

Mission Possible? High School Math Instruction and At-Risk Students

Jane Finn, Ed.D.

Professor of Education
Hope College
Education Department

Vicki-Lynn Holmes, Ph.D.

Associate Professor of Mathematics
Hope College
Math Department

Address of Submitting/Corresponding Author:

Jane Finn

Education Department
Hope College
Van Zoeren Hall 295
141 E 12th Street
Holland, MI 49423
USA

Abstract

This qualitative study investigated math educators' perceptions of the curriculum and their perceived qualifications to teach these high school math requirements to at-risk and special education populations. To understand the effect of these mathematics requirements (most states requiring all students to complete four years of mathematics, including Algebra I, Algebra II, Geometry, and one additional senior math course), ten math educators participated in two focus groups and one-on-one interviews. Findings showed these teachers believe (a) that classroom instruction will change, (b) that new stressors in terms of money, time, and focus have emerged, and (c) the feelings of being under-qualified to effectively teach the math curriculum to students with high incident disability labels have increased. To combat stress and feelings of inadequacy, future professional development to improve content and/or pedagogical skillsets was requested.

Keywords: teacher preparation, mathematics, secondary, special education instruction, at-risk students, team-teaching

1 Introduction

United States school districts have recommended updated graduation requirements for students in response to calls to increase the public-school curriculum's rigor. These changes often include four years of math consisting of Algebra I, Geometry, and Algebra II or an equivalent math class (Achieve, 2009).

These rigorous graduation requirements were due to an outcry that graduating high school seniors unprepared for college careers and/or the workforce (Elliott, 2008, Michigan Department of Education 2006, 2011; National Center for Educational Statistics, 2004).

Interesting, high school proficiency is one of the key elements linked to college and future success. Evidence indicates that the level of courses students take in high school is one of the best predictors for their future workplace success (Achieve 2010; Michigan Department of Labor and Economic Growth, 2004). This predictor is true in mathematics. There is a strong correlation between taking high-level mathematics courses in high school, college success, and high-growth employment (Achieve, 2010; Cohen, 2008). Researchers have found that inconsistent and non-rigorous math curriculums were highly correlated with the United States' poor performance on both internationally and nationally test scores (National Center for Educational Statistics, 2010; Schmidt, Cogan, Houang, & McKnight, 2011).

Numerous groups have urged high school educators to update curricula and instruction. The National Council of Teachers of Mathematics recommended that schools update students' basics skills for upcoming jobs because industries give higher wages to individuals who can think mathematically (Levesque, 2003; National Council of Teachers of Mathematics, 2000,

U. S. Department of Education, 2003a). Also, it is reported that the fastest-growing jobs in the new knowledge-driven economy will require postsecondary education, which successful completion may be hampered by substandard high school preparation (U. S. Department of Education, 2003b).

To meet this need, currently, over half of the states in America have added a graduation requirement for high school of four years of challenging mathematics courses (Achieve, 2010, Cohen, 2008). These new graduation requirements are intended to prepare all students for future job markets and improve the workforce skills while also doubling the percentage of residents with postsecondary degrees (Commission of Higher Education and Economic Growth, 2004). These new graduation requirements should apply to every student. These students vary from gifted and talented individuals, at-risk pupils, and students with disabilities (specifically students with high incident disabilities having learning disabilities, emotionally or behaviorally disturbed, and mild intellectual and developmental disabilities). The Individuals with Disabilities Education Act (IDEA) states that students with disabilities should have access to and show progress in the general education curriculum (IDEA, 2004).

While most educators agree with the need for improved mathematics rigor, these demanding math graduation requirements are controversial. Even though it is reported that rigorous high school classes prepare students for the future, teachers wonder how many of these students fully succeed in completing these requirements. Many educators believe that in order for all students to be successful, teachers need to excel in their instruction. With this thought, mathematics teachers will need to broaden their instruction to the at-risk and special education population who were previously not required to take their classes. These particular students' quality education rests with the content classroom instructors. For this reason, this study explores the perceptions of math educators regarding their preparation and expectations to instruct these at-risk and special education populations.

