Academic Outcomes for Students with Learning Disabilities in an Inclusive Mathematics Classroom

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Abstract
Preparing all students for high-stakes testing programs is an enormous task for educators, especially for special education teachers. In an inclusive mathematics classroom, both regular and special education teachers need to provide a wide range of instructional alternatives in order to facilitate increased understanding and participation of students with disabilities.

This study was designed to document quarterly assessment gains made by students diagnosed with specific learning disabilities who participated for 45 minutes daily in an inclusive classroom where both the special and general education mathematics teachers utilized specific co-teaching strategies. The participants were 38 seventh grade students, 12 of whom were diagnosed with a specific learning disability in math. Participants were tracked over a twenty-seven week period to determine the effect of utilizing specific co-teaching strategies on quarterly assessment scores. The results suggest that the students with learning disabilities benefit from flexible student grouping strategies. Students without disabilities in the inclusive classrooms achieved at or above their peers in three non-inclusive classrooms taught by the same teacher.

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Rationale

My role as a special educator is constantly changing. Because of increased expectations established by *No Child Left Behind* (NCLB) legislation, it has become necessary to make changes both in content and delivery of instruction. As our district has moved towards a more inclusionary model for students, both special and general education teachers have scrambled to redefine their roles. One result of NCLB is that special educators can only teach within content areas that they are highly qualified to teach, instead of being responsible for teaching and developing content across multiple curriculum areas.

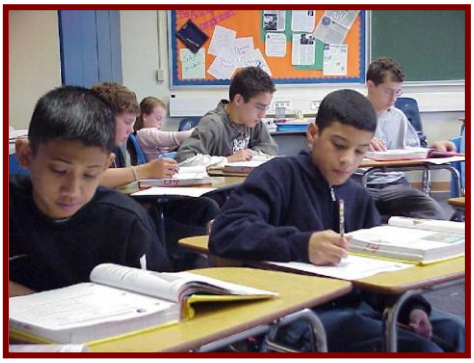
As a highly qualified intervention math instructor, I spend the majority of my school day working in mathematics classrooms with licensed 7-12 general education teachers. During the 2007-2008 school year, part of my assignment was to work with Elisa for two periods a day. Elisa was a relatively new teacher to the building, so we met briefly before school began to get to know one another. We decided that for the first few weeks I would observe her teaching style and classroom procedures, then gradually take on a more active role in the classroom.

During the first few weeks of school, I felt as if the students didn't consider me to be a "real" teacher. Even though I made an effort to talk with students and assist in the classroom, some seemed confused by my presence and even wondered out loud whether I was an aide. I consider myself well-versed in the math content and have numerous strategies and interventions that I can bring to the classroom. Having Elisa provide the majority of instruction was easy for me, but in order for the students to recognize me as an instructor in the classroom I simply had to teach. As our roles in the classroom adjusted to meet the needs of our students, Elisa and I began to wonder how changes to our instructional delivery would affect student learning. Could co-teaching really make a critical difference for classes loaded with at-risk students? Would students in the inclusive classrooms demonstrate test performance that was equal to or better than that of students in Elisa's other math classes?

Context

Baldwin Road Junior High currently serves 450 students in grades seven and eight. We have a high percentage of ethnic minorities (45%) and economically disadvantaged students (41%). Our building has not met our AYP (adequate yearly progress) goals for the previous two years, specifically due to the test performance of our special needs population. Last year, 45.5% of the current seventh grade students with disabilities scored at or above the proficiency level on the Ohio Grade 6 Math Achievement Test, compared to a passage rate of 87.3% for non-disabled students. We are in our second year of "School Improvement." If we do not continue to increase the passage rates on achievement tests, we will be labeled a low-performing school and will face sanctions imposed by the Ohio Department of Education.

The students in this study are 38 seventh graders (25 boys, 13 girls) from two math inclusion classrooms in the Reynoldsburg City School District. Fourteen students have been diagnosed with a specific learning disability (SLD); 12 of the 14 have math goals on their Individualized Education Plans (IEP). Ten students have behavior issues that significantly impact the classroom environment and two students have a 504 plan that allows them accommodations in the classroom due to attention difficulties.



