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A STUDY OF NEW JERSEY MIDDLE SCHOOL MATHEMATICS TEACHERS'  
QUALIFICATIONS AND BELIEFS ON CERTIFICATION

by  
Stephanie Marone

A Thesis

Submitted in partial fulfillment of the requirements of the  
Master of Arts in Mathematics Education Degree  
of  
The Graduate School  
at  
Rowan University  
May 1, 2007

Approved by. \_\_\_\_\_  
Advisor

Date Approved 4/26/07

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## ABSTRACT

Stephanie Marone  
A STUDY OF NEW JERSEY MIDDLE SCHOOL MATHEMATICS TEACHERS'  
QUALIFICATIONS AND BELIEFS ON CERTIFICATION

2006/07

Dr. Eric Milou  
Master of Arts in Mathematics Education

The purpose of this research was to assess New Jersey middle school mathematics teachers' qualifications and beliefs on certification. To research this topic, teachers from South Jersey middle schools were contacted and asked to respond to a survey. The survey was created by the researcher to obtain information on the qualifications of respondents and their beliefs. The survey used a Likert scale to measure teachers' beliefs on their qualifications and comfort level teaching New Jersey Core Curriculum Content Standards. It is clear from previous research that middle school mathematics teachers should be educated specifically to teach both mathematics and young adolescents. It is also clear from this research that New Jersey middle school mathematics teachers are not educated in such a way. It is imperative that all middle school mathematics teachers be properly trained in mathematics as well as middle-level education.

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Most importantly to my husband, Jim. There are no words to express the gratitude I have towards him for everything he does.

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## CHAPTER 1

### Introduction

#### *Statement of Problem*

The first middle school on record was in Bay City, Michigan, in 1950 (Manning, 2000). However, junior high schools have been around since the early 1900's. From at least the 1920's, proponents for middle schools specifically created for young adolescents have been demanding specialized preparation for middle level teachers. Modern advocates of middle school movement, which began in the 1960's, continue to pursue the need for teacher preparation programs that prepare teachers to work specifically with this age group (Alexander, Williams, Compton, Hines, Prescott & Kealy, 1968; Douglas, 1920; Elliot, 1949; Floyd, 1932; George & Alexander, 2003; Keefe, Clark, Nickerson & Valentine, 1983; Koos, 1927; McEwin & Dickinson, 1995; National Forum to Accelerate Middle-Grades Reform, 2002; Van Til, Vars, & Lounsbury, 1961).

“Perhaps the most serious obstacle to the educational development of the junior high school has been the lack of teachers specifically prepared for work at this level” (p. 49 Van Til, Lounsbury, & Vars, 1967). Early proponents of middle schools realized this downfall and promoted teachers of these grades received specialized preparation (McEwin, Smith , 2003).

Supporters of teachers proficient in middle level education recognize that students' ability to be successful in school depends heavily on their teachers' specialized training (National Forum to Accelerate Middle-Grades Reform, 1998; McEwin, Dickinson & Anfara, 2005; Conference Board of the Mathematical Sciences, 2001; Manning, 2000; National Middle School Association, 2006; Monk, King, 1994).

Unfortunately, the majority of teachers at the middle level do not have the professional preparation to effectively teach young adolescents (McEwin, Dickinson & Smith, 2003; Scales & McEwin, 1994). This is mainly attributed to licenses overlapping grade levels (e.g. elementary certification for grades K - 8 and secondary certification for grades 7 - 12). Gayle (2003) charged:

Overlapping licensure has plagued middle level teacher preparation and weakened the effectiveness of middle level teacher licensure regulations for many years. One result of such licensure structures is that many prospective teachers select options that provide the widest range of job possibilities instead of choosing to focus on specialized preparation to teach a single developmental age group. This trend has prepared teachers to teach either elementary or secondary level students, ignoring the fact that teaching adolescents requires skills that neither of these programs have. (p. 11)

Middle level teachers, professional organizations, special alliances, state departments of education and other middle level educators all stress the magnitude of middle level teacher preparation programs (Arth, Lounsbury, McEwin & Swaim, 1995; Boyer, 1983, Dickinson, 2001; Jenkins & Jenkins, 1991, McEwin, Dickinson & Hamilton, 2000; Valentine, Clark, Hackmann, & Petzko, 2002, National Board for Professional Teaching Standards, 2001; National Middle School Association, 2001).



Research shows that teachers' subject-matter knowledge is one of the most important elements of teacher quality and that students, particularly in the higher grades, benefit most from teachers with strong subject-matter background (Goldhaber and Brewer 1997 and 2000; Monk and King 1994; Rowan, Chiang, and Miller 1997).

Unfortunately, a study by Seastrom, et al. shows that it is not uncommon for a teacher to teach outside his or her area of subject-matter training and certification. Between 1999 and 2000, 68.6% of public school students in the middle grades were taught by a teacher who did not report a major and certification in the subject taught. Even more disturbing, 21.9% of the same classifications of students were taught by a teacher with no major, minor or certification. Seastrom (2002) holds:

Whether it is because a general elementary certification or training is thought to be sufficient in the middle grades, or because teacher specialization in the middle grades has not caught up with the move toward changing classes in the middle grades, teachers who teach specific subjects in the middle grades are less likely to have the recognized credentials than their contemporaries teaching in the high school grades. (p. 16)

### *Research Questions*

This study will attempt to answer the following questions:

1. Do the qualifications and educational backgrounds of New Jersey middle school mathematics teachers compare favorably with those prescribed by research?
2. Do New Jersey middle school mathematics teachers hold certification(s) specific to middle level teaching?
3. Do New Jersey middle school mathematics teachers feel a specific certification for middle school teachers should be required?