Specifically, we sought to explore the following line of inquiry: What are the math educators' perception concerning teaching math graduation requirements while teaching at-risk students and students with high incident disability special education labels?

2 Method

2.1 Participants and Procedures

Ten high school mathematics educators who taught in a Midwestern state volunteered to participate in this study. These participants were purposively selected since they could provide information about the math high school graduation requirements. In detail, these certified teachers taught Algebra I and Algebra II math content with at-risk and students identified as special education at the high school level. Participants worked in public schools that included one alternative education program, one charter school, and seven public schools. No incentives were given for participation.

These participants were interviewed using multiple settings. Two of these settings were in focus groups, and one setting was a one-on-one interview. These mixed methods allowed researchers to deepen and broaden their understanding of the research question. Notes were taken during the focus group. Throughout this process, several steps to collect reliable data were taken. The researchers wanted to understand and record the participants' responses accurately. To accomplish this, both the moderator and researcher asked participants to explain several issues during the focus group in great detail. Thus, confident that the researchers understood the focus group participants was apparent. The second method used semi-structured interviews that were individually conducted with all the participants. To ensure that the data was gathered correctly from the participants, these interviews were taped and transcribed by the researchers.

Interview and focus group questions centered around the following themes (a) the present and proposed classroom instructional techniques in their school district; (b) the teacher's stressors; and (c) the teacher's self-assessment of qualifications to meet the needs of the special education and at-risk students in addition to instructing the rest of the student body.

2.2 Instrumentation

The focus groups were conducted to obtain general background information about the math graduation requirements while helping the researchers learn how the respondents responded to teaching students who were labeled at-risk and high incident disability. Focus groups were advantageous when the participants have a similar background (Berg, 2004) and are not hesitant to provide information (Creswell, 2007).

After these focus groups were conducted, further data collection was obtained via an individual interview. For this interview, the researchers used a semi-structured, open-ended questionnaire concerning the perceptions of the math graduation requirements and curriculum and the teachers' confidence with instructing children who are at-risk or identified for special education. This open-ended questionnaire allowed the participants to discuss the topics in detail. The exact wording and sequence of questions were determined in advance and given the same way by the same researcher to the participants to eliminate as much bias as possible.

Content validity for these focus group and interview questions were tested via a team of experts who also authenticated the constructs. Four personnel from the state with knowledge of the math graduation requirements and experience as a teacher and/or administrator were given pilot questions. Based on the feedback from these individuals, the focus questions and individual questionnaires were revised.

2.3 Procedures

An in-service for mathematics instructors focused on mathematics at the high school level was held at a college/university. During this time, the instructors were asked to participate in the study. Ten teachers agreed to take part in the study. All these interviews were taped to provide reliability or dependability.

2.4 Data Analysis

In addition to accurate data gathering, the data analysis was closely monitored to get credited results of significant themes. These themes are identified as those mentioned by at least 80% (8 out of 10) of the participants. First, two researchers transcribed all comments from the focus group sessions and analysis notes taken during these sessions to obtain these results. Second, three research students transcribed the one on one interviews word for word. A member of the research team then reviewed each transcript to ensure accuracy. One researcher created main themes and sub-themes or categories and divided the transcripts into topical units. Another researcher served as an auditor by checking the interpretation and asked for clarification and rationale for specific categories. This process provided validity since it helps discover if one evaluator's expectations differed substantially from the other evaluation's expectations. The result was a set of folders that contained excerpts from the interviews and focus group sessions in specific categories. Cutting and sorting into file folders is a traditional approach used in qualitative analysis to organize categories, themes, and patterns (Berg, 2004).

3 Results

Analysis of the transcripts and group notes revealed the perceptions of Algebra educators concerning the instruction of the math curriculum required for graduation in four areas pertaining to special education (labeled as high incident disabilities) and at-risk students concerning (a) classroom instruction (b) teacher stressors, and (c) teacher qualifications to meet all students' needs.

