacher Education (NCATE, 1998) did not require professional development schools to make use of cohorts. The standards did, however, recommend "clustering" of resources and suggested student cohorts as an example (Indicator 10 of the "Organization, Roles and Structures" Critical Attribute). Other indicators in the standards, such as the development of learning communities, did not specify student cohorts, but cohort structures were again mentioned as a structure to satisfy the standards. Goodlad (1990) recommended preservice teacher cohort groups in which students take their courses and experience their field practica together. Goodlad's Postulate Nine states, "Programs for the education of educators must be characterized by a socialization process through which candidates transcend their self-oriented student preoccupations and become more other-oriented in identifying with a culture of teaching" (1990, p. 288). He recommended that the cohort group be placed at a school, not with specific teachers. Students could see themselves as part of a school community rather than as an apprentice in an individual teacher's classroom.

Many of the general problems of preservice teacher education become amplified in preservice preparation in mathematics and science. Preservice teachers, especially in elementary teacher education, often lack the confidence, skills, and content background necessary to provide a foundation for quality mathematics and science teaching (Cardena & Roden, 1998; Heikkinen, McDevitt, & Stone, 1992). A preservice teacher may take only one methods class in mathematics and science. Methods courses are often not connected to field experiences or to content courses in mathematics or science. When coupled with a poor content background, the lack of a coherent program leaves students inadequately prepared to teach mathematics and science.

A major issue in the preservice preparation of teachers in mathematics and science is the gap that often exists between how students are taught science at the university and how Colleges of Education present science teaching through their methods courses (Lyons, Stroble, & Fischetti, 1997). Preservice students see science and mathematics teaching modeled through university content classes that may lead to the impression that the fields are characterized by the rote memorization of isolated facts (Beiswenger, Stepans, & McClurg, 1998). If preservice cohorts experienced content courses together, they could jointly traverse this gap between science and mathematics methods courses and content courses.

The use of cohorts in preservice teacher programs presents an opportunity for students to learn science, mathematics, and pedagogy in a supportive, social context (Raizen & Michelsohn, 1994), an opportunity that could serve to improve preservice teacher attitudes toward science and mathematics and preparation in these areas. As preservice teachers participate in courses and learn science or mathematics together, they can begin to come to a mutual understanding that the science and mathematics enterprise is socially constructed and serves to organize our experiences. As Loucks-Horsley, Hewson, Love, and Stiles (1997) suggested, "Professional learning takes place in a community of learning; just as students deepen their knowledge of science and mathematics through communication, so too do their teachers learn through formulating, sharing, and challenging what they and their colleagues think they know in order to learn" (p. 14). This idea is very powerful. The way in which science and mathematics are learned is connected to the way knowledge is generated in these fields (Kennedy, 1998). Cohorts could contribute to a more sophisticated understanding of the fields by leading preservice teachers to develop their own community of mathematics and science learners.

Cohorts in Educational Administration

I include a review of the cohort literature in educational administration for three reasons: (1) there is a more substantial volume of descriptions of cohort programs in educational administration; (2) the rationale for the use of preservice cohorts in educational administration parallels some of the issues in preservice teacher education; and (3) preservice administrator education also takes place in an environment bridging the schools and universities.

Educational administration was the target of a great deal of criticism in the 1980s. The Carnegie Forum on Education and the Economy (1986) and the National Commission on Excellence in Educational Administration (1987) produced reports critical of existing programs. Several reports lamented the lack of rigor in preparation and the inattention to matters of curriculum and field experiences. Principals were self-selected, lacked necessary skills, took required classes that were theory-based rather than practice-based, and spent little time in the field or reflecting about their field experiences. In a 1988 survey of practicing educational administrators, only 10% valued their university experience, while 61% felt that their field experiences were most helpful in their preparation (Milstein & Associates, 1993). In an era when schools were being called on to "transform," principals were not being prepared to facilitate this transformation.

The Danforth Foundation responded to the criticisms of educational administration by creating the Danforth Program for the Preparation of School Principals (DPPSP) in 1986. In 1987, the foundation funded four programs of principal preparation. By 1992, 22 universities participated in the Danforth initiative. The Danforth agenda included

- improving communication between the universities and schools,
- emphasizing recruitmeat of candidates rather than self-selection,
- improving the recruitment and retention of women and minorities in principal preparation,
- increasing hours of field experiences,
- increasing attention of instructors to needs and characteristics of adult learners,
- enlarging the scope and duration of their preparation beyond school and university, and
- studying and revamping university coursework.

To meet this agenda, DPPSP proposed a program that led to the development of student cohorts, increased university-school collaboration, more field experiences, the careful selection and training of school-based mentors, and a field-based delivery model. The cohorts were intended to provide a supportive learning environment, encourage program coherence, and provide networking opportunities and a sense of group purpose (Milstein, 1992; Yerkes et al., 1995).

While the programs participating in the Danforth project implemented many similar features, they also differed in several respects. Yerkes et al. (1995) described a variety of programmatic features in Danforth programs. Wlhile most programs had closed cohorts, some employed open cohorts. A few schools even allowed fluid cohort membership. The number of students in a cohort also differed from as few as 5 students to 30. Some had a single faculty member who chaperoned the cohort during its program of study; others had a cohort "team" of professors.

Several reviews have suggested that there are a variety of benefits resulting from the incorporation of preservice cohorts in educational administration. Many reports from cohort-based programs described a context in which students felt supported (Mulkeen & Cooper, 1992; Weise, 1992; Yerkes et al., 1995). Several authors suggested that the effects of the program extended beyond the university coursework-the networks developed seemed to be maintained as the students began their new careers (Milstein, 1992; Weise, 1992; Yerkes et al., 1995). In a comprehensive description of five Danforth programs, Milstein suggested that "students in cohorts seem to be more motivated and of higher quality than those in earlier preparation programs" (1992, p. 34). This improvement was due to several factors. First, admissions requirements were toughened as part of the Danforth program; if students enter better prepared, they should raise expectations. Second, many structures were put in place to facilitate adult learning; adults learn best when they can direct their own learning, influence decisions, emphasize relevant problems of practice, tap into their own experience, and build strong relationships with peers (Yerkes et al., 1995). Yerkes et al. suggested that cohorts, through emphasizing social interaction and bonds, can help take advantage of these factors that promote adult learning. In an evaluation of the Danforth program at the University of Houston, Weise found it "logical to infer . . . that the basic principles of adult learning had a definite impact on active student engagement in the differentiated learning experiences" (1992, p. 182).

In addition to their affective features, cohorts helped to provide programmatic coherence. Since students were admitted as a group, the cohorts allowed a more cyclic recruitment of students and more attention to course scheduling and field experiences. The evolution of the university preparation program also provided participants with a model of how schools might be transformed (Milstein & Associates, 1993). Cohorts served to provide a clarity of purpose and, when combined with active faculty involvement, an improved delivery model for team-building and reflection. These ingredients would be just as important for school improvement as they are for the university.

