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University of Nebraska, 1984

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The purpose of this study was threefold: (1) to identify specific teacher competencies that were particularly important to Nebraska secondary mathematics teachers as derived from the literature and perceived by practicing teachers; (2) to determine the relationship between the perceived level of importance and the perceived level of mastery for each teacher competency; and (3) to determine the influence of the demographic variables of teaching experience, school size, and educational background on importance and mastery.

The basic design chosen for this study was survey research using a questionnaire to collect the data. There were four basic stages utilized to complete the study: (1) development of a 41-item instrument used to collect the data, (2) administration of the instrument to a stratified random sample of 400 Nebraska secondary mathematics teachers, (3) analysis of the data collected using descriptive statistics, Spearman's rank correlation, t-tests,

analysis of variance, and a reliability test of the instrument, and (4) interpretation of the results of the analysis.

The findings were: (1) The top five secondary mathematics teacher competencies, when ranked according to importance, were of a practical nature relating to executing instruction while the bottom five were more theoretical and were related to learning theory. (2) A strong significant positive relationship (.903) was found between the rank of perceived importance and the rank of perceived mastery. (3) Two-thirds of the items had significantly lower means for the level of mastery than for the level of importance. (4) Demographic variables had little or no effect on the ratings of perceived importance or perceived mastery. (5) The average teacher had taught for approximately 14 years, had taught mainly senior high students, had a master's degree, had some professional growth experiences within the last three years, and was certified to teach secondary mathematics.

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INTRODUCTION

Context of the Problem

With technology advancing at a scale that approximates an exponential rate, the need for well-trained secondary mathematics teachers is increasing, while the supply of secondary mathematics teachers is decreasing (Posamentier & Stepelman, 1982). According to the report, A Nation at Risk: The Imperative for Educational Reform, there is a severe shortage of mathematics teachers in the United States (National Commission on Excellence in Education, 1983). Niemann (1982) pointed out that members of the National Council of Supervisors of Mathematics are in agreement concerning this shortage and that in 1981, 26 percent of the secondary mathematics teaching positions nationwide were filled by teachers who were uncertified or only temporarily certified to teach mathematics. Niemann (1982) further stated that the proportion of uncertified teachers for Nebraska was approximately 20 percent for the 1981-82 school year. This problem is exacerbated by the fact that many present first-year secondary mathematics teachers are less academically competent than first-year secondary mathematics teachers were ten years ago (National Commission on Excellence in Education, 1983). The National Commission on Excellence in

Education found that "many teachers are being drawn from the bottom quarter of graduating high school and college students" (National Commission on Excellence in Education, 1983, p. 22).

In addition to the mathematics teacher shortage and the fact that lower ability students opt to become mathematics teachers, the National Commission on Excellence in Education (1983) also found that teacher preparation programs need substantial improvement. When considering the needs within teacher education, respondents to the PRISM (Priorities in School Mathematics) Survey felt that methods should be the first priority of the following five areas of teacher education: "methods, sensitivity to students, mathematics content, diagnosis/remediation, and materials" (National Council of Teachers of Mathematics, 1981, p. 26). In light of these facts, it is important that all college students who enroll in a preservice secondary mathematics teacher education program enter one that will prepare them with the competencies necessary to be effective secondary mathematics teachers.

Statement of the Problem

The purpose of this study was threefold: (1) to identify specific teacher competencies that were particularly important to Nebraska secondary mathematics teachers as derived from the literature and perceived by practicing teachers; (2) to determine the relationship between the perceived level of importance and the perceived level of mastery for each teacher competency (Appendix E);

and (3) to determine the influence of the demographic variables of teaching experience, school size, and educational background on importance and mastery.

Definitions

Class A School. A Nebraska secondary school with 1684-513 students in grades 9-11.

Class B School. A Nebraska secondary school with 501-153 students in grades 9-11.

Class C School. A Nebraska secondary school with 150-64 students in grades 9-11.

Class D School. A Nebraska secondary school with 63-14 students in grades 9-11.

Experienced teacher. A secondary mathematics teacher who has at least three years of full-time teaching experience.

Generic teacher competencies. The competencies (specific subject content, general methods, and professional values) that all teachers need to possess.

Inexperienced teacher. A secondary mathematics teacher who has less than three years of full-time teaching experience.

Mathematics methods course. The college undergraduate course which has as its purpose to teach mathematics teacher competencies.

Mathematics teacher competencies. The specific competencies secondary mathematics teachers need to possess. These competencies do not include the generic teacher competencies.