Literature Review

The secondary general education classroom has been promoted as the least restrictive environment for students with learning disabilities (Mastropieri & Scruggs, 2000b; McLeskey, Henry, & Axelrod, 1999). The rationale for inclusive classrooms is not based on research findings, but on principle. Educational inclusion offers students exposure to the general education curriculum (Council for Exceptional Children, 1998), opportunities to increase social networks, and access to a highly qualified content specialist. Inclusion at the secondary level also presents significant challenges as an emphasis on higher level content knowledge, independent study skills, and an increased instructional pace (Bulgren & Lenz, 1996) are combined with the pressures of high-stakes testing (Frase-Blunt, 2000). These expectations may represent problem areas for some students with disabilities who lack the prerequisite content knowledge and skills. High levels of skill acquisition may be difficult to obtain within the inclusive setting because of the diversity of learning styles and skill levels that require several modes of delivery (Vockell & Mihail, 1993) and specialized teaching techniques.

The term “inclusion” is not defined consistently in the educational community and inclusive programs differ greatly, even within the same school district. Variables such as the amount of support provided to teachers and students within the inclusion model are not easily controlled for research purposes (Hines, 2001). As a result, formal research that evaluates the impact of inclusion models on the academic outcomes of students with disabilities is contradictory and further highlights the complexity of inclusive practices. Determining the effectiveness of inclusive practices is not an easy task.

Critics of inclusion cite research findings that suggest inclusive practices either have no effect or hinder the learning outcomes for students with disabilities. In a specific review of co-teaching as the inclusive service-delivery model, Zigmond and Magiera (2002) found only four studies that focused on academic achievement gains. Three of the studies were conducted at the elementary level and researchers concluded that the inclusive practice of co-teaching was just as effective in producing academic gains as was resource room instruction or consultation with the general education teacher. However, in the

high school study, students' test scores actually worsened following a co-teaching experiment.

Murawaski and Swanson (2002), in their meta-analysis of the co-teaching literature, concluded that despite the current and growing popularity of co-teaching as an inclusion service-delivery model, further research is needed to determine whether it is an effective option for students with disabilities. Holloway (2001) reviewed five studies conducted between 1986 and 1996 that compared traditional pull-out services to fully inclusive service-delivery models and models that combined in-class services with pull-out instruction. His conclusions did not provide strong support for the practice of full inclusion and suggest that there is still much to be learned about the efficacy of inclusive classrooms, particularly at the secondary level.

Manset and Semmel (1997) reviewed inclusion models for learning disabled students reported in the research literature between 1984 and 1994. They found that inclusive programs can be effective for some, but not all, students with learning disabilities. Waldron and McLeskey (1998) agreed with this conclusion. In their research, students with severe learning disabilities made comparable progress in reading and math resource and inclusion settings. Students with mild learning disabilities were more likely to make gains commensurate with their non-disabled peers when educated in inclusive environments.

Supporters of inclusion argue that inclusive practices increase achievement for students with disabilities. Studies by Bear & Proctor (1990) and Banerji & Dailey (1995) resulted in claims that full-time placement of a student with mild disabilities in the general education classroom resulted in academic progress that was just as good as that achieved by students in separate "pull-out" classes at the elementary level. Research has also suggested that educating students in general education environments results in higher academic achievement for both students with and without disability labels (McLeskey & Waldron, 2000; Rea, McLaughlin & Walther-Thomas, 2002; Peterson & Hittie, 2003, pp. 37-39).

A critical look at research evidence that recommends one particular service-delivery over another is imperative. Numerous educational programs have been implemented over the years, usually without solid data on whether they have resulted in increased achievement. Terrell H. Bell, Secretary of Education from 1981 to 1984 under President Ronald Reagan, started the drive for educational reform by calling for both extensive use of technology and educational research to validate instructional models (Bell and Elmquist, 1991). Under *No Child Left Behind*, President George W. Bush's administration continues to push for educational programs that have been deemed effective through rigorous scientific research. However, research that meets the label of being "scientifically-based" typically includes only a small portion of the total research conducted in the field of education and related fields. This type of research generally requires large samples using control groups.