Faculty reactions to cohorts in educational administration have been mixed. Many felt that cohorts force the faculty to work together more and take greater risks. But there are downsides as well. Cohorts require more faculty time, and the university did not generally acknowledge this time in faculty reward systems. Some faculty also saw danger in a heightened sense of elitism on the part of the cohort. They feared that, in an era of more collaboration and greater sense of community, elitism may hinder, rather than promote, reform. Elitism implies a sense of superiority that may not promote attitudes of cooperation and collaboration (Daresh, 1988).

The reports available on cohort programs in educational administration are largely descriptive and anecdotal. As Valli, Cooper, and Frankes (1997) pointed out in another context (that of professional development schools), organizational changes and changes in teaching are easier to document than their effects in schools or in student learning. What is available, however, suggests that a positive relationship exists between the use of cohorts and students' sense of belonging, development of networks, sense of confidence, and reflection on practice (Mulkeen & Cooper, 1992; Norris & Bamett, 1.994; Yerkes et al., 1992, 1995).

The support for cohorts in professional schools of educational administration remains strong. Despite many reports of the benefits of cohorts, however, there has been little or no attention to whether cohorts affect the quality of educational administrators. While students reported that they liked the experiences provided by cohorts (Kraus, 1996; Norris & Barnett, 1994), there is no evidence that the graduates are practicing in ways different from graduates of traditional programs. There were no definitions provided for an educational leader and few, if any, clues about whether a cohort structure is more likely to produce better prepared administrators.

Cohorts in the Danforth program, as in preservice teacher education, are one part of a range of programmatic changes. It is difficult to attribute the improved quality of preservice students to cohort membership-especially when admission requirements changed as well. Courses and student evaluations were often changed, and preservice administration students had a more developed relationship with the university faculty. These factors could all contribute to preservice students' improved satisfaction with the program. As Weise (1992) suggested, research is needed that dissects what different components add to program effectiveness.

Purpose of the Study

The purpose of this study is to address the following questions:

1. What influence do cohorts have in the development of professional identity and attitudes about teaching?
2. What impact do cohorts have on the construction of knowledge of, and attitudes toward, mathematics and science?
3. How does membership in a cohort affect student understanding of pedagogy?
4. Do cohorts affect student retention at the university? In the first years of teaching?
5. Does the cohort improve or intensify the nature of the relationships between the university faculty, school faculty, and students?

The research questions were generated from references in literature to preservice teacher education and science and mathematics education. References came from a variety of sources: the ERIC database, evaluation documents or conference reports from existing cohort studies (largely from educational administration), journals in science and mathematics education and in teacher education, and books and handbooks on preservice teacher education. Sources that proved to be particularly helpful were Abdal-Haqq's (199 1) annotated bibliography for professional development schools and the Millstein review of Danforth programs in educational administration (Milstein & Associates, 1993).

Method

Site Selection

I visited three universities with preservice teacher education cohorts that emphasize mathematics and/or science. The sites were selected after consulting a variety of resources. Literature in preservice teacher education and in science and mathematics education was a primary source of information. I was also able to consult with Roger Soder of the National Network for Educational Renewal (NNER). Since most of the preservice programs in the NNER include cohorts, he was a valuable source of information. Through consultation with Soder and others as well as a review of the literature, I chose three sites to visit.

The first visit was planned to a consortium of programs in one state, all of which used cohorts. One program was at a Research I institution; another was an urban program for postgraduate students; and the third was a rural program in a university with a history as a normal school. Unfortunately, because of an uncooperative blizzard, I was able to visit only the urban program.

A second site was selected because several research and review articles describe the structure and outcomes for its mathematics education cohort. In conversations, faculty from this site, showed that they had considered some of the issues raised in my research questions. A doctoral dissertation evaluating the effects of the environmental science cohort was also available.

The third site was unique in several respects. It had a traditional preparation program as well as an alternative, cohort-based program; cohorts were non-content-specific, with the exception of one that was mathematics based. Thus this site allowed comparison of cohort with noncohort programs and of a content-based cohort with non-content-specific cohorts. I was involved with both the school and university settings of this site, as a teacher at the elementary school and as science methods instructor at the university.

Pseudonyms are used for the three institutions. These three programs were chosen because of the variety they represent in the structure of and approach to cohort-based teacher preparation in mathematics and science (see Table 1).

Table 1
Features of the programs at three sites studied

Site	Program feature					
	Cohort size/ postgraduate or undergraduate	Duration of cohort	Subject-matter focus in study	Faculty involvement	Methods courses	Content courses
Western University	20–30/ postgraduate	1 to 1 1/2 years	science and mathematics combined	faculty member assigned to cohort, in school each week	integrated, over two semesters	taken before admission
Southeastern State University	17–35/ undergraduate	2 years	environmental science cohort and mathematics cohort	faculty member assigned to cohort, in school each week	separate, over several semesters	taken before and after admission, but not as a cohort
Midwestern State University	20–30/ undergraduate	3 years	mathematics cohort and general cohorts	varies— mathematics cohort had different co-ordinator each semester, occasional participation at school	separate, in one "mega-methods" with integrating seminar	taken before and after admission, but not as a cohort

At Western University, the entering students are placed in theme-based cohorts. One of the themes is mathematics and science education. I spent most of my time with this cohort, but also visited an elementary school with a language arts focused cohort. The program enrolls between 100 and 200 students. The cohorts have about 20–30 students each. This program is postbaccalaureate with students taking two semesters of coursework before student teaching. Each cohort is assigned to a local elementary school. A faculty or staff member spends one day a week at the school, and there is an on-site teacher who is released from classroom duties to supervise the students and work with teachers.

At Midwestern State University, the cohort program is a small, experimental element within a much larger undergraduate teacher preparation program. The elementary education majors at Midwestern State University number between 900 and 1,000. Although secondary students are encouraged to apply, the cohorts are composed largely of elementary education students. Cohorts stay together for three years. Each cohort is assigned to a set of schools that include elementary,

 BEST COPY AVAILABLE

middle, and secondary locations. The cohorts have a university-based site coordinator!, but no site-based supervisors. In contrast with students in the regular program, cohort students take more education classes, have a coordinated methods block with an element called "team-time," and take courses taught by clinical faculty as well as regular faculty. Each year a cohort of about 30 students is admitted to the experimental program, Learning in Context, that emphasizes mathematics. For-field experiences, this cohort is housed at an elementary mathematics and science magnet school. No other cohort in Learning in Context has a specific content focus.

Southeastern State University has an undergraduate program that is totally cohort-based. It enrolls about 300 students. The cohorts vary from 17 to about 30 students. Each cohort, except for the middle school and secondary programs, has a theme. These themes run from a Padeia school concept, to environmental science, language arts, and children's thinking. Each cohort is based at one or two schools. A faculty member is assigned to a cohort based on his/her content interests. The faculty member and either a site-based supervisor or a graduate student stay with the cohort for the two-year program. The mathematics-focused cohort, which emphasizes understanding of children's thinking, is housed at a school with teachers who are trained in Cognitively Guided Instruction **(CGI)**. CGI is a mathematics-centered program focused on the development of mathematical meaning in young children (Carpenter, Fennema, Franke, Levi, & Empson, 1999).

