An Architecture of Intensification

Building a Comprehensive Program for
Struggling Students in Double-Period Algebra Classes

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Project Information

Underlying Assumptions

- Underprepared students need more time, but more time only is not enough.
- A rigorous and well-designed algebra curriculum is essential but insufficient.
- The program must influence students' beliefs about themselves as effective mathematics learners and their attitudes about mathematics, as well as their teachers' beliefs about the mathematical capabilities of underprepared students.
- This involves strategically incorporating instruction that historically resides outside of the domain of typical algebra classes but is fundamentally important to struggling students' success.

Need and Overarching Design Principles

- Need was identified by leaders in Urban Mathematics Leadership Network (UMLN) districts
- Targeting two populations
  - Underprepared algebra students
  - Teachers of underprepared algebra students
- Designing for use in double-period high school Algebra I courses.
- Designing for use at scale in urban districts and elsewhere

Key Design Features

- Algebra core
- Efficient review/repair strategies
- Ongoing, distributed practice
- Incorporation of social-psychological learning interventions
- Supports for enactments of high cognitive demand tasks
- Tools that help students organize information and support metacognitive awareness
- Enhanced formative assessment strategies
- Explicit supports for literacy and language development

Project Goals

Goal 1: Iteratively design and test student and teacher materials for a full-year, 9th-grade, double-period algebra program that integrates effective approaches for teaching algebra with instructional features that, independently, have proven to be effective with struggling learners.

Goal 2: Develop and test materials and strategies that enable teachers to effectively implement the comprehensive *Intensified Algebra I* program and that help promote collaboration within and across schools among teachers of the course. A particular target will be novice or inexperienced teachers, who disproportionately teach the double-period classes.

Goal 3: Develop and test structures and tools that promote the program's scalability in large, urban districts and elsewhere. The project will investigate the feasibility and effectiveness of leveraging technology to organize and deliver at scale consistent, high-quality supports for program implementation.

Development Timeline

Preliminary Work (2007-2009)
UMLN leaders established a Design Team of 25 leading researchers, developers, and practitioners who studied existing research and interventions and developed a program model that drew from promising practices and relevant research. That work informed the development and testing of three prototype units.

