

Abstract Title Page

Title: Examining the Impact of Child x Instruction Interactions in First Grade

Author(s): Elizabeth Coyne Crowe, Carol McDonald Connor, Michele M. M. Mazzocco

Increasing math achievement for students at all skill levels is a recognized need and priority while providing instruction that proves effective for all students is challenging for the classroom teacher. Although the differential effects of instruction within the field of reading has been the subject of much research, the effectiveness of amounts and types of math instruction is less understood. Therefore, this study aims to investigate the relation of instruction and mathematics achievement in order to uncover whether particular types of instruction may be more or less effective for students, depending on their initial levels of mathematics achievement when entering school. This randomized control trial of 420 students in 31 classrooms uses a business as usual control where a core math curriculum is provided and a treatment condition of the same core curriculum in combination with a student/peer managed math intervention. Results suggest that, overall, students with average skills perform similarly when provided with the core curriculum alone or in combination with student/peer managed math. Students with above average initial skills demonstrate greater outcomes when they receive both the core curriculum and student/peer managed math instruction while students with below average initial skills demonstrate greater gains when provided with the core curriculum alone. Classroom videocoding data suggest instructional differences between conditions that may explain such results. Students in the treatment group received greater amounts of student and peer managed math instruction, while between conditions, teacher managed instruction was provided in similar amounts. These results suggest that students respond differentially to math instruction, depending on their initial skill levels. Instructional implications will be discussed.

Abstract Body

Background / Context:

Students' ability to understand mathematic concepts and solve such problems with fluency is an important skill for both academic success and daily life. However, such math achievement continues to be an area of concern for parents, teachers, policy makers, and leaders of the workforce. A plausible solution to increasing achievement for students at all achievement levels may be the understanding of how instruction interacts with initial skill levels. Extant research in the field of reading has evidenced the existence of aptitude by treatment interactions, or child by instruction interactions. These findings demonstrate that students respond differentially to instruction depending on their initial skill level. Whereas this evidence is informing classroom reading instruction and shaping further research, the presence of child x instruction interactions in mathematics instruction has not been explored.

Purpose / Objective / Research Question / Focus of Study:

The purpose of this research is to examine whether the effect of mathematics instructional strategies depends on first graders' entering mathematics skills. In particular, we compare Saxon Math, which is a highly scripted whole class mathematics core curriculum and Saxon Math supplemented with student/peer assisted learning opportunities. The following research questions guided the study. 1) What is the effect of student/peer managed learning strategies in combination with a core mathematics curriculum on mathematical fluency and applied mathematic skills compared to the core curriculum alone? 2) What is the nature and variability of instruction provided within first grade classrooms and how do amounts and types of mathematics instruction vary depending on treatment condition?

Setting:

The study was conducted in a southern school district in first grade classrooms.

Population / Participants / Subjects:

The 460 students in 31 participating classrooms in 6 schools represented a moderate degree of rural poverty (on average, 43 percent of students qualified for the free/reduced lunch program). Schools in the sample represent a diverse level of school achievement as indicated by the state progress monitoring system.

Intervention / Program / Practice:

Two interventions were used to facilitate a treated control randomized control design where the Individualized Student Instruction in Reading (ISI-Reading) intervention condition served as a business as usual mathematics instruction control implementing the district core mathematics curriculum, which was Saxon Math. The treatment condition supplemented Saxon Math with a student/peer managed mathematics intervention. The control (business as usual) condition used Saxon math as their core curriculum. Saxon is a scripted, spiraling curriculum, with main foci of instruction, practice, and assessment. For this study teachers were randomly assigned within

schools. Teachers in the Student /Peer Managed Mathematics intervention were taught to provide and facilitate math activities following a peer-managed format while also continuing with their core mathematics curriculum. The peer/student managed intervention involved a teacher managed lesson followed by practice and support provided by a peer or small group of student. Teachers randomly assigned to the Individualizing Student Instruction (ISI) reading condition were taught to provide individualized small group reading instruction for their students using Assessment to Instruction software. Teachers were presented with grouping recommendations based on assessment data as well as instructional recommendations for each student.

Teachers in both conditions were provided with bi-weekly professional development (with foci specific to the treatment condition) and classroom assistance to facilitate the provision of the interventions. Each intervention lasted the duration of the first grade school year.

Research Design:

Teachers were randomly assigned within schools to one of two treatments. Condition A – Individualizing Student Instruction in Reading. Condition B – Student/Peer Managed in Mathematics. For this study, we focus on the student/peer managed supplemented condition.

Data Collection and Analysis:

Students were assessed during fall and spring using the Woodcock Johnson Test of Achievement of Math Fluency and Applied Problems. Math Fluency tests students' speed at solving basic calculations of addition, subtraction, and multiplication within a 3 minutes time. Applied Problems presents word problems in an oral and written format where paper and pencil computations are permitted. Concepts include but are not limited to number sense, geometry, measurement, and algebra.