Visit and Analysis Procedures

I analyzed documents from each program for information about cohort features. Cohort members, university faculty, and teachers were interviewed about the cohort structure, purpose, and effects. The participants were asked variations of the research questions as well as follow-up and clarifying questions. I had access to several university administrators who provided information about program goals and structures.

Interviews and notes were typed. After typing, I read the notes and placed them into categories defined by the research questions. Responses were analyzed for patterns and evidence about preservice cohorts and the relationships to mathematics and science education. I compared comments from different sites and attempted to find both similarities and differences in responses. I then compared and interpreted these differences in light of programmatic structures.

Several factors limited the analysis in this paper. First, material on preservice cohorts in teacher education included very few cohort descriptions and fewer reports of research. Second, my time at two sites was limited. I was most interested in the structure of mathematics and science cohorts and could not get, in my limited time, more than a superficial overview of the programs. For these reasons, this report should not be read as an exhaustive study of the three programs.

Effects of Teacher Education Cohorts

Professional Attitudes and Identity

Findings reported in the literature. Cohorts, according to the Holmes Group (1986), provide an opportunity to develop collegial and professional norms. "A sense of community among the students pursuing careers in teaching is accorded through reasonably sized cohorts that enter and pursue coordinated programs of study" (p. 89). Huey (1996) stated that "the cohort can bring structure to the field experiences by structuring activities and interaction to help students interpret and integrate activities through guided reflection to arrive at a meaningful understanding of teaching" (p. 20). According to Huey, students in cohorts can be empowered by being allowed to choose their cooperating teachers, have input on field assignments, and make their own logistical arrangements. While these same opportunities could be made for preservice students in noncohort programs, they take on a different dimension with cohorts. Cohort students, since they take the same classes and participate in the same field experiences, have a significant level of familiarity and background knowledge about each other and the teachers, so they are able to make more informed judgments. In university courses, students who have taken much or all coursework together have a greater shared knowledge from which to draw in choosing assignments or working on projects. All of these differences serve to facilitate the development of cohorts' sense of community and professional attitudes.

The professional attitudes of preservice teachers are formed through experiences in the schools and the university (Staton & Hunt, 1992). Chickering (1993) presents a model in which the institutional environment, among other things, profoundly affects student learning, cognition, and attitudes. Students in preservice cohorts, especially since they are often part of a university-school collaboration, have two institutions from which to learn and form attitudes. Relationships among the students in the cohort can serve to mediate the experiences in the schools and universities through fostering new professional norms.

Since cohorts facilitate student membership in their own group as well as with the schools, cohorts may reduce the sense of professional isolation often experienced in teacher education. Sustained relationships between students in a cohort could expose them to a variety of approaches to teaching and learning. This exposure is lacking in noncohort programs. In a survey of faculty and students in 29 education programs, Su (1992) found that peers have very little effect on the socialization of preservice teachers. Many of the factors that inhibit peer relationships (taking different courses, lack of social interaction, discontinuity of classes and student teaching) could be significantly altered by membership in a cohort. The isolation, both professional and social, that starts in preservice programs could be significantly reduced. Students in cohorts also become more familiar with teachers in the schools, again reducing isolation. Students can feel a part of their own cohort as well as form a part of a larger community composed of the schools and the university.

Findings of this study. Sweeping his arms around a classroom filled with his colleagues, a preservice teacher stated, "I don't think I could have made it without them." His sentiments were shared by all of the preservice students with whom I spoke. On the site visits, students at each of the three universities valued the sense of community developed in the cohorts. At one site, students complained about the cliques that developed, but still gave credit to their own clique for helping them through the program. Most students interviewed expressed support of, and by, other members of the cohort. When I asked what kind of support students felt they received, answers were somewhat generic. "Help with projects," "understand assignments." Two students suggested that they enjoyed complaining together.

Faculty at two of the schools suggested that cohorts developed their own sense of professional norms. Terms like "cohort effect" and "cohortness" were used to describe cohort behaviors. One instructor noted, "Your end-of-term evaluations will look like they came from a single person." Cohort effects may be both positive and negative. They are positive when students support each other in learning and developing professional identities. They can be less than positive when cohorts become clique-ish and develop strong internal pressures to conform. At one site, I attended a student meeting at which the preservice students were critical of faculty and communication issues. Later I asked a student about his views of the meeting, and he contradicted the conclusions reached. When I asked him why he said nothing, his response was that he was "tired" of being the only one willing to raise an alternative voice. Another faculty member was pleased with her current cohort but said her last cohort was enervating, "They were followers. If one was sour, they all puckered up." Cohort effects present a difficult tension. On the one hand, faculty desire a strong cohort to develop a sense of professional identity. On the other hand, the professional identity still has to be shaped and nurtured. Otherwise, as Johnson and Johnson (1991) and the NRC (1994) suggest, there is the possibility that small groups (and, by extension in this case, cohorts) can become a negative force.

A sense of separateness, even elitism, can develop on the part of cohort students. Midwestern State University faculty reported this elitism to be a double-edged sword. On one side,, the elitism helped students develop a sense of empowerment; they were more comfortable in classrooms in both the schools and the university. On the other side, faculty reported situations in which cohort students developed an arrogance and demanded special treatment or consideration. In one case, students were unhappy with an instructor, demanded a meeting with the department chair, and proceeded to explain that, since they were a cohort, they were supposed to get only the best. Since their instructor was not the best, they suggested a replacement. Another cohort produced a brochure describing the program as "elite," but faculty members convinced the students to rewrite it using less inflated language. Since all Southeastern and Western preservice students are in cohorts, the sense of elitism does not develop in those universities.

Cohort groups, if they are to be effective in heightening a sense of professionalism, must be guided to develop a sense of group purpose and goals. Faculty serve to facilitate this development. At both Southeastern and Western, a university professor or staff member is assigned to a school and is present at the school one day per week. The time is credited in the professor's teaching load, but at neither site did faculty believe that the time required by the program was recognized enough by the faculty reward structure. At Midwestern State University, each cohort has a faculty or staff supervisor, but the coordinator may change in different semesters. Cohorts at Midwestern State University have a much more intense relationship to faculty members, especially during their methods semester, than is afforded noncohort students.

Cohorts can provide, in the words of Lortie (1975), a sense of a "shared ordeal." Lortie suggests that a shared ordeal, such as boot camp or the first year of study in medical or law school, leads to a common bond and a "collegial feeling found in established professions" (p. 74). At Midwestern State, each cohort in Learning in Context shares the experience of "megamethods," the preservice version of boot camp. Students take four methods courses and are in a classroom full-time for six weeks. As an academic advisor put it, "We own them [the preservice students] for that semester." The students are in the classroom so long that teachers said they forgot that preservice students were not student teaching yet. This experience provides the students with a strong bond and a sense of having survived an ordeal together. At Southeastern, I attended a session of a weekly cohort seminar in which the cohort members clearly bonded over the PRAXIS test that many were taking the next day. There was considerable anxiety in tbe room, as those who had taken the PRAXIS gave hints about what to study. Students not in cohorts miss the shared experience that group membership can offer.