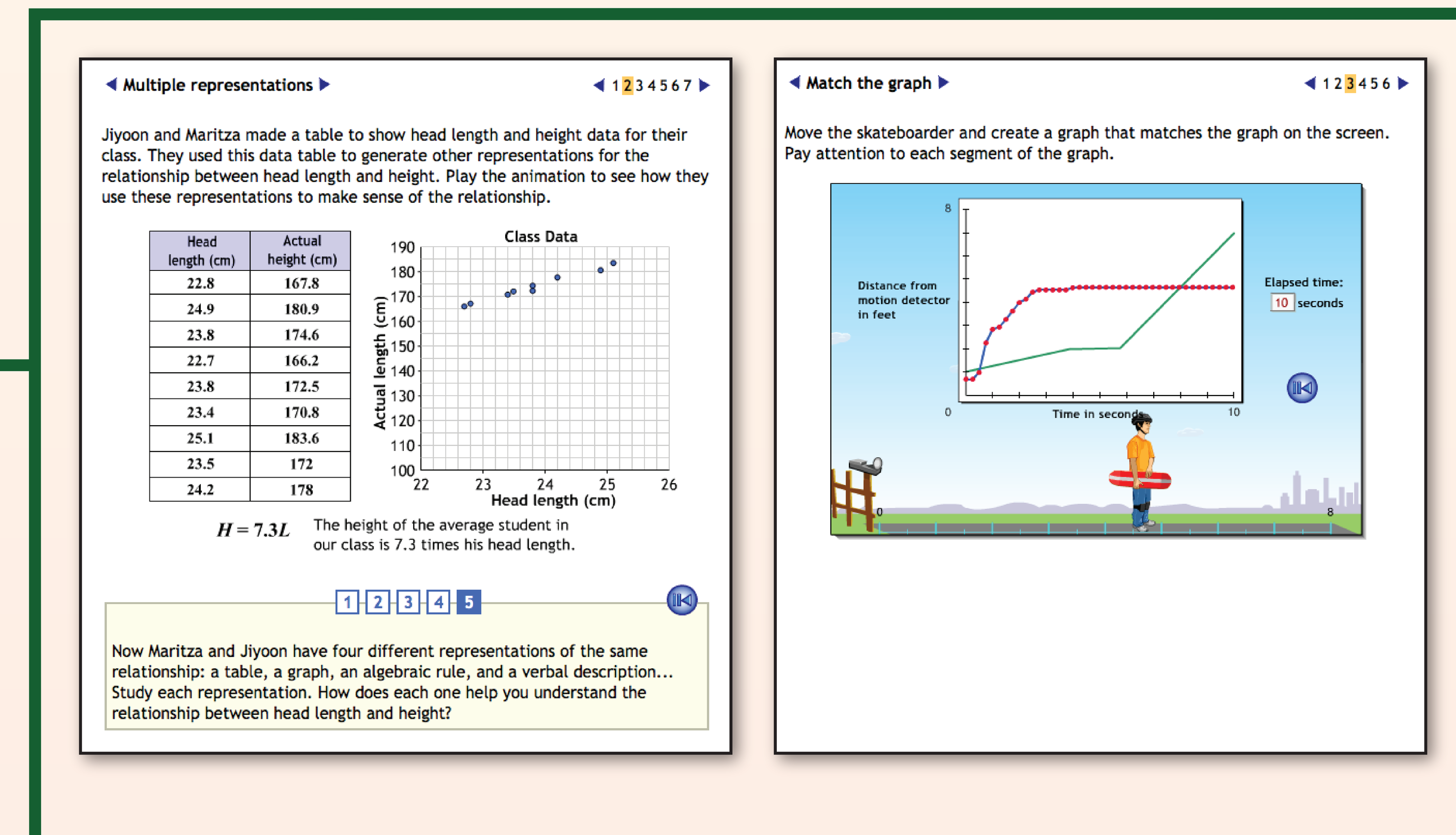
Year 1 (2009-2010)
Complete Version 1.0 of *Intensified Algebra I*—student and teacher materials for a full year of instruction, organized into 10 units (30 topics). Field test Version 1.0 with 35 teacher/co-developers and 1,400 students in two UMLN districts, Chicago and Austin.

Year 2 (2010-2011)
Conduct field test of *Intensified Algebra I* (Version 2.0) with about 150 teachers and 5,500 students in 4-6 UMLN districts.

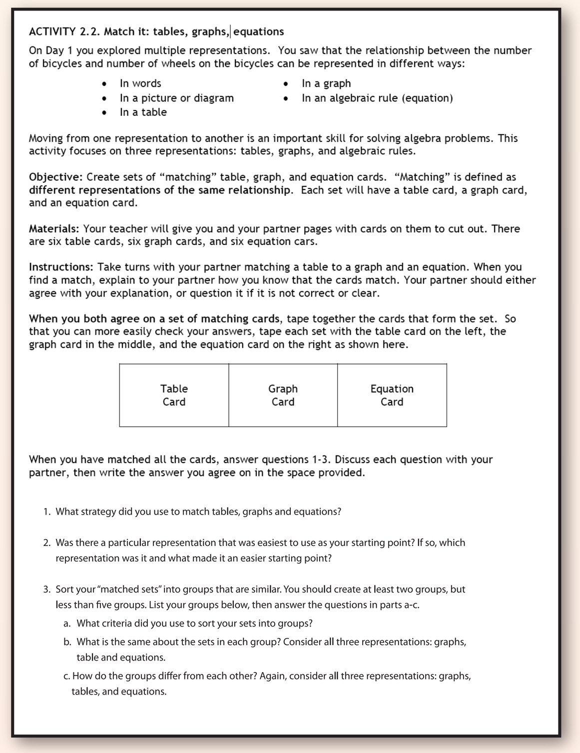
Year 3 (2011-2012)
The third year will focus on preparing for large-scale program dissemination. Conduct field test of Version 3.0 with about 250 teachers and 10,000 students in 6-9 UMLN districts.