4. Do New Jersey middle school mathematics teachers have a current knowledge base and are well-versed in the academic field(s) in which they teach?
5. Are New Jersey middle school mathematics teachers familiar with national, local and state standards and guidelines for teaching mathematics?
6. Do New Jersey middle school mathematics teachers agree with the research recommended minimum of 21 semester hours of mathematics for prospective mathematics teachers at the middle level?
7. What areas of New Jersey Core Curriculum Content Standards do New Jersey middle school mathematics teachers feel more (less) than ready to teach?

*Need for the Study*

A major objective of No Child Left Behind (NCLB) is a highly qualified teacher in every classroom. The problem is that middle grades teachers hold secondary certificates and are prepared either to teach content or hold elementary certificates with preparation to teach children. It is rare that middle-level teachers are prepared to teach both young adolescents and challenging content (Cooney, 2000). McEwin and Dickinson (1996) believe:

The lack of strong, developmentally responsive policies, practices, and programs for young adolescents and their teachers are conspicuous by their absence and are a constant reminder of the low priority given to this developmental age group and their teachers. (p. 1)

Unfortunately, research is backing up common sense: A skilled and knowledgeable teachers can make an enormous difference in how well students learn. Middle-grades teachers must have a deep understanding of both their subjects and how to

teach it so that every student learns and demonstrates significant progress in his or her performance (Ngwudike,2000).

The position of the National Council of Teachers of Mathematics (2000) is: special attention must be given to the preparation and ongoing professional support of middle-grades teachers. They need a deep understanding of mathematical ideas, pedagogical practices, interdisciplinary teaching approaches, how students learn mathematics, and adolescent development. States and provinces need to give much more attention to the development of special preparation programs for teachers of mathematics in the middle grades. (p. 212)

One of the ways of addressing the trend of United States students lagging behind their peers in mathematics achievement is to reform its teacher preparation program (Ngwudike, 2000). If an attempt to improve schooling is to be made, we have to start with the teachers (Andrews & Anfara, 2003). “If students are to achieve high standards, we can expect no less from their teachers...If we do not focus as a nation on preparing excellent teachers and providing them with quality initial preparation...then we fall short of our goals for students” (p. 12, Ngwudike, 2000). The National Commission on Teaching and America’s Future (1996) stated that “in order to teach mathematics effectively, one must combine a profound understanding of mathematics, with a knowledge of students as learners, and to skillfully pick from and use a variety of pedagogical strategies.”

### *Limitations*

The study is limited to New Jersey public middle schools. A researcher designed survey of the qualifications and educational backgrounds of the mathematics teachers in

those schools will be conducted. The study is limited by the number of surveys returned by the required date, and also by the honesty of the participants completing these surveys.

### *Definitions of Terms*

CBMS - Conference Board of the Mathematical Sciences

Highly Qualified Teacher (as defined by NCLB) - New teachers in core academic subjects hold a bachelor's degree, have full state certification and demonstrate subject-matter competency. The certification and subject-matter competency requirements are set by individual states.

Middle School - Middle school will be defined as grades six through eight.

NCATE - National Council for Accreditation of Teacher Education

NCLB - No Child Left Behind Act

NCTM - National Council of Teachers of Mathematics

TIMSS - Trends in International Mathematics and Science Study. The Trends in International Mathematics and Science Study (TIMSS) was developed by the International Association for the Evaluation of Educational Achievement (IEA) to measure trends in students' mathematics and science achievement. Offered in 1995, 1999, and 2003, TIMSS provides participating countries with an unprecedented opportunity to measure students' progress in mathematics and science achievement on a regular 4-year cycle. Through participation in TIMSS, the United States has gained reliable and timely data on the mathematics and science achievement of our students compared to that of students in other countries. The next cycle of TIMSS is scheduled for 2007.

## CHAPTER 2

### Review of Literature and Research

Since the formation of middle schools, an incredible amount of research has been conducted to investigate the proper methods of educating teachers at this level. This study made use of journal articles, opinion papers, research reports, master's thesis, doctoral dissertations and the ERIC digest. The review is divided into seven parts.

#### *Correlations between Teacher Qualifications and Student Achievement*

“Good middle school teachers have the knowledge, skills, and dispositions to enable them to awaken each day ready to grow, ready to care, ready to risk, *ready to teach*” (Necochea, et al pp. 178 - 179). In general, teachers need a deep understanding of the content area which they teach to be able to make connections, promote discovery, evaluate alternative responses, and provide experiences that promote higher-level thinking skills (Cain, 2000). “Effective teaching requires knowing and understanding mathematics, students as learners, and pedagogical strategies” (Graham & Fennel, 2001, p. 3). Darling-Hammond (1994) has noted the percentage of teachers who were fully certified and had majored in the content areas they taught is the strongest predictor of how well a state's students perform on national assessments.

Research shows that if a teacher is assigned to a subject he or she is not trained to teach (teaching out-of-field), there is a negative effect on student achievement (Darling-

Hammond 2000; Goldhaber and Brewer 1997; Monk and King 1994). In 1997, Goldhaber and Brewer found a positive relationship between a teacher's postsecondary degrees and their students' mathematics performance. Students whose teachers held a bachelor's or master's degree in mathematics experienced higher levels of performance than that of students whose teachers were out-of-field. Students of teachers who held a postsecondary degree in mathematics and teaching certificate performed better than students of teachers who were only certified in mathematics.