Levels of student social interaction within cohorts vary between programs. In Learning in Context at Midwestern State University, there are planned, informal structures for social interaction as well as formal experiences in classes or schools. There is an annual overnight trip to an environmental education center, travel to professional meetings, and monthly meetings that are partly social and partly business. At Western University, the interactions centered around coursework. There were occasional class meetings off campus, but most of the interactions were course related. At Southeastern State University, there were occasional, optional meetings of cohort members. For example, several members of the environmental science cohort participated in an overnight stay at a local science museum. While these "extracurricular" events were welcomed by some students, at one site they were also considered somewhat of a nuisance to people with busy schedules.

Knowledge and Attitudes about Mathematics and Science

Findings reported in the literature. To teach to the new standards in both mathematics and science, teachers must have a solid preparation that allows them to understand the nature and content of the intellectual fields as well as the connections between content areas (NRC, 1996). Preservice teacher education programs have been subject to the criticism that preservice students, especially those in elementary education, lack a rigorous preparation in subject matter (Holmes, 1986). This weakness in content understanding is especially pronounced in mathematics and science (Coble & Koballa, 1996; Raizen & Michelsohn, 1994).

Cohorts represent potential for students to support each other in their study of mathematics and science content. If cohorts take content courses together and have structures in place to support small group learning, then student understanding of science and mathematics content might improve. This potential for improved content understanding through small group work: has support from a meta-analysis of small group learning in science, mathematics, and technology. Springer, Stanne, and Donovan (1997) found that achievement in mathematics and science is improved significantly through small group learning. The application of their research finding to the context of cohorts is complicated, however, by the fact that the authors found no significant difference between small groups that had short, medium, or lengthy working periods (p. 16).

Attitudes toward subject matter have been shown to improve in a content-themed cohort. In a study of a preservice elementary cohort that emphasizes environmental science, Hildreth (1997) found that, after two years in the program, preservice teachers expressed a greater sense of efficacy in teaching science than a comparison cohort that was not science focused. Hildreth also found that preservice teachers in the environmental science cohort significantly improved in some measures of attitudes toward science and knowledge of process skills. Since botlh groups in Hildreth's study are cohort groups, these results do not suggest an advantage of a cohort but rather an advantage to extra attention paid to science within a cohort. More research is needed to isolate the variables involved to see what effects cohort membership has versus what effects extra instruction and experience in science have. In their meta-analysis of small group learning, Springer et al. (1997) also reported a tendency for attitudes toward mathematics and science to improve the longer that small groups worked together.

Descriptions of preservice teacher cohorts in the literature do not include enough detail to determine whether the program goals included the improvement of mathematics and science (or any content area) learning. It is possible that the promise of cohorts to improve individual academic preparation remain unrealized, because there are few systematic efforts to take advantage of cohort structure for learning mathematics or science content. Most of the emphasis focuses on issues of collaboration and emotional support or attitudes.

Individual learning can be strengthened through small group membership and the structuring of group goals (Johnson & Johnson 1997; Koeppen, Huey, & Connor, in press; NRC, 1994). Improved academic achievement is unlikely, however, without explicit goals to support it (Huey, 1996; Johnson & Johnson, 1997; Koeppen, Huey, & Connor, in press). There is little evidence about preservice student achievement in programs that employ preservice cohorts (e.g., Ross, 1995). Members of a group may feel confined to stay within the norms of a group and not excel. For example, Huey found that cohort members were not better prepared academically nor more likely than traditional students to seek academic recognition. Students may have a heightened sense of confidence, but their academic preparation is comparable to students in noncohort programs.

Findings of this study. All three programs had a cohort that emphasized mathematics and/or science. There are two ways for students to be supported in the learning of mathematics or science content. One is for students to take content courses together and help each other learn, e.g., they could study together or tutor each other. Another way is that students, especially if they take concurrent methods courses, may contextualize mathematics and science content through its importance in their professional development. If students think about teaching a subject as they learn it, they may be more motivated to understand it.

None of the three sites configures the content courses so that the students can help each other or take advantage of the reinforcement through methods courses. Western University is a graduate program in which students had already taken the required mathematics and science classes. Since students 'do not take content courses together, there is little opportunity for them to support each other in learning mathematics or science content. The Western Student Handbook states the expectation that students be well versed in the central concepts, tools of inquiry, and structures of the disciplines they teach. The methods courses are integrated (mathematics, social studies, science, and reading) so there is no concentrated block of time available for students to study mathematics or science pedagogy. Students who choose mathematics and science as their areas of emphasis engage in a seminar that meets occasionally through the semester. Sessions are geared to support student understanding of issues of pedagogy in mathematics and science, but not to learning mathematics and science.

Both Southeastern and Midwestern have undergraduate programs, but they have open cohort systems: students take only education courses together, not content classes in other areas, continuing the traditional division between what is taught and how it is taught. **Southeastern** State University cohorts often have the methods course associated with its area of emphasis during their first semester. This scheduling helps to cement students' identity as a science cohort and could help students see connections to science in their other curriculum classes. At Midwestern State University, the integrated methods courses occur after the midpoint of a cohort cycle. Since they take place so late in the program, it is unlikely that students get much support in. learning science or mathematics content or in placing it into the context of methods. **At** none of the three universities were there small group structures in place to help students understand content. Given the lack of attention to this dimension of learning, it is highly unlikely that preservice cohorts facilitate the understanding of content at these three sites.

This suspicion was confirmed by faculty members. At each site at least one faculty **member** was asked whether students benefited academically from cohort membership. In every case the answer was, "No." In fact, at Midwestern, several faculty members even thought the opposite. They felt that cohort pressures tended to suppress achievement levels. As discussed above, students who were very capable may feel the social pressure of a cohort to conform to the average. I asked one student in science methods class why he never contributed to discussions and he said he was tired of the "eye rolling" response of his fellow students. This "regression toward the mean" may appear inconsistent with the cohort sense of elitism. While students as a group may feel "elite" when compared to other groups, members within a cohort may be discouraged from appearing more elite tlhan others. None of these programs had a mechanism in place to support individual achievement.

It is unlikely, given the present organization of preservice cohorts, that content understanding in mathematics and science will improve as a consequence of cohort membership. The programs, both the ones visited and those described in the literature, are not designed to support small group learning of content or to pay attention to content in general. Hildreth, however, provides evidence that attitudes toward science could be improved through a content-themed cohort. Faculty at Midwestern State University are in the process of collecting and analyzing data on attitudes toward mathematics in a mathematics-themed cohort. Attitude surveys and focus groups have been administered to the mathematics cohort periodically. Preliminary evidence suggests that students in the mathematics-themed cohort have come to be more confident toward their own ability in mathematics, but changed little in their attitudes toward teaching mathematics. These cohort students started with a positive attitude toward teaching mathematics, and that remained constant through their three years in the program. At the end of the program students felt that they needed fewer experiences to learn mathematics content or pedagogy. These surveys and focus groups were not done with any comparison groups. It is therefore impossible to say that any changes were a result of the cohort program.