Algebra Core

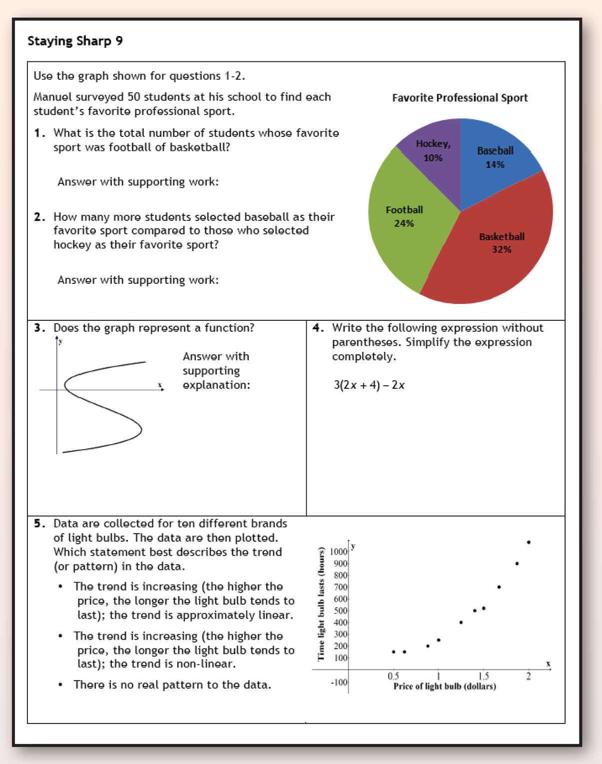
Agile Mind Online Service



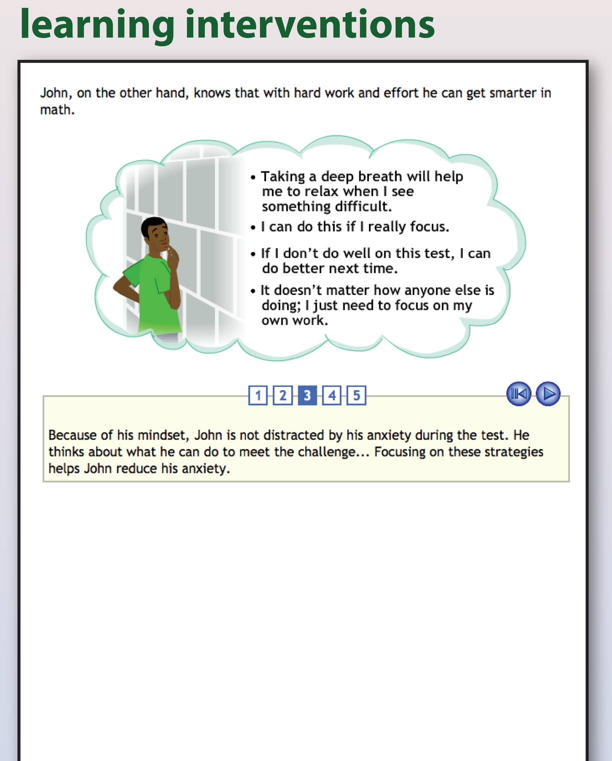
efficient review/ repair strategies