“Studies discover again and again that teacher expertise is the most important factor in determining student achievement” (Ngwudike, p. 8). However, the research on the amount of schooling in a subject is somewhat conflicting. Researchers have realized that more substantial mathematical content knowledge is needed for teaching school mathematics than was previously believed (Tucker, 2000). Some researchers argue that teachers should earn a major in any subject field they intend to teach (Ravitch, 1998). Others maintain it is sufficient for a teacher to obtain a minor in a field (Ingersoll, 1999). Nevertheless, as Ngwudike (2000) points out, it's not necessarily the quantity of school, but the quality of schooling. “Student achievement is largely dependent on good teachers. Good teachers are products of good teacher education programs” (p. 3).

Jim Geringer, the 1999-2000 Education Commission of the States Chairman claims

An effective teacher is the single most important factor affecting student learning. It's more important than standards, more important than class size, more important than how much money is spent. Each of these is significant, but the quality of teaching dwarfs them all. (p. 2)

In a 1991 study, Ferguson found that teachers' expertise, measured by education, scores on a licensing examination, and experience, accounted for about 40% of students' achievement. He added that there is no other school resource that will help gain greater increases in student achievement than hiring highly qualified teachers. Teachers who are truly highly qualified teach well-designed, standards-based lessons, and they are able to teach those lessons successfully because they know how and why their students learn (Center for Teaching Quality, 2006).

A study of New York City schools with similar student populations found that, in all grade levels tested, differences in teacher qualification accounted for more than 90% of the differences in student achievement in reading and math (Armour-Thomas, Clay, Comanico, Bruno, & Allen, 1989).

For years, research has identified strong links between quality teaching and student achievement. One study, "Paying for Public Education: New Evidence on How and Why Money Matters" (Ferguson, 1991), found that in 900 schools in Texas, the level of teacher expertise—measured by whether a teacher had a master's degree, scores on licensing examinations, and length of experience—accounted for 43 percent of the difference in student achievement in math and reading in grades one through 11.

*Need for specialized preparation of middle-level teachers*

Middle level educators agree that middle level teachers need specialized professional preparation to be highly successful (NMSA, 2006). Currently, only 17 states offer certification for mathematics teachers in the middle grades (Graham & Fennel,

2001). This is disheartening considering more and more middle school students are being exposed to important concepts in algebra and geometry. Teachers need to know how the roots of mathematically sophisticated content areas develop early on in a child's mathematics education.

Educating middle level teachers is completely different than educating elementary or secondary teachers. Unfortunately, many times young adolescents are not taught by teachers specifically prepared to teach them (Jackson & Davis, 2000). This should be of great concern because

elementary teachers seldom have a math background appropriate or sufficient for teaching middle grades math, and most secondary programs do not examine the middle grades math content in a manner needed by teachers of these grades...teaching middle grades mathematics requires preparation different from, not simply less than, preparation for teaching high school mathematics, and certainly reflecting more depth than that need by teachers of earlier grades. (CBMS, 2001, p. 25)

#### *TIMMS Results*

While the average performance of eighth graders in the United States improved since 1995 (average scores on TIMMS assessment: 492 in 1995, 502 in 1999, 504 in 2003), the United States was still 19<sup>th</sup> in comparison to 38 nations in mathematics. Between 1999 and 2003, there was no decline in scores; however there was no increase in scores either. Fourth graders in 1999 had an average score of 518. In 2003, those students, then in eighth grade, held their average score at 518. Without teachers who are knowledgeable in subject matter and education, students in the United States may continue to perform below their international peers (Ngwudike, 2000).



*Suggestions for Elements for Preparation and Certification Programs at the Middle Level*

One key element to any successful teacher preparation program is methods classes that teach future educators how to package subject matter skills into quality learning experiences, instruction and assessment, as well as exposing future teachers to how students learn (Berliner, 1986; Gaskill, 2002; Scales, 1992; Scherer, 2001). Also, education courses in mathematics methods positively correlate to student achievement in those subjects. Furthermore, for mathematics teachers, education methods courses had more powerful on student achievement than merely taking more courses in the content area (Monk, 1994). “Effective mathematics teaching requires that teachers understand what students know and need to learn and then challenging and supporting them to learn it well” (NCTM, 2000, p. 16). Teachers gain experience in these realms through experiences in their pre-service development programs (Graham & Fennel, 2001).

Sondra Cooney of the Southern Regional Education Board in Atlanta, Georgia suggests these guidelines for middle level teacher education programs:

- subject-specific certification for the middle grades with a major in an academic area or with dual minors in two academic areas;
- a high school certification with special provisions for those who want to teach in the middle grades to help them gain experience and understanding of how young adolescents learn;

- an academic concentration that elementary majors could add that would prepare them to teach in an academic field in the middle grades.

McEwin, Smith, and Dickinson disseminated research (Cooney, 2000; Jackson & Davis, 2000; McEwin & Dickinson, 1996; National Forum to Accelerate Middle-Grades Reform, 2002) about elements for effective middle level teacher preparation programs.

They found these programs should contain:

- a comprehensive understanding of early adolescence and the needs of young adolescents;
- philosophy and organization of middle level education;
- middle level curriculum;
- middle level planning, teaching, and assessment;
- concentrated study in two broad teaching fields;
- middle level field experiences

The National Middle School Association (2001) suggest the program elements below are unique to middle level teacher preparation and do not address other important elements that are essential to all quality teacher preparation programs.

- Young adolescent development: Teachers must have comprehensive knowledge in the development and needs of young adolescents through coursework and working directly with them.
- Middle level philosophy and organization: which includes: 1. the origins and development of the junior high and middle schools; 2. effective middle level

school organizational features and practices; 3. middle level philosophy; 4. middle level trends and issues and 5. other information that helps all teachers of young adolescents better understand the rationale for and context of middle level schooling.