Pedagogy

Findings reported in the literature. Many authors have reported a tension between. preservice students' understanding of new standards of practice and the expectations and examples set by their cooperating teachers (see, for example, Frykholm, 1995; Fuller, 1997). If preservice students are expected to change in their understanding and application of new standards of teaching, then they must be supported to do so, even when their field experiences are not consistent with these standards. A cohort may provide one way to establish and maintain these new norms of teaching.

As students in cohorts start to develop their set of professional norms and attitudes, it is critical that the process be facilitated by university faculty. Graber (1996) described a cohort-structured program that had a clear, reform-minded agenda, yet students were assigned to a school with a traditional program. To avoid the clear tendency of students to identify with their mentor teachers, the university faculty consciously and thoroughly addressed the discrepancies and helped the cohort understand practice as well as ways practice could be changed. The cohort established and maintained the new expectations and supported each other with a reform-minded approach. Graber attributed much of the program's success to the cohort. Cohorts facilitated the development of friendships and overcame the resistance to new ideas about teaching by some members of the cohort. Graber found that "the influence of a cohort cannot be underestimated, particularly because it facilitates an environment in which students begin to feel a part of a strong professional culture" (p. 457). Graber also cautioned that, if careful attention is not paid to the cohort experience, it can have very negative implications. For example, the program emphasized a fitness-based rather than the traditional sports-based curriculum. If students had not 'been carefully debriefed and if their experiences both before coming into the program and during field placements had not been carefully analyzed, the cohort could have reinforced traditional beliefs rather than supported students in rethinking their assumptions. Group cohesion may not be enough in itself; the cohesion has to be shaped around improving practice.

Findings of this study. Each of the three sites visited has a different approach to establishing new norms of pedagogy. At Midwestern State University the students do not take their content-focused methods course until their program is half over. For the first three semesters, students observe and model the pedagogy practiced in the classroom. This pedagogy may or may not reflect ideas presented in the university courses. Since there is no mathematics education faculty member assigned to the mathematics cohort, except during the methods semester, it is unlikely that students' view of pedagogy is sculpted by the university, at least in the first half of their program. Several faculty who have taught cohorts at Midwestern State University indicated that they felt the preservice students developed their own professional norms in the context of their field experiences. Since there is no consistent faculty leadership of the cohort, the preservice students are on their own. In focus group data collected before their megamethods semester, Midwestern students reported that, aside from trips to the NCTM meetings, they didn't see why theirs was considered a mathematics cohort.

At Southeastern faculty attempt to establish the content emphasis of the cohort early, in the first semester of the program, through a methods course reflecting the area of specialization. Depending on faculty availability, this early methods experience does not happen with every cohort. Since the faculty member assigned to a cohort reflects the content focus, the cohort develops a content focus even in the absence of an early methods course. This professor (or, sometimes, graduate student) conducts weekly seminars and is in the partner school once a week. These elements can serve to reinforce the expected pedagogical practice and allow the, cohort to develop a norm of expected practice based on interactions with their university faculty, colleagues, and inservice teachers.

The development of professional norms of practice at Western University is enhanced through occasional meetings of the cohort. Students said these meetings address logistical as well as pedagogical issues. I attended one meeting in which a professional development expert briefly discussed science at the early childhood level and provided some sample lessons for young children. The meetings are facilitated by the university faculty supervisors. Students in the mathematics/science cohort expressed frustration at being at a language arts-centered school. They were faced with trying to develop their attitudes and pedagogy without access to a school-based model of what mathematics and science looked like in the classroom. The classroom teachers also expressed a desire to host a language arts-focused cohort. Both preservice and inservice teachers felt mismatched. The students wanted to apply and witness science and mathematics teaching as they learned it at the university. The teachers wanted their strengths in language arts to be recognized more than their deficiencies in mathematics and science. It appeared that the students developed their professional norms in sync with their university experiences and in opposition to their school experiences.

From the evidence gained through these site visits, I suggest that there are several key elements to establishing new norms of pedagogy in a preservice cohort. First there must be an early initiation into the pedagogy of the content area focus. The results are less pronounced at Midwestern than at Southeastern, where the science or mathematics theme is introduced early. Next, there should be strong faculty leadership of the cohort. At Western and Southeastern, a faculty member is involved from the start and participates in both field experiences and seminars, focusing the cohort on the content area. Finally, field experiences should be consistent with university experience. Without these elements in place, cohorts may not support their members in teaching to new standards of pedagogy. Students who had field experiences consistent with their university experiences were more satisfied than those who did not.

Retention of Preservice and Inservice Teachers

Findings reported in the literature. Retention of qualified teachers is a serious issue in some localities. Some states, such as California and Texas, are experiencing an acute shortage of teachers, especially in urban areas. These areas cannot afford the large attrition rate of beginning teachers. The attrition rate approaches half of all teachers within the first five years of teaching, and it is especially disturbing that the academically talented and those with a content specialization are more likely to leave teaching (Darling-Hammond & Sclan, 1996). Given the financial investment in educating teachers and the intense need for a teaching force that is academically prepared, it is important to consider the possible effects of cohorts on retention. There are two issues of retention. One is the retention of students within a program. The second is the retention of teachers after they enter teaching.

Tinto (1993) has shown that student retention is enhanced by participation in small learning communities. Cohorts represent such a group. Cabello and Eckmier (1995) reported that the support of a cohort was instrumental in the retention of some students in a five year program in California. In interviews and surveys, over 90 percent of a cohort listed the support network of the cohort as the program's greatest strength. They stated that "the graduates contend that this support network [of cohort students and faculty] helped them from burning out at school and in their first two years of teaching" (p. 41). The program graduated 68% of its original members, a rate that is artificially low because several of those who left were employed with an emergency credential by local districts. Of those who graduated, all but one reported being successful in their teaching careers after three years of teaching.

Cohorts, through building personal and professional relationships, may support students and teachers who may otherwise quit. Preliminary data from Iowa State University indicates that this may be true. In a survey of cohort students, Huey (1996) found that students appreciated the support they received from each other and that retention was better for students in cohort groups than for those not in cohort groups. Members of cohort groups were more likely to plan to stay in teaching than those from noncohort programs. Coupled with the evidence from California (Cabello & Eckmier, 1995), cohorts may be a significant tool for promoting teacher retention.

Findings in this study. Preliminary evidence from Midwestern State University suggests that retention is improved with cohort membership, Midwestern State University faculty intend to continue to collect these data. But since Western and Southeastern have only cohort programs, retention rates for cohort and noncohort students cannot be compared at those institutions. It is important to study retention at a more sophisticated level.