3.1 Classroom Instruction

Even though the participants voiced concern over students at-risk or identified as special education for Algebra II, not one participant (N=0%) expressed concern for students at-risk or identified as special education passing Algebra I. In the concerns for the type of "rigor" being implemented through the new math requirements, there is a definite distinction made between Algebra I and Algebra II. Three main reasons that these participants were unconcerned about Algebra I were (a) that there have been improvements made through the implementation of alternative course credits using remediation techniques; (b) the paired classroom where the special education instructor team-taught with the general educator has enhanced instruction these students; and (c) the confessed lowering of content math standards in the teaching instruction.

3.1.1 Alternative education /remediation

All of the educators (100%) reported that their schools had provided adequate support for the at-risk and special education students through increased math hours. These increased hours took the form of Saturday schools, double class periods, lunch classes, afterschool classes, attending math classes twice a day, and block scheduling. While teachers discussed some models that seemed more practical – students engaged in learning – than others, all were aimed at equipping both the at-risk and special education students for success in Algebra I. No one reported remediation in Algebra II. One participant summed the general feelings up well when she reported:

What I am seeing is that my math classes' special education students are handling the math graduation requirements with adequate supports.

Another participant reported that improvements have occurred in these students' math scores because they are included in all the math content courses. This person commented:

I do think that there have been improvements [in math scores] for special education students and at-risk students because they [students in special education and at-risk students] have exposure to more mathematics than ever before.

3.2 Team-teaching

Another theme for at-risk students and pupils labeled as special education passing Algebra I was the role of team-teaching in enhancing student math proficiency.

Through the interviews, educators indicated that special education instructors effectively bridge the gap on how the general education can teach the student labeled as special education. For the most part, special education teachers have not helped with teaching the content of the course only how to differentiate this content. One mathematics teacher remarked:

I [as a math instructor] do rely on the special education teachers for their input as to what and how their students [who are labeled high incident in special education] might learn best. We [as a math department] have been fortunate enough to have a special education teacher team-teach in most of our math classes.

Through the special education teachers' input, math teachers felt they understood and improved their teaching to those students labeled as special education and at-risk better than before the team teaching occurred.

Another benefit to this team-teaching is that special educators could also assist with those students who are identified as at-risk. One math instructor said:

Our school has a regular paced math course that is three trimesters and a fast-paced Algebra course that is two trimesters for students. These two courses have the same exact material, but the three-trimester class is team-taught with a special education teacher. I was lucky. She [the special education teacher] is certified in math and knew her math. She [the special education teacher] is helping those kids that are at-risk by identifying which kids should take the team-taught course while alerting me [as the math teacher] to peculiarities like "this kid doesn't like change, so we [as teachers] need to do this" or "this kid has trouble taking notes, so maybe he [student in special education] can have a copy of your notes already typed up so that he [the student in special education] can highlight the notes." These extra hands are helpful.

While only 10% of the special education teachers were certified and well-grounded in the mathematics content, all of the teachers were optimistic about the benefits of corroboration between the Algebra teacher and special education instructor.

3.2.1 Lower math standards

Eighty percent of the participants commented on the surface quality of their teaching due to the updated standards. This change was the number one reason math educators were unconcerned with students identified as at-risk and special education passing Algebra I. These teachers reported that they had been "forced" to "dummy" the curriculum making it easier and resulting in a less rigorous class. The other twenty percent acknowledged the pressure to "pass" students, but had thus far resisted it. One educator commented:

We will pass them [students in Algebra], of course. They [the students who have barely passed] just won't know the material as I believe they should. Right now, if students fail a test, we [as math instructors] are encouraged to record 50% on this particular student's test. This way, a student can learn 10% of the material and pass with a "D". We are encouraged to do that or either water-down the [content of the] course.

The other participants revealed that they were also encouraged to pass students or encouraged a "false" passing.

Other school districts allow the students who have failed to retake a test during a study period or free period. As one person reported, "Students who fail a test or a segment of the test are permitted to retake the test during lunch hour or second class with help. Credit is essentially given for attendance."

The majority of the educators lamented that a practice designed to enhance learning grounded in the criterion-referenced tenet had become another way to falsely "pass" unqualified students.