Further research is needed to determine the interaction between the various models and academic outcomes for students with and without disabilities. Research is also needed to validate instructional models that are particularly appropriate at the secondary level (Boudah, Schumacher & Deshler, 1997). The success (or failure) of a program is dependent on how a program is implemented and the particular needs of individual students. A poorly run program with limited resources will seldom be superior to one in which there is a heavy investment of time, preparation, and resources. Effective but flexible teaching strategies and an individualized approach are critical ingredients in special education; neither of these is associated solely with one particular approach (Zigmond, 2003).

While there is a body of evidence that certainly supports the use of inclusive education, there is very little research that outlines the effects of inclusion on students with disabilities where both the special and general education mathematics teachers utilize specific co-teaching strategies. NCTM challenges educators to examine content, pedagogies, and organization of their practices in order to create learning environments that are both inclusive and nurturing to all students (NCTM, 1995). The focus of this study is alternative instruction utilizing flexible grouping, and its effect on both typically developing students and students with learning disabilities in math.

Procedure

As inclusive practices have gained ground, classroom teachers have adopted collaborative models of instruction, such as co-teaching. Bauwens and Horcade (1995) describe co-teaching as general education and special education teachers working together to provide all students with instruction, discipline, and support. Within the Reynoldsburg School District the typical inclusion classroom defined for this study include an intervention specialist, paired with the classroom teacher, and a blend of both typically developing and special education students. These students are cross-categorical, having been identified with a variety of disabilities. Average class sizes are approximately 25 students; greater than one third are identified special needs students. The intervention specialist assists with intervention students and modifications in academic content but typically do not participate in the direct instruction or content planning.

One of the first explanations of collaborative teaching defined by (Cook & Friend, 1995) includes five basic variations:

one teach-one assist- requires one teacher to take the lead in delivering instruction while the other teacher monitors or assists students individually

station teaching- each teacher takes responsibility for teaching part of the content to small groups of students

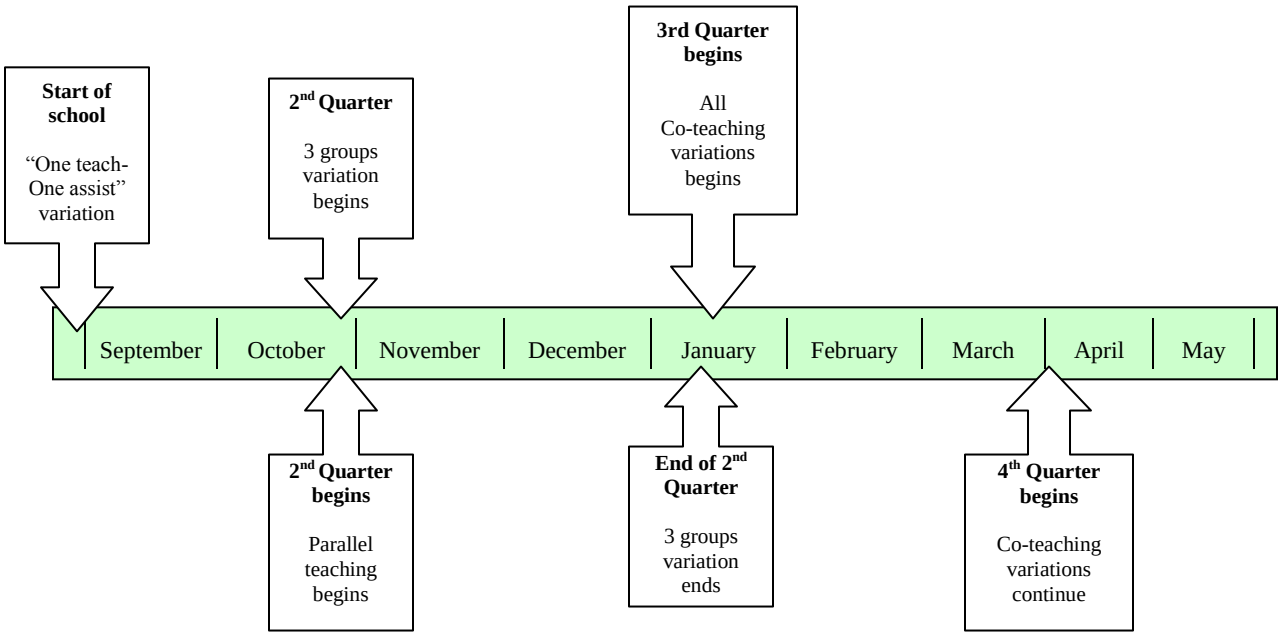
parallel teaching- teachers plan instruction together but split the class and deliver the same instruction to smaller groups within the same classroom