It is important to study the effects of cohorts on retention in more detail. Are bright and capable students who would otherwise drop out completing the program? Alternatively, do weaker students finish when they would otherwise drop out? Research needs to clarify what types of students benefit from this support and whether retention of all entering students is an appropriate goal.

A critical issue for many teachers educators is the recruitment and retention of "minority" students (Boyer & Baptiste, 1996). Most of the preservice teachers I met and observed at both Midwestern and Southeastern were white students in their early twenties. The students at Western were more diverse: There was a range of ages from early twenties to forties or fifties, and there were significant numbers of Latinos in the classes. An emphasis in bilingual education was available, and the program seemed successful in attracting students. Unfortunately, no data were available on the retention of the minority preservice teachers.

University/School Collaboration and Relationship

Findings reported in the literature. Frequently there is a wide gulf between teachers and university faculty. Teachers often feel that university professors are too research-focused and out of touch with "real life." A cohort structure could model situations in which there is a sharing of, and value for, knowledge generated in schools and in universities. For example, many programs with cohorts have field-based seminars in which teachers, university faculty, and preservice students participate in dialogues about teaching and learning. In this way the collaboration serves to build a learning community that values continuous learning in the school culture.

Field experiences are an important link between the university and the school. Field experiences can be organized in a variety of ways. Students from a single cohort may be placed in different schools and these schools may, or may not, have a formal link to the university. Students may have an intense, long-term relationship with a school or may be transient visitors. The relationship of the university to the school sites is also variable. There may be a close relationship with seminars, professional development, and/or joint research projects. This describes what Goodlad (1990) has termed "simultaneous renewal." At the other extreme, the relationship between university and school faculties may not extend beyond a mutual interest in a preservice student.

Findings of this study. At all three sites there are opportunities for a teacher, or several, to teach the cohort. At Western University, there is a university position for a teacher on special assignment. The teacher, on leave from the school district for the year, teaches various methods courses for the university. At Southeastern State University, there are teachers working as supervisors, and at least one teacher, a media specialist, teaches a class for her school's cohort. At Midwestern State University, several teachers with the mathematics cohort have taught methods courses, and many others have made presentations in cohort courses. Teachers involved as clinical faculty expressed a range of opinions. All were flattered by their selection. Several indicated a desire to start or continue graduate work so they might eventually become regular faculty. With one exception, the clinical faculty felt respected in their work at the university.

While many preservice programs employ teachers as adjunct or temporary instructors, these instructors provide an additional benefit with a cohort program. At one site, students described their surprise at finding some of their cooperating teachers teaching courses at the university. The students shared experiences at the school and the university. Having teachers from their cooperating school as instructors helped students make connections between the two.

The cohort at each of these sites serves as a joint focal point for the university faculty and school teachers. Teachers report a sense of ownership and pride in the students at their school.. Teachers at one site expressed some dismay when they found out a few cohort members would student-teach overseas. Not only would they miss the students, but the teachers felt they had an investment in the students. The faculty who facilitate the cohort groups work more closely with school personnel than is typical of many programs. At Southeastern State University **and** Western University, faculty members are in the schools every week. At Midwestern State University, the faculty also have more involvement **with** the schools, especially during the methods semester.

Cohorts can, and do, serve as glue between the university and school. In each of the sites there is an intense relationship between the teachers and faculty, mediated through a shared interest in the cohort. The university faculty see the school faculty more often and share some responsibilities with them. The school faculty also come to know the university faculty. At least two of the sites have joint research projects underway. At Midwestern State University there are also study groups with participation and leadership shared by university and school-based faculties. Although at each site there were many teachers and administrators who seemed out of the loop, it is still reasonable to conclude that cohorts can bring the two faculties together in ways that traditional programs typically have not.

Discussion

Teacher education has been the subject of both internal and external criticism. Teachers report feeling inadequately prepared to meet challenges in the classroom (NCES, 1999; **Rigden,** 1996). One response has been the implementation of preservice cohorts that would enable preservice teachers to support each other as they create and participate in a community of learners. The purpose in this paper has been to explore the potential of preservice cohorts to contribute to preservice education, with particular attention to these questions in mathematics and science education:

1. What influence do cohorts have in the development of professional **identity** and attitudes about teaching?
2. What impact do cohorts have on the construction of knowledge of, and attitudes toward, mathematics and science?
3. How does membership in a cohort affect student understanding of pedagogy?
4. Do cohorts affect student retention at the university? In the first years of **teaching?**
5. Does the cohort improve or intensify the nature of the relationships between the university faculty, school faculty, and students?

The use of preservice cohorts in mathematics and science may improve the preparation of teachers through attention to a better understanding of content and pedagogy, more positive attitudes, and participation in setting new professional norms. Cohorts could also address the issue of program coherence by providing students with the opportunity to experience, discuss, and analyze mathematics and science courses together. In order for this potential to be realized, university programs must structure cohorts to take advantage of the affective and cognitive dimensions of sustained cooperative learning.

Evidence from a survey of teacher education literature and the three site visits suggests that there are several important effects of preservice cohorts. Membership in a cohort helps preservice teachers develop a sense of community and confidence. At each site, and in the literature from educational administration, preservice students cited the cohort as the most beneficial **part** of the program. Cohort students bonded through classes, tests, and field experiences. In addition to improved professional attitudes, preservice cohort students developed positive attitudes about their content area. Data from Southeastern suggest that this benefit is limited to cohorts with a mathematics or science focus. Cohorts without such a focus do not improve their attitudes about teaching mathematics or science. Perhaps because of increased support and more positive professional attitudes, retention may be improved through cohort membership. Finally, cohorts are often part of a more extensive program of university and school collaborations. By providing a focal point for both institutions, preservice cohorts force more intensive interactions and familiarity between universities and schools, setting the stage for closer relationships between the faculties.

In addition to some of the positive effects of cohorts, there are other effects that are less than positive. Even though the content background of teachers in mathematics and science is thought to be inadequate, cohorts are not structured to help students learn more content. Programs would have to be structured differently if an improvement in content preparation is to be effected. Students would need to enroll in content courses together and engage in cooperative learning techniques before improved content knowledge could be expected. Faculty members and administrators with the two undergraduate programs suggested that requiring cooperation from a variety of departments and colleges would'be logistically difficult. At Southeastern there is the added problem that many students enter the program as transfer students who have already completed many of their general education requirements. In the fifth-year program at 'Western, the students have already completed their general education courses before they enroll in the certification program.

Faculty reports from both the literature review and site visits also paint some negative images that may result from a bloated sense of empowerment. Cohort students can become clique-ish, demanding, and elitist. Faculty spoke of having to chisel their way into the cohort. The faculty can become the outsiders with little effect on group norms. Cohort behavior, unless carefully tended, can have a negative impact on building the bridge between theory and practice.