3.3 Stressors and Frustrations for Math Teachers

While this topic was intended to determine the effect of new math requirements on classroom instruction (for example, types of instructional changes), the question revealed educators' frustration with the quality of their instruction due to time and money constraints as well as the down-side of focusing on the needs of the students who at-risk and high incident special education.

3.3.1 Time

Lack of time was a significant theme revealed by 90% of the educators when attempting to meet the curricular needs of students who are at-risk or labeled as high incident special education. These participants feel that the math courses require more content to be addressed with a population that inherently requires more attention and review time to master the material. This stress adds to their regular teaching demands. Many of these teachers believed that the amount of preparation educators has already put into meeting state and federal standards and the changes made in instructional practices have been enormous. One participant said:

I have already given at least half of my preparation time, adapted my classes to the math requirements and the needs of at-risk and special education students. In addition to this time, I have given a lot of time to differentiating the material, such as creating online versions, using visual aids while changing instructional practices like creating interactive, student relevant lessons, and adding a lot of formative practice before summative tests. My frustration level is high on how much time it has taken.

Other instructors have noted that they do not have time to individually teach the student who is failing the course due to watching all the other students in the class and making sure that these students perform up to their abilities. One person noted:

I do not have time to go back and bring a student up to the level where he should have been to pass the next course. My [math] colleagues and I have continuously worked on meeting state standards, adapting our instruction, and adopting new instruction practices. We already offer a "help" class that meets after school three days a week and a Saturday class. To be honest, time is an issue.

The frustration level came across in the educators' words, tone, and the additional amount of time the discussion necessitated. The discussions took twice as long, second only to feelings of inadequacy. To add to the frustration, the math curriculum has many new content areas that must be addressed. The teachers felt they were continually rushing through the curriculum to ensure that all the content is covered. One teacher summed it up by saying:

My classroom teaching has suffered because I'm always rushing through the curriculum-- whether the students have understood the material or not. I don't have time to do the hands-on manipulative activities used to shore up and cement [my students'] learning, nor can I do the "fun" stuff. I barely get through the required material--and that I do not do as well as I want to. It is frustrating!

This comment is reflective of both the special education instructors and the Algebra content teachers.

3.3.2 Money

The issue of budget cuts and monetary considerations came up with 80% of the participants. These teachers expressed concerns that the assistance they require to effectively teach at-risk and students with high incident disabilities was compromised because of monetary constraints. This constraint was mainly in the areas of acquiring needed supplies and participating in professional developments. One person reported:

I'm open to change in my teaching. I have to be. With the myriad of restraints on my time and having to complete the state requirements, I do not have the time to teach as I should. Much as I want to, which I do -- I have too many students. On top of that, we [her school] have budgetary constraints. If I want to search for new material or a different curriculum or get training or purchase software-- I cannot do so. My hands are tied. I get exasperated and frustrated, but with whom? My students? My principal? Myself? Politicians? I can only do what I can do.

3.3.3 Focus

Through these interviews, these educators reported that they felt they were doing a disservice to all students -- the regular education students, the gifted and talented individuals, and the at-risk and high incident disabled ones. Much time and attention are required to assist students who are at-risk and high incident disabilities in their classrooms and this was causing time to be taken away from the rest of the general population. The educators emphasized the "futile"

aspect of the situation. They expressed that the extra time and attention needed for at-risk and special education students left all students feeling that they were failing and therefore frustrated all. One teacher, not-so-jokingly, replied that instead of “leaving no child behind, he was leaving all children behind.” As one teacher noted:

I almost feel like we are leaving our brightest students at a disadvantage because I am so concerned about getting even the lowest of students to pass my math class.

3.4 Teacher Qualifications

This topic revealed whether educators felt that they need additional training to meet the students at-risk or identified as high incident disabled. The participants reported that they felt qualified to teach the content but unprepared to effectively meet the full range of these types of students’ needs.