alternative teaching- one teacher works with a smaller group of students to re-teach, pre-teach, or supplement instruction, while the other instructor simultaneously provides instruction to the larger group

team teaching- requires both teachers to share responsibility for the instruction of all students by continually alternating the role of primary instructor within individual lessons

Elisa and I began the school year by using the "one teach-one assist" model but soon decided to change our approach (See Figure 1). We needed to target a group of students who were struggling in order to prepare them for the first quarterly assessment. Quarterly assessments administered within our district parallel the Ohio Grade 7 Math Achievement Test and are used to gauge progress towards mastery of the indicators taught during the specific grading period. The first quarterly assessment measured progress on number sense and operations, the second on algebra, and the third on geometry and measurement.

Figure 1: A Timeline of Co-Teaching Strategies Used in the Inclusive Math Classroom



We jointly agreed that the whole classroom environment was not conducive to both of us teaching separate lessons at the same time. Some of our students were highly distractible due to various health conditions or behavior issues, and we felt that a separate learning environment might prove to be more productive. We decided to teach and present the same content, using the same materials; however we would each use our own instructional styles in two separate classrooms. By reducing the student-teacher ratio, I was also able to target the skills and strategies that the small group of students needed and Elisa was able to allow for more student participation and monitoring in her classroom by having a reduced teacher-student ratio. The overall goal was to provide small group instruction only when it was deemed necessary and to maximize our use of time and resources in the large group setting.

At this point we had unwittingly moved to the next level of co-teaching, parallel teaching. Student choice was added when some students expressed concern about the group they were assigned to. Many students preferred the small group because they could "talk more" or "get more help." Other students felt that we were doing something more exciting than what was being taught in the regular classroom or were simply curious about the alternate classroom setting. We allowed students the option of leaving a group mid-lesson if they felt the group assignment was not appropriate for them, but this was only exercised a total of five times across three quarters. In four of the instances, students concluded that the pacing of the lesson was too slow for them; in the other instance, a student chose to leave due to a potential social conflict. By including student choice in our instructional model, students became partners in the educational process by self-assessing and communicating their skill needs on a daily basis.

Midway through the second quarter, we noticed that some students were excelling at solving algebraic equations while others needed more practice. We created a "3 groups" strategy; one group received enrichment problems, the second worked on basic to medium-level problems, and the third on basic problems. Group assignments were flexible, and Elisa and I took turns working with each group. Having three groups and two teachers required one of us to work with two groups.

As we neared the third quarter of the school year, Elisa and I had become very comfortable working with each other. Dialoguing daily about content and how the students were progressing became routine. Even though we shared a common lunch and planning period, we weren't always available to meet. We had to make time to discuss issues such as discipline, pacing, and grading, even if it was in the few minutes before school started. We both felt confident in our abilities to team-teach daily, but we felt that the needs of our students this year were best met alternating between small and large group strategies. Small group instruction a few days a week allowed us more opportunities to work with students on an individual level and it also led to a decrease in behavior problems. Whole group instruction on the remaining days was used for introduction of new material, to demonstrate instructional techniques while the other instructor observed, or for hands-on math labs or projects that required a large number of students.