- Middle level curriculum: discipline specific, integrative, and interdisciplinary.
- Subject matter knowledge: Teachers should be trained in two academic areas. The rationale behind this is that interdisciplinary teaching is gaining momentum in middle schools. Teachers that teach on teams are knowledgeable in two disciplines, making the desired integration of subject areas more likely and effective. Also, teachers obtain more flexibility in employment when they are licensed in two content areas.
- Middle level planning, teaching, and assessment: Emphasis should be placed on learning a wide variety of teaching strategies and effectively applying these strategies in middle level classrooms. Equally important is for teacher candidates to learn how to construct and employ assessment techniques ranging from traditional testing to authentic assessments, portfolios, exhibitions and open-ended problems.
- Middle level field experiences: Practicing teachers said it is an essential component of professional preparation programs (Wilson, Floden, & Ferrini-Mundy, 2001). These experiences should be early and continuing, increasing in complexity and involvement, ultimately ending in an extended field experience

where prospective middle level teachers function as the lead teacher in a classroom.

The Conference Board of the Mathematical Sciences (2001) advocates at least 21 semester hours of mathematics for prospective mathematics teachers to teach more sophisticated content of the middle grades. By requiring this, these teachers will have the foundation to have a well-developed understanding of the mathematics they teach. They recommend two types of courses. First, approximately 12 semester-hours should be devoted for teacher candidates to “develop a deep understanding of the mathematics they will be teaching” (CBMS, 2001, p. 25). Second, teacher candidates need to strengthen their mathematical knowledge and understand the “mathematical connections between one educational level and the next, connections between elementary and the middle grades as well as between middle grades and high school” (CBMS, 2001, p. 26).

#### *Mandating middle-level teacher licensure and licensure trends*

In a 1994 study by Scales and McEwin, they found only 20% of middle level mathematics, social studies, science, and language arts teachers had specialized middle level teacher preparation. And this was in states with available middle level licensure. Andrews & Anfara (2003) highlight the importance of, and states inability of, mandating middle-level licensure:

Virtually anyone with any kind of degree or licensure is permitted to teach young adolescents. This malpractice reflects directly on the responsibilities of teacher licensure/certification agencies and professional practice boards that fail to fulfill their

primary function of protecting the public - in this case young adolescents. Middle level teacher licensure regulations should require that middle level teachers receive the specialized knowledge, skills, and dispositions necessary to be highly effective even in their first years of teaching. The failure in some states to create mandatory middle level teacher licensure has resulted in the majority of middle level teachers being inadequately prepared to teach young adolescents when they begin their careers. A major reason specialized middle level teacher preparation programs are not universally available in the nation is the failure of many states to design and implement licensure regulations that reflect and require the specialized knowledge, dispositions, and performances needed to teach young adolescents successfully. (p. 8)

Jackson and Davis (2002) point out that why would teachers restrict themselves to four grade levels (5 - 8) by getting a middle-grades license when they can cover six (7-12) or nine (K-8) grade levels over the same duration of time if it is not mandatory? States that have mandatory middle-level licensure have more specialized middle-level teacher preparation programs. Yet, the majority of states that offer middle-level licensure do not require middle-level teachers to hold that credential to teach young adolescents (Andrews & Anfara, 2003).

Now The National Forum to Accelerate Middle-Grades Reform advocates every state require middle-level teachers to have middle-level credentials. They hope this will encourage more colleges and universities to offer programs that distinctly for middle-level teaching, and more states to require mandatory middle-level licensure. With anticipation this will lead to more schools to hire teachers with the appropriate preparation (NFAMR, 2006).

The NMSA (2006) also realizes that a correlation exists between the type of licensure required and the number of teacher preparation intuitions that offer specialized middle level teacher preparation programs.

Mandatory middle level teacher licensure leads to the development, implementation, and continuation of specialized middle level teacher preparation programs. A major reason specialized middle level teacher preparation programs are not universally available in the nation lies in the failure of many states to design and implement licensure regulations which promote the specialized knowledge , dispositions, and performances needed to successfully teach young adolescents. As well, many states with specialized middle level licensure have plans with widely overlapping grade levels. The result of such plans is that most prospective teachers select options with the widest range of job possibilities instead of choosing to focus on specialized preparation for a single developmental age group. (position statement, p. 6)

Overall, states are coming around to the importance of mandating middle level licensure. In 1925 only six states issued license for teaching in the junior high school (Powers, 1925) and nine states in 1932 (Floyd, 1932) had licensure different from elementary and secondary teachers. The number of states some provision for middle level teacher licensure has also grown: two in 1969 (Pumerantz, 1969), eight in 1978 (Gillan, 1978), 26 in 1985 (McEwin, & Allen, 1985), 33 in 1992 (Valentine & Mogar, 1992) and 44 (including DC). As of 2000, (Gaskill, 2002) only 21 of 44 states have some form of middle-level licensure regulations for teachers. The seven that do not include provisions for middle level teacher licensure are California, Idaho, Louisiana, Maryland, Mississippi, Montana, and New Jersey.

In 2003, 30 % of grades seven and eight teachers assigned to teach math or science lack the subject knowledge to do so (Andrews, 2003). Today: 46% of states

require a middle-level license for teaching in middle-level classrooms. (National Forum to Accelerate Middle-Grades Reform)

*“Add-on” Endorsements*

“Experience has clearly shown that one of the least effective plans for ensuring the special preparation of middle level teachers is creating add-on endorsement plans” (p. 104, Jackson & Davis, 2000). According to McEwin & Dickinson (1996), some of the possible causes of the ineffectiveness of add-on endorsements are: It is usually not a requirement of states to obtain them to teach at the middle level, they usually consist of two or three courses in middle level teaching and, the more complete an endorsement program, require students to prolong the amount of time they are in college.