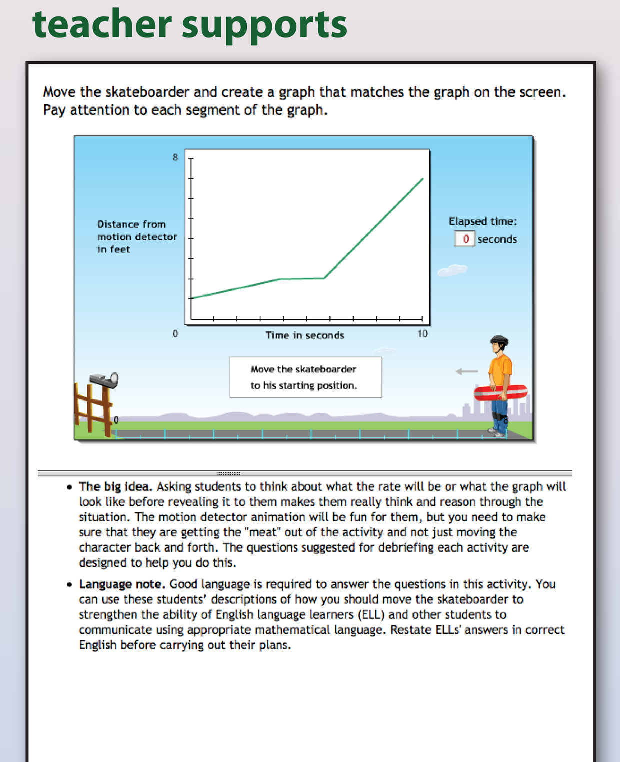
ongoing, distributed practice



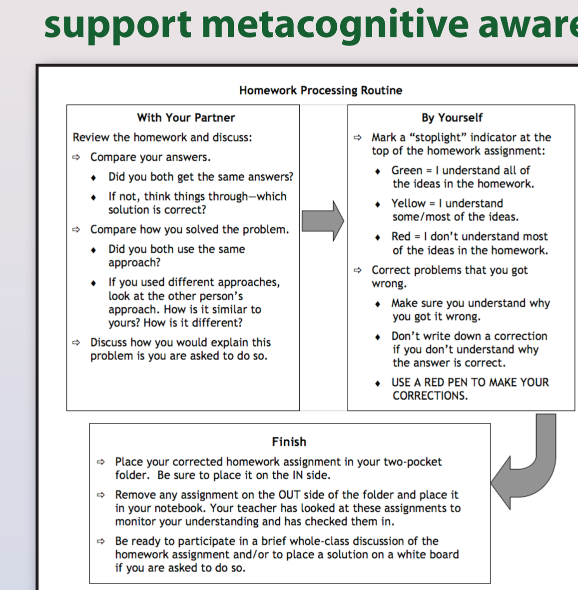
social psychological learning interventions