A profound difficulty emerged early in this study. Research on preservice cohorts proved to be limited in both amount and quality. Detailed program descriptions and evaluations of innovative programs were scarce. Research was even more rare. As Houston noted, "Evaluations of the effectiveness of such programs [nontraditional teacher education programs] are virtually nonexistent. Even the content of programs often is poorly chronicled. The 'black box' of professional preparation experiences decries comparison" (1996, p. ix). It is hoped that future papers on preservice teacher education will have a more carefully documented literature from which to draw. It is critical to study these preservice innovations more vigorously so tlhat increasingly embattled teacher education programs can defend and improve their programs based on solid research.

There are many issues worthy of study. At a core level, there is an assumption that preservice students learn from each other. What is :not clearly known is what and how they learn from each other (Hawkey, 1995). More careful attention should be dedicated to understanding the relationships among preservice students in a cohort. How can they facilitate, or obstruct, each other's learning? How do they help **each** other make sense of their shared experiences?

Part of the difficulty in making recommendations about the use of cohorts in mathematics and science education results from the problems in isolating some of the variables involved. Cohorts are virtually always part of a larger reform effort that includes expanded field **experiences** and curricular reform, so it is difficult to identify the parts that are necessary for effective structuring of preservice cohorts. Mixing increased field experiences and cohorts is especially problematic. It is not clear whether improved attitudes and feelings of professional preparation are related to an increase in comfort in working in schools or due to the support of a cohort structure. Since cohorts demand considerable resources,, it is important to discover which elements are most important and have the greatest effect.

In many ways, little attention has been paid to the purpose and design of the cohort **experience.** Students were unclear about the purpose of the cohort except for a nebulous concept of "supporting one another." One fundamental weakness in attempts to reform teacher preparation is attention to structure rather than to a reconceptualization about practice (Myers, 1997). If cohorts are taught in the same ways and. have the same types of field experiences, then cohorts are likely to produce teachers who teach like those we already have. Cohorts would then be conservative structures. There is nothing magical in the structure itself. "Simply placing students near each other and allowing interaction to take place does not mean that learning will be maximized, high quality peer relationships will result, or student psychological adjustment, **self-**esteem, and social competencies will be: maximized. Students can obstruct as well as facilitate each other's learning. Or they can ignore each other" (Johnson & Johnson, 1991, p. 2:3-4).

If students are to become part of a community of learners of mathematics and science,, then the community will need to be carefully constructed. Students are unlikely to develop the requisite goals or attitudes on their own. **Researchers** need to generate more careful research and attend to these issues of learning in preservice programs. Developers of cohort programs need to pay more explicit attention to what cohorts are meant to accomplish. Otherwise preservice cohorts run the risk of becoming a distinction without a. difference.

References

Abdal-Haqq, I. (1991). *Professional development schools and educational reform: Concepts and concerns* (ERIC Digest 91-2). Washington, DC: ERIC Clearinghouse on Teacher Education.

American Association of Colleges for Teacher Education. (1994). *RATE VI: The context for the reform of teacher education.* Washington, DC: Author.

Barone, T., Berliner, D. C., Blanchard, J., Casonova, U., & McGowan, T. (1996). A future for teacher education. In J. Sikula (Ed.), *Handbook of research on teacher education* (2nd ed., pp.1 108-1 149). New York: Macmillan.

Basom, M., Yerkes, D., Norris, C., & Barnett, B. (1994). *Exploring cohorts: Effects on principal preparation and leadership practice.* Unpublished manuscript. (ERIC Document Reproduction Service No. ED 387 857)

Beiswenger, R. E., Stepans, J. I., & McClurg, P. A. (1998). Developing science courses for prospective elementary school teachers. *Journal of College Science Teaching, 27,* 253-257.

Boyer, J. B., & Baptiste, H. P. (1996). The crisis in teacher education in America: Issues of recruitment and retention of culturally different (minority) teachers. In J. Sikula (Ed.), *Handbook of research on teacher education* (2nd ed., pp. 779-794). New York:: Macmillan.

Bullough, R., Kauchak, D., Crow, N., Hobbs, S., & Stokes, D. (1997). Professional development schools: Catalysts for teacher and school change. *Teaching and Teacher Education, 13,* 153-169.

Cabello, B., & Eckmier, J. (1995). Looking back: Teacher's reflections on an innovative teacher preparation program. *Action in Teacher Education, 17,* 33-42.

Cardena, C. E., & Roden, J. K. (1998). Academic proficiency of students who reported intentions of majoring in education. *Journal of Teacher Education, 49,* 38-46.

Carnegie Forum on Education and the Economy. (1986). *A nation prepared: Teachers for the 21st century.* Washington, DC: Author.

Carpenter, T. P., Fennema, E., Franke, M. L., Levi, L., & Empson, S. B. (1999). *Children's mathematics:* Cognitively Guided Instruction. Portsmouth, NH: Heinemann.

Chickering, A. (1993). *Education and identity.* San Francisco: Jossey-Bass.

Coble, C. R., & Koballa, T. R. (1996). Science education. In J. Sikula (Ed.), *Handbook of research on teacher education* (2nd ed., pp. 459-484). New York: Macmillan.

Daresh, J. (1988). "Learning at Nellie's elbow": Will it truly improve the preparation of educational administrators? *Planning and Changing, 19,* 178- 187.

Darling-Hammond, L., & Sclan, E. (1996). Who teaches and why. In J. Sikula (Ed.), *Handbook of research on teacher education* (2nd ed., pp. 67-101). New York: Macmillan.

Davis, J. (1993). *Better teaching, more learning.* Phoenix: Oryx Press.

Frykholm, J. (1995, April). *The impact of the NCTM Standards on preservice teachers ' beliefs and practices.* Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Fuller, R. A. (1997). Elementary teachers' pedagogical content knowledge of mathematics. *Mid-Western Educational Researcher, 10,* 9- 16.

Goodlad, J. (1990). *Teachers for our nation's schools.* San Francisco: Jossey-Bass.

Goodlad, J., Soder, R., & Sirotnik, K. (Eds.). (1990). *Places where teachers are taught.* San Francisco: Jossey-Bass.

Graber, K. (1996). Influencing student beliefs: The design of a "high impact" teacher education program. *Teaching and Teacher Education, 12,* 451-466.

Hawkey, K. (1995). Learning from peers: The experience of student teachers in school-based teacher education. *Journal of Teacher Education, 46,* 175-183.

Heikkinen, H. W., McDevitt, T. M., & Stone, B. J. (1992). Classroom teachers as agents of reform in university teacher preparation programs. *Journal of Teacher Education, 43,* 283-289.

Hildreth, D. (1997). *Learning to teach science in a professional development school.* Unpublished doctoral dissertation, University of North Carolina, Greensboro.

Holmes Group. (1986). *Tomorrow's teachers: A report of the Holmes Group.* East Lansing, MI: Author.

Houston, W. R. (1996). Foreword. In J. Sikula (Ed.), *Handbook of research on teacher education* (2nd ed., pp. ix-xi). New York: Macmillan.