*Studies of availability of teacher preparation programs and teachers who received specialized preparation*

Graham, Li, and Curran Buck (2000) performed a study of teacher preparation programs in the United States. They found that there is no considerable difference between the current programs and those around in the 1900’s. For instance, prospective high school mathematics teachers are usually required to complete a major in mathematics (Graham & Fennel, 2001).

In a national survey of middle school principals conducted in 2000 by Valentine, Clark, Hackmann, and Petzko (2002) found “only 18% of respondents reported that the majority of teachers at their schools held middle level teacher licensure” (p.10). A similar study by Scales and McEwin (1994) found only 20% of middle level

mathematics, social studies, science and language arts teachers received specialized middle level teacher preparation before they began their careers.

This is not surprising considering that in a 1996 national study of teacher preparation programs, only 51% of institutions reported offering middle level courses or having specialized middle level teacher preparations programs at one or more degree levels (McEwin, Dickinson, Swaim, 2002). However, this was a dramatic increase from years past. In 1987, 33% (Alexander & McEwin, 1988) and in 1973, 23% (Gatewood and Mills) of institutions offered specialized middle level teacher preparation programs. McEwin and Dickinson (1995) sum it up beautifully:

A major reason for the lack of teachers with special preparation to teach young adolescents lies not in the unwillingness of prospective and practicing middle level teachers to enroll in these programs, but the unavailability of undergraduate and graduate middle level teacher preparation programs. (p. 3)



## CHAPTER 3

### Methodology

#### *Procedures*

To research this topic, mathematics teachers from New Jersey public middle schools in Burlington, Camden and Gloucester counties were contacted via email and asked to respond to a survey regarding their educational backgrounds and teaching qualifications. Public middle schools in New Jersey with web sites listed on the New Jersey Department of education website were contacted to participate in the survey. The email addresses for the teachers were found via the internet. Emails were sent to each respective school's mathematics teachers requesting the survey be completed via the link to the website *surveymonkey.com*. The survey was emailed on January 23, 2007 and asked to be completed by February 6, 2007.

The survey of nineteen questions was divided into two parts: 1) educational backgrounds and teaching qualifications of New Jersey public middle school teachers, and 2) questions on teachers' aptitudes and beliefs in middle level and mathematics education. The TIMSS 2003 study was used in part to develop the survey. The results of the survey will be analyzed and suggestions will be made as to what, if anything, New Jersey should do to its current licensure program.

### *Measures*

The survey was created by the researcher in order to investigate educational backgrounds and teaching qualifications of New Jersey middle school mathematics teachers.

Part 1 of the survey will ask the degrees in which the teachers earned, their major area(s) of study, and the amount of classes devoted mainly to middle-level education, mathematics content, mathematics pedagogy/instruction, mathematics curriculum, integrating information technology into mathematics, and improving students' critical thinking or problem solving skills. The survey will also ask the certifications in which the teachers hold and his or her past and current teaching experience.

Part 2 of the survey will utilize a Likert scale measure the qualifications and educational backgrounds of New Jersey middle school mathematics teachers, if these teachers feel they have ample preparation to teach the mathematics courses to which they are assigned and if they feel they have ample specific middle school preparation. Each category of the Likert scale will be assigned a numeric value: strongly agree = 5, agree = 4, neither agree nor disagree = 3, disagree = 2, and strongly disagree = 1.

### *Design and Analyses*

Means will be calculated for each item on the Likert scale. Higher means are indicative of stronger mathematical backgrounds and teacher preparation specific to middle level teaching. A t-test will assess whether New Jersey middle school mathematics teachers feel they have ample preparation to teach the mathematics courses to which they are assigned, if they have specific middle school preparation, if they feel a

specific certification for middle school teachers should be required and if they agree with the research recommended minimum of 21 semester hours of mathematics for prospective mathematics teachers at the middle level? Frequency tables will be used to determine the degree(s) and certification(s) which these teachers hold, their major area of study and the amount of college courses taken devoted to the areas mentioned above. Correlation analyses will be conducted to determine if there is a significant relationship between teachers' feelings of their mathematics abilities and the amount of mathematical content knowledge they have. Correlation analyses will also be conducted to determine if there is a significant relationship between teachers' feelings of their ability to teach and understand adolescents and the amount of specific middle level preparation they have.

#### Research Questions

Each research question will be strongly connected to each question on the survey. Each research question is listed below along with the survey questions to correlate to it.

Research question 1: "Do the qualifications and educational backgrounds of New Jersey middle school mathematics teachers compare favorably with those prescribed by research?" was answered by survey questions 1, 2, 3, 4, 5, 9 and 10.

Research question 2: "Do New Jersey middle school mathematics teachers hold certification(s) specific to middle level teaching?" was answered by survey questions 6 and 7.

Research question 3: “Do New Jersey middle school mathematics teachers feel a specific certification for middle school teachers should be required?” was answered by survey question 11, part a.

Research question 4: “Do New Jersey middle school mathematics teachers feel they have a current knowledge base and are well-versed in the academic field(s) in which they teach?” was answered by survey question 11, part b.

Research question 5: “Are New Jersey middle school mathematics teachers familiar with national, local and state standards and guidelines for teaching mathematics?” was answered by survey question 11, part c.

Research question 6: “Do New Jersey middle school mathematics teachers agree with the research recommended minimum of 21 semester hours of mathematics for prospective mathematics teachers at the middle level?” was answered by survey question 11, part d.

Research question 7: “What areas of New Jersey Core Curriculum Content Standards do New Jersey middle school mathematics teachers feel more (less) than ready to teach?” was answered by survey questions 17, 18, 19, 20 and 21.