As our roles in the classroom adjusted to meet the needs of our students, Elisa and I wondered how the changes to the way we grouped students and our instructional delivery would affect student learning. As the year progressed, the content and the way we grouped students became more complex. We could not compare scores over time because we were assessing different standards each quarter, but we could analyze scores to determine which quarter netted the most significant gains.

Findings

Each quarterly assessment had an equivalent number of multiple choice, short answer, and extended response items that totaled 28 points. Raw scores from all three quarterly assessments were used to calculate the collective mean score of students with an IEP in the inclusion classes in comparison to non-disabled students in the same classes (See Table 1.). The first quarterly assessment measured progress on number sense and operations, the second on algebra, and the third on geometry and measurement.

T-tests on mean scores for quarterly assessments one and two revealed significant differences ($p<.05$) between IEP and non-IEP students. The third nine week period yielded no significant differences between groups. As the material became more complex, it appeared that the gap between the two populations started to narrow (see Table 1).

Table 1. Quarterly Assessment Performance

Quarterly Assessment #1 (Number Sense & Operations)

	Mean	SD
IEP Students	15.57	5.04
Non-IEP Students	19.20	4.31

Quarterly Assessment #2 (Algebra)

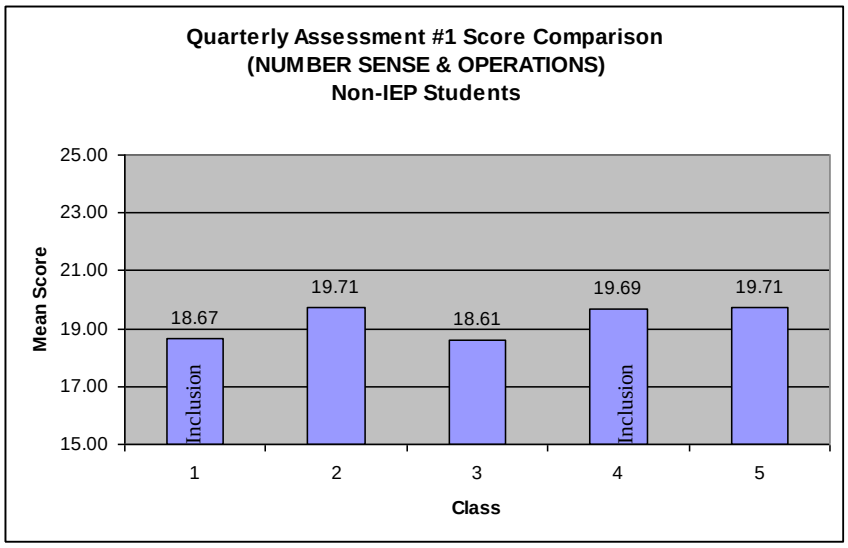
	Mean	SD
IEP Students	11.30	5.62
Non-IEP Students	16.63	4.64

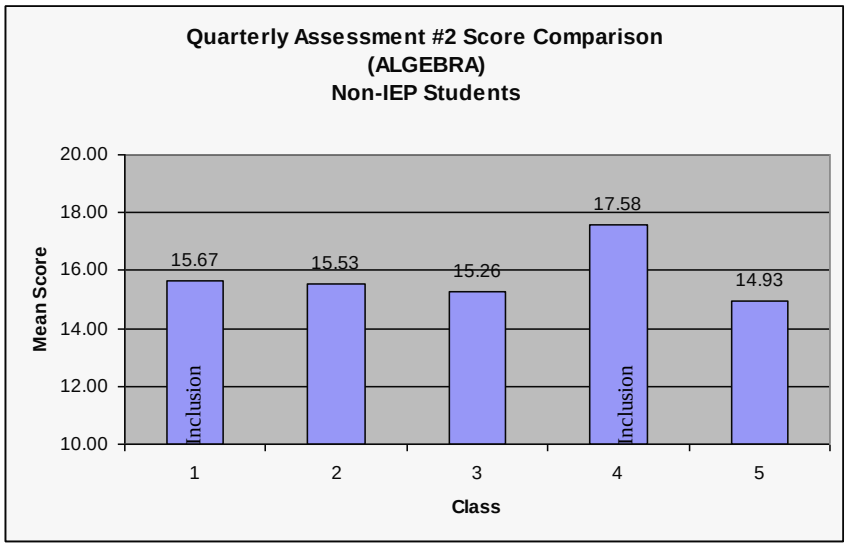
Quarterly Assessment #3 (Geometry)

