



Mathematics Knowledge Development for Special Education Teachers



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General Background

During recent years there has been increasing concern surrounding the mathematics achievement for American students when compared to students in other countries. Poor test scores continue to reflect a lack of preparedness for future educational pursuit and success. This concern has led to wide spread reforms such as the federal No Child Left Behind Act of 2001. This legislation requires all children regardless of socio-economic status, race/ ethnicity, disability, or language proficiency to achieve at high levels. Achievement of all subgroups is measured on an annual basis using standardized testing. These scores are used to make major decisions regarding school finances, teacher retention, and course offerings.

One subgroup that continues to be examined is that of students with disabilities. Special education programs are often left out of materials adoptions and trainings. This can leave teachers undertrained and their struggling students underprepared.

In addition, some special education licensure programs do not require a deep understanding of the content knowledge necessary to teach a subject matter effectively. In fact, a teacher could get a special education license after having been in another profession with relatively little content knowledge ever explored. In this case, a person would need to have a bachelor's degree in their field, pass a state exam covering basic content, and complete a special education licensure program covering mainly disabilities, learning, and the law. This would allow a person to teach special education in an elementary setting without ever having had exposure to deep math content save for the content received in order to attain their bachelor's degree. (TSPC Initial License Requirement Website, 2009)

Focus Background

Jones School District was one in which many of these problems were evident. The special education classrooms did not have materials that were consistent with current adoptions nor did the teachers have the training that would be needed to implement these materials and lessons effectively. This special programs department noticed these difficulties as well as the seriousness of achievement scores that indicated a drastic need for improvement.

The department bought the SRA Number Worlds® curriculum for use as a pilot in seven area schools. This curriculum is intended for struggling learners in mathematics. The pilot was intended to measure two outcomes: teacher satisfaction with using the materials as well as student achievement.

After four months of use in the classrooms, results indicated that teacher satisfaction increased with use of the materials while student achievement stayed the same. This might indicate that although materials play a major role in achievement and lesson delivery, the teaching done by the teacher is a primary factor (Birk, 2009).

Goal

Recent research regarding best practices in mathematics instruction indicates that certain aspects of a mathematics education are critical to the amount of learning that can take place within an academic environment. Most notable are: (a) Worthwhile and engaging mathematical tasks, (b) an inquiry focused classroom culture, and (c) teacher content knowledge of the subject matter (Kilpatrick, Swafford, & Findell, 2001; NCTM Principles and Standards for School Mathematics, 2000; The National Research Council, 2005; Boaler & Greeno, 2000; Hiebert et al., 1997).

Each of these critical components for math learning are created, designed, and implemented by the classroom teacher. For this reason, it is necessary to focus on increasing teacher understanding of the subject matter as well as delivery of the content.

The goal of this intervention is to increase teacher knowledge of mathematics, in both content and best practices, in order to increase student achievement as well as teacher satisfaction with lesson design and delivery. Student performance will be measured using pre and post test scores on a standards based teacher made assessment (the same one used during past study) and teacher satisfaction will be measured using a survey.

Varying Methods

(A) One method of increasing knowledge on a subject matter is to have a book study. Book studies are appealing because the cost is minimal and teachers are able to do this work on their own time without being away from the classroom. This can also be seen as a negative method because teachers may feel that they have been taken advantage of when they are asked to work in addition to their contractual time.

(B) Another would be to enroll teachers in higher level mathematics courses. This would allow teachers to continue to develop math skills that they may or may not have had as part of their undergraduate preparation. Research suggests that the more courses that a teacher has had in a subject, the higher their students achieve (Kukla-Acevedo, 2007). The cost of this would be higher because teachers would need to have substitutes if this was during work time. The district would also need to pay the cost of the course. If this were outside of school times, this would need to be done based on volunteer agreement. This often does not help to target teachers who may be resistant to this learning for a number of different reasons.