## CHAPTER 4

### Findings

The purpose of this chapter is to describe the results of the survey according to the procedures described in the previous chapter. Sixty-three out of 503 surveys were returned, a 12.5% return rate, from 28 different South Jersey middle schools. Table 4.1 summarizes the demographic information from part one of the survey.

**Table 4.1** *Background information*

<b>Degrees Earned</b>			<b>Major Area of Study</b>		
	<b>#</b>	<b>%</b>		<b>#</b>	<b>%</b>
Baccalaureate	42	67.7	Ed - Math	15	24.2
Master's	23	37.1	Ed - General	18	29
Doctorate	1	1.6	Ed - Middle Level	2	3.2
Other	3	4.8	Mathematics	6	9.7
			Other	21	33.9
<b>College Courses Devoted to Middle-Level Education</b>			<b>College Courses Devoted to Mathematics Content</b>		
0 - 2	33	53.2	0 - 2	15	24.2
3 - 5	18	29	3 - 5	22	35.5
6 - 8	7	11.3	6 - 8	9	9
9 or more	3	4.8	9 or more	16	16
Other	1	1.6	Other	0	0
<b>College Courses Devoted to Mathematics Pedagogy/Instruction</b>			<b>Grade Level Certification</b>		
0 - 2	40	64.5	K - 8	43	69.4
3 - 5	16	25.8	7 - 12	13	21
6 - 8	6	9.7	Middle Level (5 - 8)	8	12.9
9 or more	1	1.6	Other	15	24.2
Other	0	0			

Subject Certification			State Certification		
Mathematics (any level)	28	45.2	New Jersey	55	90.2
Elementary Education	17	27.4	Pennsylvania	9	14.8
Highly Qualified in Mathematics	10	16.1	Delaware	0	0
Other	7	11.3	Other	7	11.5
Years Teaching Mathematics			Years Teaching Middle Grades		
1 - 5	18	29.1	1 - 5	25	40.3
6 - 10	20	32.3	6 - 10	18	29
11 - 15	11	17.7	11 - 15	10	16.1
16 - 20	5	8	16 - 20	6	9.7
21 or more	8	12.9	21 or more	3	4.8

*Analysis of Research Questions*

Research Question #1: Do the qualifications and educational backgrounds of New Jersey middle school mathematics teachers compare favorably with those prescribed by research?

Questions 1, 2, 3, 4, 5, 9 and 10 were used to answer research question 1. This information is summarized in table 4.1. Question 1 asked participants which college/university degree(s) they hold. An overwhelming majority, 67.7%, hold a baccalaureate degree. Question 2 asked their major area of study. 33.9% stated their major area of study was in some subject other than mathematics/mathematics education, elementary education or middle level education such as special education, political science and psychology. Question 3 asked how many college courses they have taken that were devoted mainly to middle-level education. Over half of the respondents only took two or less. Question 4 asked how many college courses they have taken that were

devoted mainly to mathematics content. Again, the majority, 64.5%, took two or less courses in mathematics content. Question 5 asked how many college courses they have taken that were devoted mainly to mathematics pedagogy/instruction. 69.4% of the respondents took two or less courses in this area.

Questions 9 and 10 dealt with the experience of the teachers surveyed. Most of the teachers, 32.3%, taught mathematics between six and ten years. 40.3% of the teachers taught mathematics in the middle grades for one to five years.

Research Question #2: Do New Jersey middle school mathematics teachers hold certification(s) specific to middle level teaching?

This question was answered by survey questions 6 and 7. Only 12.9% of the teachers surveyed hold a certification specific to middle level education. However, 45.2% of these teachers are certified to teach mathematics at any level.

*Refer to table 4.2 for data on research questions three through six.*

Research Question #3: Do New Jersey middle school teachers feel a specific certification for middle school teachers should be required?

Question 11, part a, shows thirty (52%) respondents either agree or strongly agree with this statement. The mean of the responses to this question was 3.36 with a standard deviation of 1.18.

Research Question #4: Do New Jersey middle school mathematics teachers feel they have a current knowledge base and are well-versed in the academic field(s) in which they teach?

Question 11, part b, shows forty-nine (86%) of respondents feel they are well-versed in the academic field(s) in which they teach, while 4% feel they are not. The mean of responses to this question was 4.26 with a standard deviation of 1.07.

Research Question #5: Are New Jersey middle school mathematics teachers familiar with national, local and state standards and guidelines for teaching mathematics?

Forty-eight (84%) of survey participants responded with agree or strongly agree with this statement. The responses to this question had a mean of 4.16 and a standard deviation of 0.96.

Research Question #6: Do New Jersey middle school mathematics teachers agree with the research recommended minimum of 21 semester hours of mathematics for prospective mathematics teachers at the middle level?

Twenty-four (43%) of the respondents agree or strongly agree with this statement. The mean of responses was 3.25 with a standard deviation of 1.01.

**Table 4.2:** Survey question 11: parts a, b, c and d

	1	2	3	4	5	Mean	Std. Dev.
	Strongly Disagree	Disagree	Neither Agree/Disagree	Agree	Strongly Agree		
a) I feel a specific certification for middle school mathematics teachers should be required.	7% (4)	19% (11)	22% (13)	34% (20)	17% (10)	3.36	1.18
b) I have a current knowledge base and am well-versed in mathematics.	4% (2)	0% (0)	11% (6)	39% (22)	47% (27)	4.26	1.07
c) I am familiar with national and state standards and guidelines for teaching mathematics.	2% (1)	7% (4)	7% (4)	42% (24)	42% (24)	4.16	0.96



d) I feel middle level mathematics teachers should be required to take a minimum of 21 semester hours of mathematics for middle level certification.	7% (4)	16% (9)	34% (19)	30% (17)	12% (7)	3.25	1.1
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Research Question #7: What areas of New Jersey Core Curriculum Content Standards do New Jersey middle school mathematics teachers feel more (less) than ready to teach?