Classrooms were videotaped at fall, winter and spring. Fall and spring video tapings included mathematics and language arts instruction blocks. Winter video tapings included all instructional time. Videos were coded using Noldus coding software and a coding system for both mathematics and language arts instruction. The coding discussed herein is based on the behavior of student grouping. Videos were analyzed and coded to identify teacher managed individualized instruction, teacher managed whole class instruction, student managed instruction, peer managed instruction. Data were analyzed using HLM regression. Descriptive statistics were calculated using SPSS.

Findings / Results:

Research Question:

1) What is the effect of student/peer managed learning strategies in combination with a core mathematics curriculum on mathematical fluency and applied mathematics skills compared to the core curriculum alone?

HLM results suggest that for first graders with above average initial skills in Math Fluency, student/peer managed learning in combination with Saxon math curriculum yielded higher scores in Math Fluency and Applied Problems in comparison to students with above

average initial skills who were receiving Saxon core math instruction alone, controlling for initial status and free and reduced lunch status. For students with below average initial skills in fluency, students using the Saxon Math core curriculum alone achieved higher scores than did student with below average. There was no main effect of student/peer managed learning, meaning that students with typical initial scores in math fluency had spring achievement that did not depend on whether they received instruction from the core alone or the core in combination with student/peer managed learning.

2.) What is the nature and variability of instruction provided within first grade classrooms and how do amounts and types of mathematics instruction vary depending on treatment condition?

Overall, there was a high degree of variability within mathematics instructional types. Differences were most notably observed in the amount of time spent in peer managed and student managed instruction. Students in the peer assisted supplement condition participated in markedly more time in peer managed and small group instruction. Across conditions, students received similar amounts of teacher managed mathematics instruction. Students in the math intervention received 7 more minutes of teacher managed whole class instruction than students in the control, while both groups received the same amount of teacher managed mathematics instruction delivered to individual students.

Conclusions:

Results suggest that student mathematics achievement and growth may depend on types and amounts of instruction and their initial mathematics achievement scores. These relations draw attention to the fact that not all students respond in the same way to instruction and that the growth students experience over the school year may depend on the amounts and types of mathematics instruction their teacher provides. Overall, it appears that average students perform similarly whether they are provided with predominately core math instruction or core in addition to student/peer managed instruction. However, for students who begin first grade with below grade level scores, the core seems to hold some advantage over the core plus peer-instruction, whereas above average students seem to excel when provided with both the students/peer managed intervention in combination with the core. This is similar to child X instruction interaction findings in literacy, where children with weaker literacy skills who spent substantial amounts of time in child and peer managed literacy activities (e.g., sustained independent silent reading) showed weaker reading skill gains compared to their peers with stronger literacy skills.

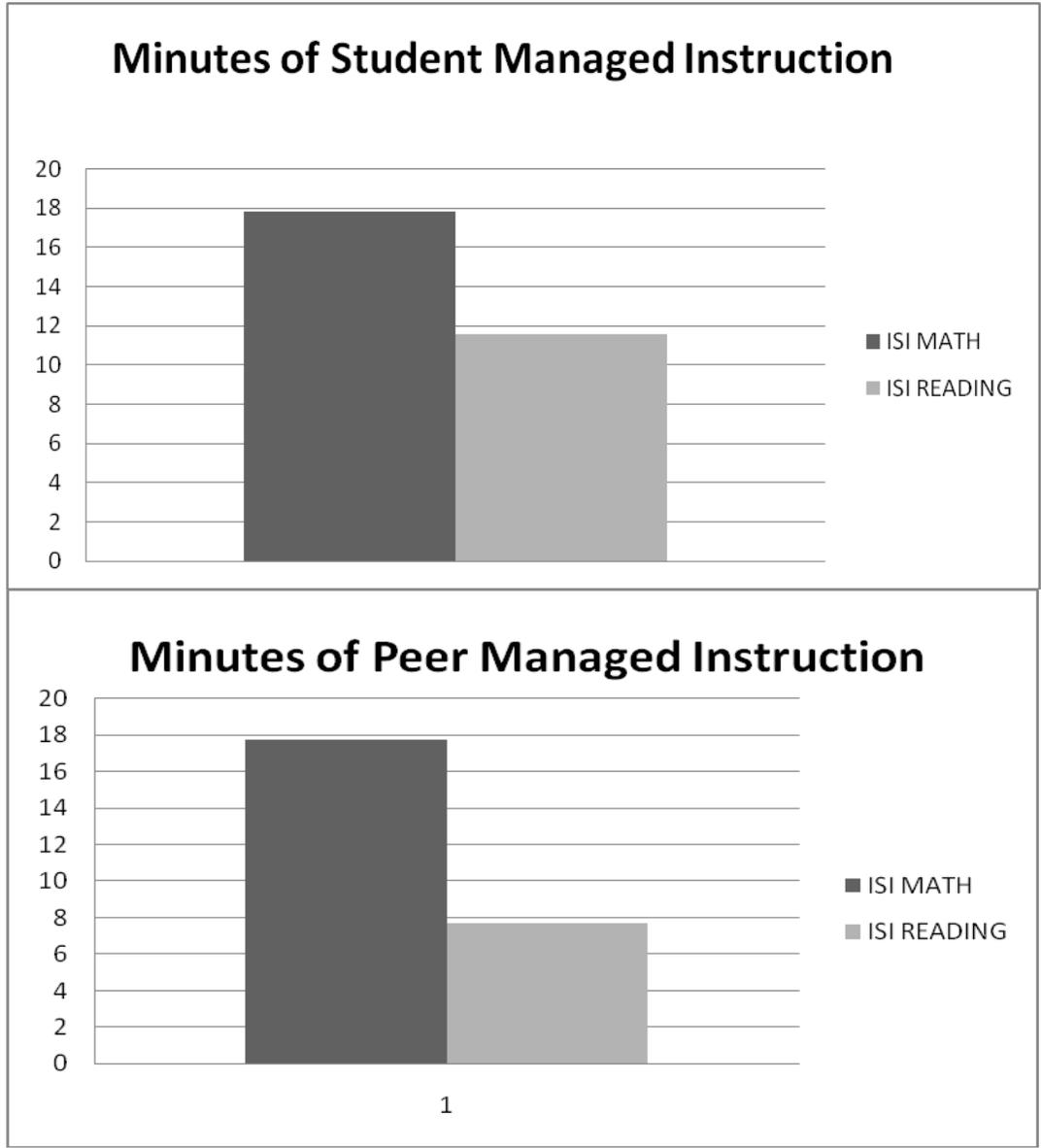
This study represents the first analyses of data for the purposes of uncovering child x instruction interactions in math. Further coding of classroom videotapes will provide amounts of time spent in particular mathematics skills as well as the mode of deliver (teacher managed, student, or peer managed). Such results will help to further explicate the relation of instructional amounts and types to differential responses by students to such instruction.