Mathematics teacher educator. A college instructor who teaches at least one mathematics methods course per year.

Secondary mathematics teacher. A teacher who teaches at least one course in mathematics in grades 7-12 in a public or private school in Nebraska.

Significant. A statistical difference or relationship at the .01 level.

Hypotheses

Before the hypotheses were tested, the level of importance and the level of mastery as perceived by Nebraska secondary mathematics teachers were determined for each of the mathematics teacher competencies (Appendix E). In order to find the relationship between the level of perceived importance and the level of perceived mastery and to test the influence of the demographic variables on the perceived importance and the perceived mastery, the following null hypotheses were formulated:

1. There will be no significant relationship between the level of perceived importance and the level of perceived mastery for each of the mathematics teacher competencies.

2. There will be no significant difference between the mean ratings of perceived importance and the mean ratings of perceived mastery for each of the mathematics teacher competencies.

3. There will be no significant difference between the responses of the experienced teachers and the responses of the

inexperienced teachers regarding their levels of perceived importance or perceived mastery of the mathematics teacher competencies.

4. There will be no significant differences between the responses of the mathematics teachers from class A, B, C, or D schools in either the perceived importance or the perceived mastery for any of the mathematics teacher competencies.

5. There will be no significant difference between the responses of those teachers who held a bachelor's degree and those teachers who held at least a master's degree regarding their levels of perceived importance or perceived mastery of the mathematics teacher competencies.

6. There will be no significant difference between the respondents' and nonrespondents' perceptions of importance and mastery of the mathematics teacher competencies.

Assumptions

The design of this study was based on the following assumptions:

1. Teaching ability can be described in terms of competencies.

2. Secondary mathematics teacher competencies can be identified.

3. The perceptions of those who were the students in preservice mathematics teacher education programs, namely the

secondary mathematics teachers, are valuable to mathematics teacher educators.

4. Nebraska's secondary mathematics teachers are in a position to judge the importance of mathematics teacher competencies.

5. Nebraska's secondary mathematics teachers are able to determine their level of mastery for each of the mathematics teacher competencies.

Delimitations and Limitations

Delimitations

1. The population in this study was limited to Nebraska's secondary mathematics teachers.

2. Generic teacher competencies were not included in this study.

3. The study concentrated on the level of importance and the level of mastery of the listed mathematics teacher competencies (see Appendix E).

4. Although worthy of study, it was beyond the scope of this research project to determine where and how teachers obtain each of the mathematics teacher competencies.

5. The design of the study was questionnaire research utilizing a stratified random sample of Nebraska's secondary mathematics teachers.

Limitations

1. Conclusions for this study apply only to the secondary mathematics teachers of Nebraska.

2. Conclusions for this study were based upon the perceptions that Nebraska's secondary mathematics teachers had about the level of importance and the level of mastery for each of the listed mathematics teacher competencies (see Appendix E).

3. Those respondents who were not endorsed to teach secondary mathematics had not participated in a preservice secondary mathematics teacher education program. Therefore, their responses do not reflect teacher competencies learned in a mathematics teacher education program.

Significance of the Problem

Aichele (1978) edited one of the most recent and comprehensive books dealing with mathematics teacher education, Mathematics Teacher Education: Critical Issues and Trends. In this NEA Professional Studies Publication various mathematics teacher educators made recommendations to identify the mathematics teacher competencies that should be included in an effective preservice secondary mathematics teacher education program. Also taking the mathematics teacher educator perspective, Shumaker and Potter (1977) proposed specific mathematics teacher competencies that should be addressed in a mathematics methods course. Sherrill (1978) and Coon

(1975) collected data from mathematics teacher educators to determine the present status of specific mathematics teacher competencies and preservice mathematics teacher education programs.

A survey of Dissertation Abstracts International from 1861 to 1983 relative to specific secondary mathematics teacher competencies revealed that very few studies were based on the opinions of mathematics teachers. In fact, only three dissertations since 1970 were found based on the opinions of secondary mathematics teachers. These three dissertations (Lindeman, 1977, McQueen, 1975, & Von Kuster, 1971) focused on the effectiveness of preservice teacher education programs; none of these studies dealt exclusively with specific mathematics teacher competencies. Conducting exhaustive manual and computer searches of the literature in the form of books, journals, and doctoral dissertations, very little research was found relative to specific secondary mathematics teacher competencies. Thus, a systematic collection of opinions from secondary mathematics teachers regarding specific mathematics teacher competencies would help in filling a gap in the literature.