Table 4.3 summarizes the information obtained about this statement. Paired sample tests were conducted to determine if the respondents felt stronger about one statement than another. Table 4.4 shows the results of the paired sample tests. The mean of the teacher responses to the geometry question was 4.23 and the mean for the number sense question was slightly higher at 4.48. However, this difference of this pair, like all others, was not statistically significant.

**Table 4.3:** Survey question 12: parts a, b, c, d and e

	1	2	3	4	5	Mean	Std. Dev.
	Strongly Disagree	Disagree	Neither Agree/Disagree	Agree	Strongly Agree		
<i>I feel I have a deep understanding of the following New Jersey Core Curriculum Content Standard clusters:</i>							
a) Number sense	2% (1)	0% (0)	2% (1)	41% (22)	56% (30)	4.48	0.72
b) Algebra	2% (1)	4% (2)	6% (3)	40% (21)	49% (26)	4.30	0.89
c) Measurement	2% (1)	0% (0)	4% (2)	48% (26)	46% (25)	4.37	0.73
d) Geometry	2% (1)	4% (2)	9% (5)	40% (21)	45% (24)	4.23	0.91
e) Data Analysis	2% (1)	0% (0)	4% (2)	50% (27)	44% (24)	4.35	0.73

**Table 4.4:** *T-test of survey question 12: parts a, b, c, d and e*

	Part a		Part b		Part c		Part d		Part e	
	t	p	t	p	t	p	t	p	t	p
a) Number sense			1.146	0.254	0.794	0.429	1.603	0.112	0.928	0.355
b) Algebra					-0.43	0.665	0.431	0.667	-0.32	0.752
c) Measurement							0.898	0.371	0.131	0.896
d) Geometry									-0.78	0.435
e) Data										

## CHAPTER 5

### Summary, Conclusions, Recommendations

#### *Summary*

Organizations such as The Forum to Accelerate Middle-Grades Reform, National Middle School Association, National Board for Professional Teaching Standards, Center for Teaching Quality, Conference Board of the Mathematical Sciences, Education Commission of the States and countless researchers stress the need for teacher preparation programs that prepare teachers to work specifically with middle level students.

The Conference Board of Mathematical Sciences believe that in order for middle grades mathematics teachers to have a thorough understanding of the mathematics they teach, they should be required to take at least 21 semester hours of mathematics. This should include at least 12 semester hours of the elemental ideas specific middle level mathematics.

Educators fully certified and prepared in education and their chosen discipline are more successful than educators without such preparation (Ashton & Crocker, 1987; Greenberg, 1983). In a 1992 study, Monk (1994) found a positive correlation between a teacher's knowledge of the subject matter taught and his or her students' learning in that subject. Goldhaber and Brewer (1997) found this to be especially true in mathematics.

Students of teachers with higher postsecondary degrees in mathematics had higher levels of performance than students whose teachers were out-of-field. Unfortunately, studies on teacher qualifications show a high occurrence of teachers teaching outside their certification area and discipline (Bobbitt & McMillen, 1994; Ingersoll 2000; Neuschatz & McFarling, 1999; Robinson, 1985).

It is unfortunate that middle level teachers are sometimes not prepared to teach both the content and the students. The purpose of this research was to identify whether or not middle school mathematics teachers in Southern New Jersey have such preparation. The research was designed to answer the following questions:

1. Do the qualifications and educational backgrounds of New Jersey middle school mathematics teachers compare favorably with those prescribed by research?
2. Do New Jersey middle school mathematics teachers hold certification(s) specific to middle level teaching?
3. Do New Jersey middle school mathematics teachers feel a specific certification for middle school teachers should be required?
4. Do New Jersey middle school mathematics teachers have a current knowledge base and are well-versed in the academic field(s) in which they teach?
5. Are New Jersey middle school mathematics teachers familiar with national, local and state standards and guidelines for teaching mathematics?
6. Do New Jersey middle school mathematics teachers agree with the research recommended minimum of 21 semester hours of mathematics for prospective

mathematics teachers at the middle level?

7. What areas of New Jersey Core Curriculum Content Standards do New Jersey middle school mathematics teachers feel more (less) than ready to teach?

To research this topic, teachers from South Jersey middle schools were contacted and asked to respond to an online survey. A total of sixty-three surveys were returned, a return rate of 12.5%.

### *Conclusions*

The first research questions asked if the qualifications and educational backgrounds of New Jersey middle school mathematics teachers compare favorably with those prescribed by research. Only 34% of respondents' major area of study was mathematics/mathematics education. Only 3% of respondents' major area of study was middle level education. An overwhelming 63% of respondents were educated in some other subject area than mathematics or middle school.

The majority of teachers, 53.2%, had only a maximum of two courses devoted to middle-level education. Also, 24.2% had the same number of courses devoted to mathematics content. Approximately 37% took seven or more college courses devoted to mathematics content, that which is suggested by the Conference Board of the Mathematical Sciences.

It can therefore be concluded that these teachers' qualifications and educational backgrounds do not compare favorably with those prescribed by research.

The second research question asked if New Jersey middle school mathematics teachers hold certification(s) specific to middle level teaching. Only 12.9% of the teachers surveyed hold a certification specific to middle level education. It can be concluded that the teachers surveyed do not hold such specific certification.

The third research question asked if New Jersey middle school teachers feel a specific certification for middle school teachers should be required. Fifty-one percent of respondents either agree or strongly agree with this statement. It seems that, by a small margin, New Jersey middle school teachers feel a specific certification for middle school teachers should be required.