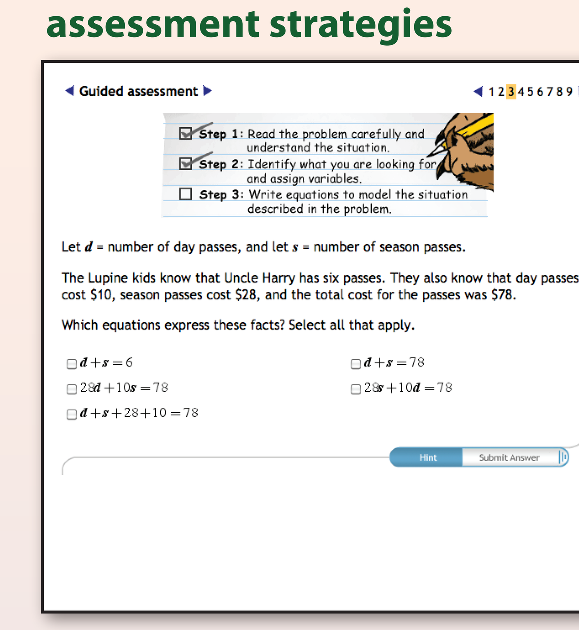
teacher supports



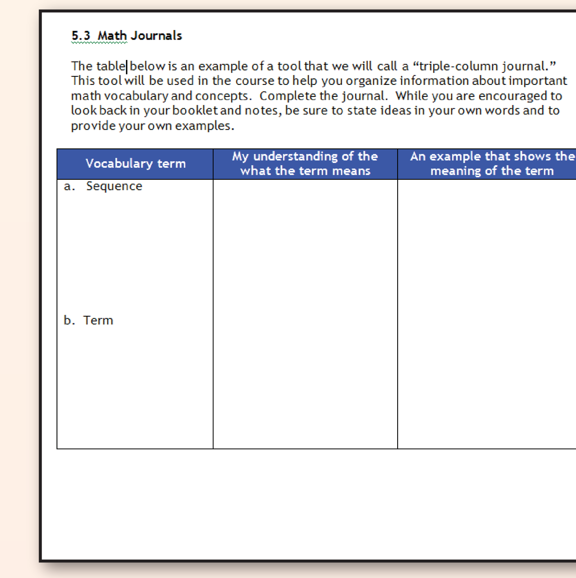
tools that help students organize information and support metacognitive awareness



enhanced formative assessment strategies



explicit supports for literacy and language development



Research Plan

The design-based research involves two levels of field test sites: a small group of six intensive research classrooms and a broader group of implementing classrooms. We will use the intensive research classrooms to engage in a descriptive study of teachers' enactment of units, and of students' academic, social, and emotional learning outcomes through the use of interviews, classroom observations, and assessments. We will use the broader group of implementing classrooms to validate the emergent trends from our intensive classroom studies and to gather data via web-based surveys about specific program implementation issues. Participants from the broader group of classrooms will also serve as a base for the Year 3 research regarding the enactment of the *Intensified Algebra* program in multiple districts. Involving more classrooms in the research/ development process helps solidify an initial constituency for program dissemination once it is completed.

Research Questions

Year 1 (2009-2010)

- Are the lesson elements manageable by teachers and students?
- Do the lessons have the intended outcomes with respect to mathematics content learning, development of strategic/metacognitive skills, and attitudes and motivation toward mathematics, with particular attention to the effects of these elements on the performance of special needs students?
- What supports do teachers need for skillful enactment?

Year 2 (2010-2011)
The research focus in the intensive research sites and the broader group of implementers parallels Year 1 except that it shifts to trends and outcomes exhibited by teachers and students over the extended timeframe of the whole academic year.

In the intensive research classrooms:

- What is the nature of students' understanding of core algebraic concepts and skills as demonstrated across the year, including changes evidenced by pretest to posttest comparisons on various assessment instruments?
- How do students' beliefs and attitudes about mathematics and themselves as learners change throughout the school year? How are teacher beliefs affected?
- What are the core issues that arise in implementing the program design? What tools do teachers find useful for promoting student understanding and identity as learners of algebra? For what aspects of their work do *Intensified Algebra I* teachers need additional resources and supports?
- How much of the curriculum can be covered and taught well? What is essential and what might be dropped?
- What are the challenges of implementation and synthesis of program components?
- What are the differences among our six teacher cases in terms of their instructional planning and enactments and how are these differences related to familiarity/experience with the program?
- How does the youth-development instruction affect students across the entire year?

Year 3 (2011-2012)

- Is there evidence supporting the efficacy of design changes and the efficacy of the program for particular teachers and students?
- What kinds of teacher support issues arise when the program is enacted outside the immediate oversight of the program's developers?

We also will significantly expand our efforts to use the web-based teacher and student measures piloted in Year 2 in the broader sample of implementation sites. The goal of this data collection effort is to establish a database of sufficient size and scope to begin to examine possible relationships among student outcomes, teacher implementation issues, teacher and student demographics, and particular district features.

Finally, Year 3 will include a small-scale efficacy study, comparing performance on end-of-algebra assessments of *Intensified Algebra* classrooms to those in a "typical" double-period Algebra I course. Previous year's performance on the district's end-of-year assessments will be used as a covariate.

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