Supporting Success in Algebra

A Study of the Implementation of *Transition to Algebra*

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Background

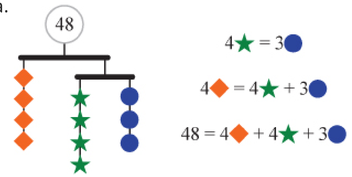
- Algebra 1 is a gateway to advanced mathematics in high school and college success.
- Unfortunately, a significant number of students enter high school underprepared in Algebra 1[1, 2]. These students are disproportionately Black, LatinX, and from low-income families.
- The COVID-19 pandemic has increased achievement gaps and social inequities in education[3, 4].
- Underprepared students can benefit from additional instructional time in mathematics[5,6]. Algebra support courses taken alongside Algebra 1 are commonly offered by districts[7,8,9] and hold promise for improving student outcomes when combined with strong curricula and PD[10,11]. Yet, there is a lack of evidence-based practices, curriculum materials, and district guidance for how to structure algebra support courses effectively[9].

Intervention

Transition to Algebra (TTA) is an innovative algebra support curriculum designed to raise the competence and confidence of students underprepared in Algebra 1. Developed at EDC with support from the National Science Foundation, TTA is designed for use in yearlong support courses taken alongside Algebra 1 or Integrated Math 1.

Rather than re-teaching or pre-teaching algebra content, TTA focuses on essential *algebraic habits of mind*, key mathematical ways of thinking that bring meaning and coherence to students' work. TTA features Mental Math, Puzzles, and Dialogues to help students develop mathematical practices and problem-solving stamina.

- Puzzling and Persevering
- Seeking and Using Structure
- Using Tools Strategically
- Describing Repeated Reasoning
- Communicating with Precision



Underlying the design of TTA is the hypothesis that students underprepared for Algebra 1 can benefit from very specific help in building the logic of algebra by connecting arithmetic pattern and algebraic structure.

Research Questions

1. What is the impact of TTA on the algebra achievement of 9th grade students underprepared for Algebra 1 compared with similar students receiving business-as-usual instruction?
2. What is the impact of TTA on attitudes toward mathematics of 9th grade students underprepared for Algebra 1 compared with similar students receiving business-as-usual instruction?
3. Do teachers' instructional practices moderate the difference between the achievement and attitudes of ninth-grade students underprepared for Algebra 1 in TTA and the business-as-usual condition?
4. In what ways do teachers use and adapt TTA for use in their classrooms? Do differences in teachers' adaptations relate to student outcomes?
5. What supports do teachers need to successfully implement the TTA intervention? Do differences in the level of support provided to TTA teachers relate to student outcomes?

Research Design

Sample
- 100 teachers and 3,400 students in Treatment schools
- 64 teachers and 2,100 students in Comparison schools
- 63% of schools were mid-high and high-poverty schools

Data Collection
- TTA implemented in algebra support courses in Treatment schools; business-as-usual instruction conducted in similar courses in Comparison schools
- Student and teacher data collected in 2018–2019

Analysis
- Quasi-experimental pre-post research design with propensity score weighting to analyze student outcomes
- Mixed methods analyses with parallel qualitative and quantitative datasets to analyze implementation data

Key Constructs and Instruments

Student achievement in algebra
8th and 9th grade scores on standardized math assessments
Student *Algebra Assessments* (pre and post)
Student-level secondary data (grades, demographics, attendance)
Student attitudes about mathematics
Opinions about Math survey
Curriculum use and implementation, instructional supports
Teacher surveys (fall, spring, end-of-year)
Teacher interviews
Classroom observations
Administrator interviews

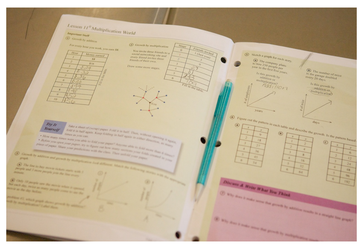
Supports Provided to Participating Districts

- Curriculum-focused summer and school-year PD workshops, webinars, and resources for Treatment teachers to support TTA implementation.
- TTA student materials and teacher guides provided to all Treatment teachers through partnership with Heinemann/Houghton Mifflin Harcourt.
- Algebraic Habits-of-Mind workshops for Comparison districts post-data collection to address their algebra support needs and contexts.
- District-level reports for administrators and teachers with results from student *Algebra Assessments* and *Opinions about Math* surveys.

Initial Findings

Our analyses are ongoing. Initial findings from our analyses of our teacher surveys include:

- Almost all Treatment teachers felt TTA was somewhat or very effective in meeting the needs of underprepared students (96%), special needs students (87%), and ELL students (87%), citing TTA's visual approach and puzzles as helpful.
- Treatment teachers described two very common challenges: (1) having sufficient instructional time to teach TTA, and (2) aligning the algebra support course to the Algebra 1 course students were taking concurrently. This issue of whether to use the additional instructional time to align directly day-to-day to Algebra 1 to support learning of on-grade-level content – or to use the time to address the foundations of algebraic understanding – was a tension articulated by participating teachers and administrators throughout the project.
- Both Treatment and Comparison teachers noted that student engagement and perceptions of the algebra support course were difficult challenges, regardless of the curriculum in place. Student attendance was also a commonly cited challenge for algebra support courses (again, regardless of curriculum).
- Treatment and Comparison teachers identified similar student learning needs in the support course, citing struggles with the foundational elements of algebra and the need to teach pre-requisite skills, for example in fractions, integers, and number sense.



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