The fourth research question asked if New Jersey middle school mathematics teachers feel they have a current knowledge base and are well-versed in the academic field(s) in which they teach. It can be concluded from the mean response that these teachers feel they have a current knowledge base and are well-versed in the academic field(s) in which they teach, contradictory to their educational backgrounds.

The fifth research question asked if New Jersey middle school mathematics teachers are familiar with national, local and state standards and guidelines for teaching mathematics. Eighty-four percent of respondents either agree or strongly agree with this statement. The mean of the responses to this question, 4.16, was significantly higher than the neutral response of 3. It can be concluded that the respondents are familiar with such guidelines.

The sixth research question asked if New Jersey middle school mathematics teachers agree to the research recommended minimum of 21 semester hours of mathematics for prospective mathematics teachers at the middle level. The mean of the responses, 3.25, was only slightly higher than the neutral response of 3. Forty-three percent of the respondents either agree or strongly agree with this statement. It can be concluded that the respondents agree with this statement, even though they do not practice what they preach.

The seventh and final research question asked what areas of the New Jersey Core Curriculum Content Standards do New Jersey middle school mathematics teachers feel more (less) than ready to teach. The standards were number sense, algebra, measurement, geometry and data analysis. The mean for all respondents answers for all standards, 4.48, 4.30, 4.37, 4.23, 4.35, respectively, were all significantly higher than the neutral response of 3. The conclusion that these respondents feel more than ready to teach all five standards can be made.

### *Recommendations*

It is clear from previous research that middle school mathematics teachers should be educated specifically to teach both mathematics and young adolescents. It is also clear from this research that New Jersey middle school mathematics teachers are not educated in such a way. Currently, New Jersey has a middle school endorsement. A teacher certified in elementary school may complete 15 credit hours of any mathematics courses

to be certified for middle school as well. However, the state does not specify which mathematics courses are taken.

New Jersey should require a stand-alone certification for middle school mathematics teachers. The researcher understands the lack of prospective mathematics school teachers. For this reason, at the very least, New Jersey should specify which mathematics courses are appropriate for the endorsement. This would in turn force colleges and universities to offer, and prospective teachers to take, courses devoted specifically to mathematics and middle-level education.

It should also be noted that middle-level educators, specifically in special education, should not be what the NCLB deems “highly-qualified” if such teachers only pass a standardized test. All teachers should be required to take necessary college courses to hold this title and to be certified to teach middle school mathematics.



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## APPENDIX

### Survey

1. Which college/university degree(s) do you hold?
  - Baccalaureate
  - Master's
  - Doctorate
  - Other (please specify)
  
2. What was your major area of study?
  - Education - Mathematics
  - Education - General
  - Education - Middle Level
  - Mathematics
  - Other (please specify)
  
3. How many college courses have you taken that were devoted mainly to *middle-level education*?
  - 0 - 2
  - 3 - 5
  - 6 - 8
  - 9 or more
  - Other (please specify)
  
4. How many college courses have you taken that were devoted mainly to *mathematics content*?
  - 0 - 2
  - 3 - 5
  - 6 - 8
  - 9 or more
  - Other (please specify)
  
5. How many college courses have you taken that were devoted mainly to *mathematics pedagogy/instruction*?
  - 0 - 2
  - 3 - 5
  - 6 - 8
  - 9 or more
  - Other (please specify)



6. What grade level(s) are you currently certified to teach?

K - 8

7 - 12

Middle level (5 - 8)

Other (please specify)

7. What subject area(s) are you currently certified to teach? (free response)

8. What State granted your teaching certification?

New Jersey

Pennsylvania

Delaware

Other (please specify)

9. How many years have you taught mathematics, including this year? (free response)

10. How many years have you taught mathematics in the *middle grades* (5 - 8), including this year? (free response)

11. Please answer the following questions based on middle level mathematics education. Use the scale below.

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

I feel a specific certification for middle school mathematics teachers should be required.      1    2    3    4

I have a current knowledge base and am well-versed in mathematics.      1    2    3    4

I am familiar with national and state standards and guidelines for teaching mathematics. (For example, National Council of Teacher of Mathematics, DOE, NJCCCS, and other subject area frameworks)      1    2    3    4

I feel a minimum of 21 semester hours of mathematics teachers in the middle grades should be required for middle level certification.      1    2    3    4

12. I feel I have a deep understanding of the following New Jersey Core Curriculum Content Standards clusters:

1	2	3	4	5
Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree

NUMBER SENSE, including: Representing decimals and fractions using words; numbers and number lines; integers, including words, numbers and number lines; ordering and operations with real numbers. 1 2 3 4

ALGEBRA, including: Numeric, algebraic and geometric patters or sequences; Simple linear equations and inequalities, and simultaneous (two variable) equations; equivalent representations of functions as ordered pairs, tables, graphs, words, or equations; attributes of a graph, such as intercepts on axes. 1 2 3 4

MEASUREMENT, including: Estimations of length, circumference, area, volume, weight, time, angel and speed; computations with measurements in problem situations; measurements of irregular or compound areas. 1 2 3 4

GEOMETRY, including: Pythagorean theorem to find length of a side; congruent figures (triangles, quadrilaterals) and their corresponding measures; Cartesian plane (ordered pairs, equations, intercepts, intersections and gradient); translation, reflection, rotation, and enlargement. 1 2 3 4

DATA, including: Sources of Error in collecting and organizing data; data collection methods, (e.g., survey, experiment, questionnaire); characteristics of data (mean, median, range and shape of distribution); simple probability. 1 2 3 4