3.4.1 Teaching students in special education

Almost all participants felt that they were qualified in their content area to teach this content to all students (N= 90%); however, 80% of them also expressed feelings of being “unprepared” or “overwhelmed” with the task of bringing the struggling students to proficiency standards. As one person remarked:

I do not know what training I needed. Three years ago, the high school that I worked for provided professional development training in formative and summative assessments techniques in differentiation and blended instruction using computers/internet. This training is not enough to handle the influx of the wide range of ability levels in my class. These methods were designed for the norm, with slight variations, not the extreme. I welcome additional training.

Words such as "welcome," "invite," and "request" were heard concerning additional pedagogical instruction during this discussion. This emphasizes the educator’s desire to be effective instructors for all students.

An additional handicap to teaching, as evidenced by the distinction teachers made on the severity of a student's special education learning needs. Unlike the at-risk students, dealing realistically and effectively with appropriate expectations for the student labeled as special education—even though it is high incident special education--was a common thread in the discussions. One person explained:

I was totally unprepared to work with students with more severe learning disabilities. My biggest fear is that I am never quite sure what might be appropriate expectations for these students.

The complexity of the special education labels was beyond most of the teachers' purview. They could identify more with at-risk populations but could not relate to students labeled as special education severity. They were uninformed about expectations, and though they knew bridging or scaffolding was essential to good instruction, these teachers were at a loss to do so. The discussion ended with half of the educators yearning for placement of these students in special education self-contained classrooms and whether this "rigor" was essential for these populations.

Some individuals commented on what the students labeled as special education needed to succeed in life. Showing this, one person commented:

Most of my resource students [students labeled as high incident special education] will never need Algebra 2. They [students in special education] need functional math such as balancing a checkbook, not completing the squares; signing their name to an appropriate document that they can read... not sine/cosine. How am I to help the classroom teacher reach my students when their math levels are between 3rd and 5th grade? What is a “fair” expectation of proficiency under these types of students in these circumstances?

3.4.2 Additional training

To increase their effectiveness, all teachers welcomed professional development and special education team-teaching opportunities. These math teachers lamented their lack of expertise in reaching and teaching these at students labeled as at-risk and high incident special education. The classroom teacher reported valuing the special educator's pedagogical knowledge and practical tips on reaching the students with special needs. One hundred percent (100%) of the participants said that they would welcome relevant teacher training. One participant observed:

I would attend training on how to reach these students [in high incident special education or who are at-risk]. However, I do not want to sit through a generic session. I don't have the time. I need some specific instructional practice or trade secrets to assist the low-skilled student who has no home support and high absenteeism. Take home packets do not help.

4 Discussions

Interviews and focus groups with math educators were conducted to gain their perceptions on the impact of the new math curriculum and teachers' qualifications to teach these math requirements to at-risk and special education populations. Several conclusions are reported related to classroom instruction, stressors, and qualification of teachers. Each of these themes are discussed below.

4.1 Classroom Instruction

One of the positive outcomes of this research study is the focus on improving classroom instruction. Teachers reported that their school districts provide more remediation for those students who are failing the math requirements. These remediation techniques take the form of Saturday math classes, block scheduling, double math class periods per day, and after school classes. Research has shown that students can better understand the curriculum when they actively engage in other programs outside the classroom. For example, Goldberg & Hahn (2008) noted that extra classes or workshops help the students grasp the math information better than a stand-alone math class. Also, summer programs and Saturday classes have been shown to help struggling students avoid failure (Christie, 2003). These types of curriculum modifications and additions have been identified as critical for students with disabilities to make progress in the general education setting (Fisher & Nancy, 2001; Martinez, Bragelman, Stoelinga, 2016, Wehmeyer, Lattin, & Agran, 2001).

The instructors in this study also praised the team-teaching concept because having the special education teacher in the classroom with these math educators helped bridge the gap between the students who are high incident disabilities as well as the at-risk students with the general population. Research shows that teaming a class can act as a catalyst for academic enrichment opportunities within the school day and helps many students experience success in math and other subjects (Fink, 2011; Fontana, 2005; Friend, 2011, Maguire, 2019, Rimpola, (2014).