Overall, implications resulting from the presence of child x instruction interactions may offer guidance to teachers and educational leaders on what types and amount of instruction to differentially provide to students. Such implications would not be specific to curriculum but apply to math instruction in general. Further research is necessary to explicate whether these interactions exist across grade levels and may be specific to particular math skills.

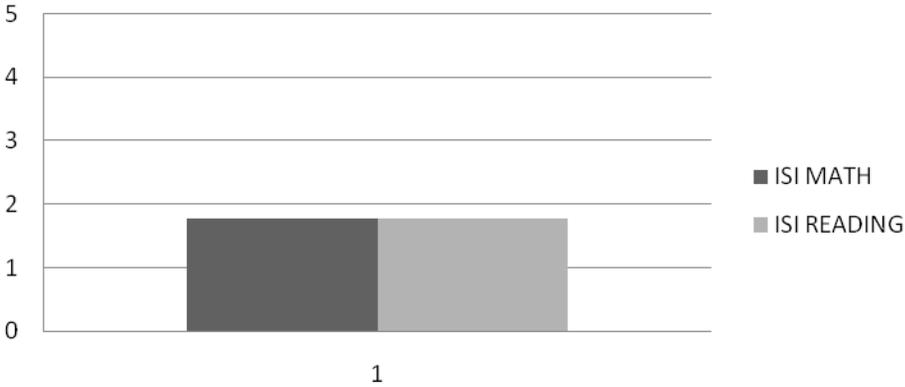
Appendix A. References

- Connor, C. M., Morrison, F. J., Fishman, B., Ponitz, C. C., Glasney, S., Underwood, P., et al. (2009). The ISI classroom observation system: Examining the literacy instruction provided to individual students. *Educational Researcher*, 38(2), 85-99.
- Connor, C. M., Morrison, F. J., Fishman, B. J., Schatschneider, C., & Underwood, P. (2007). THE EARLY YEARS: Algorithm-guided individualized reading instruction. *Science*, 315(5811), 464-465.
- Connor, C. M., Piasta, S. B., Fishman, B., Glasney, S., Schatschneider, C., Crowe, E., . . . Morrison, F. J. (2009). Individualizing student instruction precisely: Effects of child by instruction interactions on first graders' literacy development. *Child Development*, 80(1), 77-100.
- Fuchs, D., & Fuchs, L. S. (1998). Researchers and teachers working together to adapt instruction for diverse learners. *Learning Disabilities Research & Practice*, 13, 126-137.
- Math Pals. (2009). <http://kc.vanderbilt.edu/pals/>
- Noldus Information Technology. (2001). The observer Video-Pro: Interactive multimedia tutorial (Version 1.0) [software]. Leesburg, VA: Noldus Information Technology, Inc.
- NAEP. (2010). National Assessment of Educational Progress: The nation's report card. Retrieved from <http://nces.ed.gov/nationsreportcard/>
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Saxon Math Publishers. (2008). <http://saxonpublishers.hmhco.com/>
- U.S. Department of Education (2006). Math Now: Advancing math education in elementary and middle School. Retrieved from <http://www.ed.gov/about/inits/ed/competitiveness/math-now.html>.
- U.S. Department of Education. (2008). Foundations for success: The final report of the National Mathematics Advisory Panel. Retrieved from the U.S. Department of Education Web site: <http://www.ed.gov/about/bdscomm/list/mathpanel/report/final-report.pdf>

Appendix B. Tables and Figures



Minutes of Teacher Managed Individual Instruction



Minutes of Teacher Managed Whole Class Instruction