The results of this study provide a data-base useful to teacher educators in designing or modifying preservice secondary mathematics teacher education programs. The comparison of the level of importance to the level of mastery for each of the mathematics teacher competencies could also be very helpful in designing relevant inservice programs for school personnel in charge of secondary mathematics teacher inservice programs.

CHAPTER II

REVIEW OF RELATED LITERATURE

The purpose of this study was threefold: (1) to identify specific teacher competencies that were particularly important to Nebraska secondary mathematics teachers as derived from the literature and perceived by practicing teachers; (2) to determine the relationship between the perceived level of importance and the perceived level of mastery for each teacher competency (Appendix E); and (3) to determine the influence of the demographic variables of teaching experience, school size, and educational background on importance and mastery.

With the goal of identifying specific competencies for secondary mathematics teachers, it seemed prudent to first examine facets of teacher education relative to generic teacher competencies. A search of related literature revealed the following views: (1) teacher competencies should be relevant to the teaching task, and (2) the theory of teacher competencies should be turned into practice. To accomplish these two considerations, the following three major approaches to teacher education were found: (1) the competency-based approach, (2) the humanistic approach, and (3) the problem-solving approach. The search of the literature was

then focused on preservice secondary mathematics teacher education programs to identify specific mathematics teacher competencies in the following areas: (1) teacher competencies related to mathematics content, (2) mathematics teacher competencies related to humanistic and behavioral studies and teaching and learning theory, (3) mathematics teacher competencies related to laboratory, clinical, and practicum experiences.

Preservice Teacher Education Programs

Relevance

The relevance of education and teacher training have been under attack for many years. In the classic, Saber Tooth Curriculum (1939), Benjamin attacked the relevance issue throughout the entire book. He claimed, through his satire on education, that most, if not all, of the content in teacher education programs are outdated and irrelevant.

Teacher training programs have recently come under attack on a national scale, particularly in the report, A Nation at Risk: The Imperative for Educational Reform (National Commission on Excellence in Education, 1983). The members of the Commission found "that teacher preparation programs need substantial improvement" (p. 22). The Commission members recommended that "Persons preparing to teach should be required to meet high educational standards, to demonstrate an aptitude for teaching, and to demonstrate competence

in an academic discipline" (p. 30).

Dickson, Kean, and Andersen (1973) made it clear that the competencies taught to prospective teachers in teacher education programs should be relevant to the skills necessary for good teaching. However, Sarason (1962) observed that "the content and procedures of teacher education frequently have no demonstrable relevance to the actual teaching task" (p. vii).

Dickson et al. (1973), identified five "musts" a teacher education program should have in order to insure the inclusion of a set of relevant teacher competencies included in the program:

> (1) We must contribute to the solution of societal problems. . . . (2) Our programs must continually reflect the real world. . . . (3) We must understand and satisfy the needs of our students as both we and they perceive them. . . . (4) We must live our lives as we teach. . . . (5) Our theoretical ideas must find important applications within our students' curricula. (p. 2)

Contributing to the solution of society's problems is truly a "must" in order to develop a set of relevant teacher competencies. Ignoring society's problems in developing any set of teacher competencies guarantees its irrelevance (Dickson et al., 1973). Grambs (1969) accused teacher educators and all members of higher education of not considering:

> (1) the uncertain state of international balance; (2) the dislocations (both personal and social) of technology; and (3) the divergent views of the role of education and possible solutions to the problems of educational practice. (p. 114)

Teacher educators must understand these present factors and be responsive to them if teacher education programs are going have relevant sets of competencies now and in the uncertain future (Dickson et al., 1973). Naisbitt (1982) stated in his book, Megatrends: Ten New Directions Transforming Our Lives: "The most reliable way to anticipate the future is by understanding the present" (p. 2).

In order for a set of teacher competencies to be relevant, the context of the real world should be reflected in educators' attempts to help solve society's problems (Dickson et al., 1973). Cushman (1977) cited the lack of such attempts as a major criticism of teacher education: "Critics accused teacher education institutions of irrelevant curricula, of programs that were out of touch with the socioeconomic changes of the real world . . . " (p. 4).

Meeting the needs of students was identified as the third "must" for developing a relevant set of teacher competencies (Dickson et al., 1973). Papert (1980) in his book, Mindstorms: Children, Computers, and Powerful Ideas, advocated all learning be related to the needs of students by helping them expand their models. He stated "the fundamental fact about learning: Anything is easy if you can assimilate it to your collection of models. If you can't, anything can be painfully difficult" (p. vii).