4.2 New Stressors

Despite significant positive findings, some negative aspects emerged, mainly concerning the use of time and money. Specifically, the teachers noted how frustrated they felt with their instructions' quality due to lack of time and pressures to save money for the school districts. The teachers commented on the amount of time it took to implement the new math standards as well as changing how they teach due to this new curriculum. This pressure is in addition to the other teaching responsibilities, such as maintaining discipline. It is not a new finding that funding needs to be provided to teachers to effectively employ a new curriculum. According to Miles (2001) and Fawcett (2004), administrators should use their resources to support reform efforts. Additional research shows that some educators worry about the pressure to implement this curriculum for students with disabilities without adequate funding (Education Resource Strategies, 2015; Miller & Mercer, 1998).

Another aspect of teacher frustration is the quality of teacher performance. Low teacher morale is not conducive to productive or effective teachers (Darling-Hammond, 2007; Lane, Jones & Penny, 2019; National Commission on Teaching and America's Future, 2006; Nelson & Landel, 2007). Research shows that unresolved frustration and low morale leads to teacher discontentment, poor performance in the classroom, and greater teacher absenteeism and burnout (Ewton, 2007).

4.3 Qualification of Teachers

Interviewees mentioned that they believed that they had enough content knowledge to teach high school math successfully. However, they felt overwhelmed and unprepared, knowing how to effectively instruct students who struggle to achieve the math standards. Specifically, they discussed the perception it being a disadvantage to all students when also having students with significant learning disabilities in their math classroom. Research has shown that students with disabilities who have teachers who use different classroom activities and curriculum modifications such as Universal Design for Learning and goal-setting skills, will have significant differences in their learning (Lee, Wehmeyer, Soukup, and Palmer, 2010; Rimpola, 2014; Rose & Meyer 2002).

Many instructors try their best of their ability to help all students to learn and to be successful. However, controversy occurs as to whether all students should have the same educational track or diploma. Research says there is no "one size fits all" solution to education. Nevertheless, the teachers agreed that the math curriculum requirements align with the controversial but increasingly prevailing success yardstick of the standardized test (Education Insiders News, 2010, Darling-Hammond, 2007). These participants expressed the need to see the relativity of higher math and higher job skills to the individual student. Higher math skills may change from student to student.

5 Limitations of the Study

This study incorporated qualitative research to study a Midwestern state's math educators' perceptions of the math standards and teachers' qualifications to teach the math requirements to at-risk and high incident disability populations. Despite some significant findings, some limitations deserve mention.

First, the generalizability of the findings is limited because of the nature of the participant sample. That is, math instructors whose perceptions were sought constitute a limited group and may not represent all the educators who teach the new math curriculum. Further, social desirability is a concern when using interviews and focus groups in research. Some participants may respond to questions based on what they perceived is expected of them or what they deem to be the socially or politically correct response (Patton, 1990). Thus, although participation was voluntary, the findings' validity may be limited by the bias inherent in the data-collection methods used. Finally, this study only focused on one state located in the Midwest. There are other states following the same type of graduation requirements in the math area and other subject/curriculum areas. Therefore, it is not possible to conclude what perceptions these other math instructors have on the impact of these new requirements.

6 Future Research

This study provides new information concerning the perceptions of math instructors on the impact of this math curriculum and if these educators feel qualified to teach high school students who are high incident disability (labeled as learning disabled, ADHD, emotionally disturbed/behavioral disordered, and mildly developmentally disabled), as well as at-risk students. Teachers believe that dropout rates will remain steady, that classroom instruction has changed, that different stressors have erupted, and that they would appreciate quality teaching training that would focus on teaching all children these math standards.

Many unanswered questions remain. Future research is needed to investigate various other types of content teachers' perceptions concerning instructing the new standards. Comparison of attitudes and reasons could provide important information relative to what educators perceive in the classroom. Besides, it would be interesting to interview different math instructors from different states with similar graduation requirements and compare states. Furthermore, the research could also be completed on the same teachers in five years and compare these teachers' perceptions as of today and in the future to see the impact of these math graduation requirements.

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