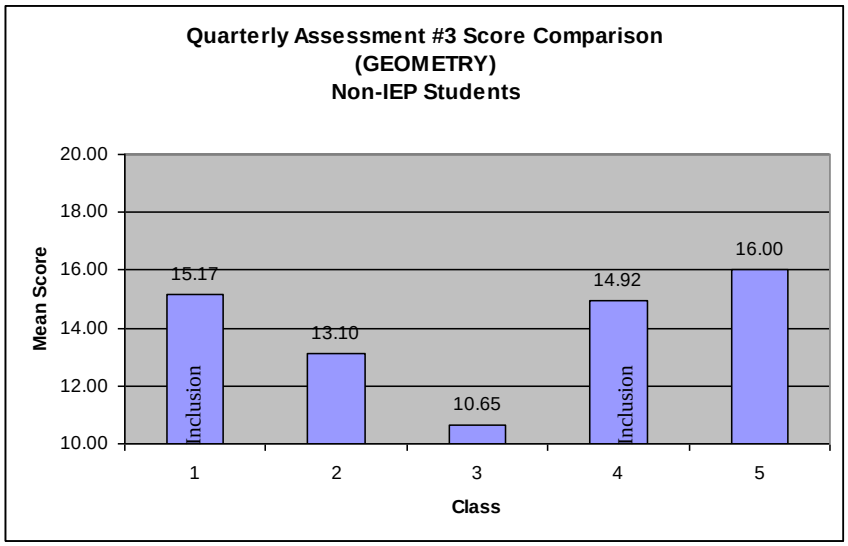
	Mean	SD
IEP Students	12.54	7.06
Non-IEP Students	15.04	4.91

A further exploration of class performance patterns was undertaken to determine whether there were differences between general education students in the inclusion classes and the students in Elisa's other three general education classrooms. Would general education students in the inclusive classrooms be helped or hindered by being placed in an inclusion classroom with a high number of at-risk students? Comparisons of quarterly assessment scores for non-IEP students are included below (See Tables 2-4). Results indicate that non-IEP students achieved as well as or above the mean of their typical peer counterparts within the non-inclusion classrooms on all three quarterly assessments, particularly when the combined "parallel teaching/3 groups" and multiple co-teaching strategies were used.

Tables 2-4. Mean Quarterly Assessment Scores of Non-IEP Students in All 5 Classes







Implications for Practice

Although the results of this case study cannot be generalized to other settings, they provide insight into the possible benefits of flexible grouping in the inclusive math classroom. When an array of grouping strategies was used, the performance gap narrowed between students with learning disabilities and their typically developing peers. The use of co-teaching strategies did not have a negative impact on non-disabled students in the inclusive classrooms. While the results of this study suggest that the use of flexible grouping is beneficial, an entirely new group of students will enter the seventh grade next year and we should not assume that the same strategies will produce similar results.

I still have many unanswered questions. What impact will co-teaching have on my IEP students' OAT scores? Would prolonged use of flexible groups lead to better overall performance or would students eventually tire of the constant switching? With increased use of flexible grouping, would students get better at making choices about which classroom configuration works for them?

The education of students with disabilities is a complex process. Successful inclusion is unlikely to occur unless general and special education teachers possess the skills necessary to meet the needs of students with disabilities in the general education classroom. Co-teaching requires flexibility, strong interpersonal skills, fluid communication, and experience providing intensive, individualized instruction. It also requires knowledge of the general education curriculum and skills in adapting this curriculum. Co-teachers must have a high degree of respect for one another and a willingness to change teaching styles and preferences often. Both teachers must relinquish egos and consider the classroom to be "ours" instead of "mine". It requires

that two people, with diverse training experiences, plan and work together for the benefit of all students in the classroom.

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