Huey, G. (1996). *The impact of cohort group membership on preset-vice teachers.* Master's thesis, Iowa State University, Ames.

Johnson, D., & Johnson, F. (1991). *Active learning: Cooperation in the college classroom.* Edina, MN: Interaction Book Company.

Johnson, D., & Johnson, F. (1997). *Joining together: Group theory and group skills.* Boston: Allyn and Bacon.

Kasten, K. L. (1992). *Students'perceptions of the cohort model of instructional delivery.* Paper presented at the annual meeting of the University Council of Educational Administration, Minneapolis, MN.

Kennedy, M. M. (1998). Education reform and subject knowledge. *Journal of Research in Science Teaching, 35,* 249-264.

Koeppen, K. E., Huey, G. L., & Connor, K. R. (in press). Cohort groups: An effective model in a restructured teacher education program. *In* D. M. Byrd & D. J. McIntyre (Eds.), *Teacher education yearbook VIII: Research on effective models for teacher education.* Thousand Oaks, CA: Corwin.

Kraus, C. M. (1996). *Administrative training: What really prepares administrators for the job?* Paper presented at the annual meeting of the American Educational Research Association, New York.

Lortie, D. C. (1975). *Schoolteacher: A sociological study.* Chicago: University of Chicago Press.

Loucks-Horsley, S., Hewson, P., Love, N., & Stiles, K. (1997). *Designing professional developmentfor teachers of science and mathematics.* Thousand Oaks, CA: Corwin.

Lyons, N., Stroble, B., & Fischetti, J. (1997). The idea of the university in an age of school reform: The shaping force of professional development schools. In M. Levine & R. Trachtman (Eds.), *Making professional development schools work: Politics, practice and policy* (pp. 88-1 11). New York: Teachers College Press.

McBee, R. H. (1998). Readying teachers for real classrooms. *Educational Leadership, 55,* 56-58.

Milstein, M. (1992). *The Danforth Program for the Preparation of School Principals (DPPSP) six years later: What we have learned.* Paper presented at the annual meeting of the University Council for Educational Administration, Minneapolis, MN.

Milstein, M., & Associates. (1991). ***Learning to work in groups: A program guide for educational leaders.*** New York: Teachers College Press.

Milstein, M., & Associates. (1993). ***Changing the way we prepare educational leaders: The Danforth experience.*** Newbury Park, CA: Corwin.

Mulkeen, T., & Cooper, B. (1992). Implications of preparing school administrators for knowledge work organizations: A case study. ***Journal of Educational Administration, 30,*** 17-28.

Myers, *C.* (1997, March). ***The absence of self-study in school-university teacher education.*** Paper presented at the annual meeting of the American Educational Research Association, Chicago. ED 408 273

National Center for Education Statistics. (1999). ***Teacher quality: A report on teacher preparation and qualifications of public school teachers.*** Washington, DC: Author.

National Commission on Excellence in Educational Administration. (1987). ***Leadersfor America's schools: The report of the NCEEA.*** Tempe, AZ: Author. (ERIC Document Reproduction Service No. 286 265)

National Council for Accreditation of Teacher Education. (1998). ***Standards for professional development schools.*** Washington, DC: Author.

National Research Council. (1994). ***Learning, remembering, believing.*** Washington, DC: National Academy Press.

National Research Council. (1996). ***National science education standards.*** Washington, DC: National Academy Press.

Norris, C. J., & Bamett, B. (1994). ***Cultivating a new leadership paradigm: From cohorts to communities.*** Paper presented at the annual meeting of the University Council of Educational Administration, Philadelphia, PA.

Raizen, S. A., & Michelsohn, A. M. (1994). ***The future of science in elementary schools. San*** Francisco: Jossey-Bass.

Rigden, D. (1996). What teachers have to say about teacher education. ***Perspective, 8*****(1).** Washington, DC: Council for Basic Education.

Ross, J. (1995). Professional development schools: Prospects for institutionalization. ***Teaching and Teacher Education, 1 I,*** 195-20 1.

Rutherford, F. J., & Ahlgren, A. (1990). ***Science for all Americans. New*** York: Oxford University Press.

Sandoval, P. A. (1992). ***The "U" in UTEP: Development of the urban curriculum and its delivery.*** (Second year report to the Indiana Department of Education, Teacher Training and Licensing Advisory Committee). ED 360 270

Shamos, M. (1995). ***The myth of scientific literacy.*** New Brunswick, NJ: Rutgers University Press.

Springer, L., Stanne, M. E., & Donovan ***S.*** (1997). ***Effects of small group learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis*** (Research Monograph 11). Madison: University of Wisconsin-Madison, National Institute for Science Education.

Staton, A. Q., & Hunt, S. L. (1992). Teacher socialization: Review and conceptualization. ***Communication Education, 4,*** 109-137.

Stepans, J. I., & McCormack, A. (1985, October). ***A study of scientific conceptions and attitudes toward science of prospective elementary teachers: A research report.*** Paper presented at the meeting of the Northern Rocky Mountain Educational Research Association, Jackson Hole, WY.

Stoddart, T. (1993). The professional development school: Building bridges between cultures. *Educational Policy, 7, S-23.*

Su, J. Z. X. (1992). Sources of influence in preservice teacher socialization. *Journal @Education for Teaching, 18,* 239-258.

Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition.* Chicago: University of Chicago Press.

Valli, L., Cooper, D., & Frankes, L. (1997). Professional development schools and equity: A critical analysis of rhetoric and research. In M. Apple (Ed.), *Review of research in education* (Vol. 22, pp. 25 l-304). Washington, DC: American Educational Research Association.

Weise, K. R. (1992). *A contemporary historical study of the Danforth Program for Preparation of School Principals at the University of Houston.* Unpublished doctoral dissertation, University of Houston.

Winitzky, N., Stoddart, T., & O'Keefe, P. (1992). Great expectations: Emergent professional development schools. *Journal of Teacher Education, 43,517.*

Yerkes, D., Basom, M., Norris, C., & Barnett, B. (1995, August). *Using cohorts in the development of educational leaders.* Paper presented at the 13th annual International Conference of the Association o:f Management, Vancouver, BC.

Yerkes, D., Cuellar, M-F., & Cuellar, A. (1992, April). *Towards an understanding of organizational culture in schools of education: Implications for leadership development.* Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Single copy price is $6.25. To order copies contact:

CENTER DOCUMENT SERVICE
Wisconsin Center for Education Research
1025 W. Johnson St., Room 242
Madison, WI 53706-1796
608/265-9698

NO PHONE ORDERS. PREPAYMENT REQUIRED FOR ORDERS UNDER $20.00.

Price is subject to change without notice.

National Institute for Science Education
University of Wisconsin-Madison
1025 West Johnson Street
Madison, WI 53706

(608) 263-9250
(608) 262-7428 fax
niseinfo@macc.wisc.edu
http://www.nise.org

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

NOTICE

Reproduction Basis

- [X] This document is covered by a signed "Reproduction Release (Blanket)" form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.

- [ ] This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").