(C) Another method would be to contract with a development group. This would give teachers an opportunity to interact and discuss recent research regarding best practices. They would also explore their personal mathematical development while engaging in mathematical tasks. The cost of this work would be the consultation in addition to substitute costs if done during the school day. If not, previously discussed implications would apply.

(D) Finally, another method would be to have training on the pilot materials that were previously adopted. This was not done at the time of the adoption, however, teachers were expected to use them with proficiency. This method assumes that the materials are the primary factor impacting student achievement. It would include the cost of training as well as substitutes.

Chosen Method and Defense

After considering all methods carefully, I chose method C as the most comprehensive for meeting the goal and in turn, impacting student achievement and teacher satisfaction. This method allowed for development of both content knowledge (when doing and learning mathematics) and content delivery (when analyzing best practice research and lesson design). All other methods allowed for only one area to be explored. This also assumes that the primary factor impacting students is the teaching and teacher rather than any specific set of materials.

Method C has the same cost as two of the other three methods and will be paid for through monies allocated for special education improvement through the Oregon Department of Education referred to as SPR&I*. The costs included are the consultation training as well as substitute fees for teachers involved. It is important to have training during the work day in order to have all intended members participate.

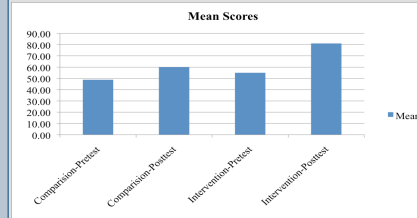
It will begin with half of the special education teachers in the district participating for two years of implementation. After data has been reviewed, further implementation would be considered. Students whose teachers participated in the intervention will be assessed. Their progress will be compared to the progress of students whose teachers did not participate in the intervention.

*The Oregon Department of Education (ODE), Office of Student Learning & Partnerships (OSL&P) implements a statewide special education monitoring system called Systems Performance Review & Improvement (SPR&I). This system is a continuous improvement monitoring process focused on improving student outcomes (ODE School Improvement website, 2009).

Results and Conclusions

Fourteen teachers participated in the consultation training on best practices and content knowledge development. Obviously, completion of the training would suggest that we had met our goal: development of teacher knowledge. In this case however, the secondary effects of the training- student achievement and teacher satisfaction- are even more important.

The following graph highlights the achievement results from students whose teachers participated in the training (Intervention) compared to those whose teachers did not (Comparison). Assessments were given at the beginning and end of two consecutive school years. Pretest data reflects an average for the two scores in the first year and posttest data reflects an average for the two scores the second year. This data shows a statistical significance in increased achievement on a standards-based teacher made assessment for the Intervention group.



Results and Conclusions cont.

The second impact of the teacher development would be an increased satisfaction for teachers when teaching math. This was assessed using a survey given to participants after both the first year and second year of training. This survey had four focus statements: (a) I design math lessons with a clear focus, (b) I know what my students understand, (c) I critically evaluate materials and use them for specific reasons, (d) I enjoy teaching math. Participants were asked to rate these statements on a scale from one to five. One represented "Much more after training", three represented "No change," and five represented "Much less after training."

All participants involved in the training rated the first three statements as either "Much more after training" or "More after training". Twelve of the 14 participants rated the last statement as "Much more after training" or "More after training" while two participants reflected "No change".

Overall, responses to the survey indicated a statistically significant positive response to the training. Comments such as, "I finally feel like I know how to use materials to enhance my lessons" and "I used to hate teaching math and now I look forward to it" seem to reflect a genuine positive impact on participants.

Summary and Future Considerations

This data shows that teacher development in mathematics in both content as well as delivery has a positive impact on student achievement and teacher satisfaction. During the following years, teachers who were in the comparison group will receive the same training as the teachers in the initial intervention group. We will continue to track student data as well as teacher satisfaction using the same tools. We will also begin to look at how this information manifests in OAKS assessment data. Participants who were in the initial intervention will move toward a studio cohort model to continue to implement best practices at their site while coaching each other through lesson creation. After all groups have been trained and have moved into the studio model, professional development will continue on a needs basis as determined by the cohort groups.

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