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.

An Architecture of Intensification

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

Learning Sciences Research Institute University of Illinois at Chicago A. Castro Superfine, M. Gartzman, S. Goldman, J. Lynn, J. Pellegrino, D. Briars Charles A. Dana Center The University of Texas at Austin K. Cook, S. Hull, C. Schneider, U. Treisman

Time in seconds

Elapsed time:

seconds

Agile Mind, Inc. L. Chaput

efficient review/ repair strategies

ACTIVITY 2.2. Match it: tables, graphs, equations On Day 1 you explored multiple representations. You saw that the relationship between the number of bicycles and number of wheels on the bicycles can be represented in different ways: In a picture or diagram In an algebraic rule (equation) Moving from one representation to another is an important skill for solving algebra problems. This activity focuses on three representations: tables, graphs, and algebraic rules. Objective: Create sets of "matching" table, graph, and equation cards. "Matching" is defined as different representations of the same relationship. Each set will have a table card, a graph card. Materials: Your teacher will give you and your partner pages with cards on them to cut out. There

nstructions: Take turns with your partner matching a table to a graph and an equation. When you find a match, explain to your partner how you know that the cards match. Your partner should either agree with your explanation, or question it if it is not correct or clear. When you both agree on a set of matching cards, tape together the cards that form the set. So graph card in the middle, and the equation card on the right as shown here



partner, then write the answer you agree on in the space provided.



When you have matched all the cards, answer questions 1-3. Discuss each question with your

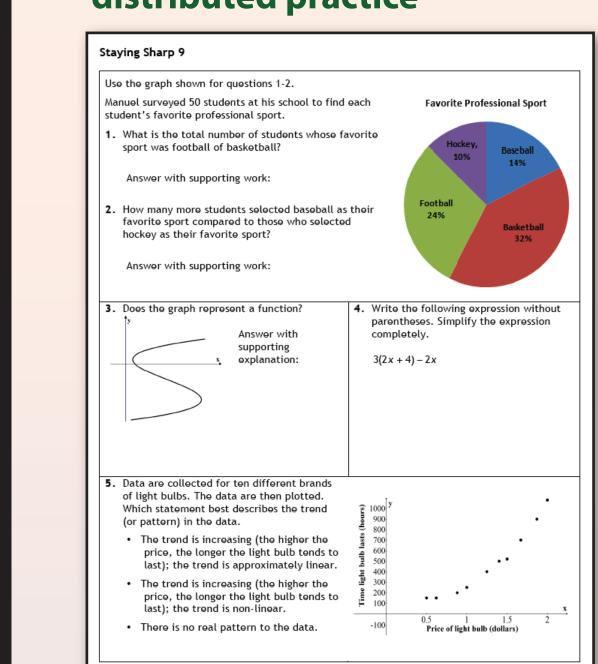
- 1. What strategy did you use to match tables, graphs and equations
- representation was it and what made it an easier starting point . Sort your "matched sets" into groups that are similar. You should create at least two groups, bu
- less than five groups. List your groups below, then answer the questions in parts a-c. a. What criteria did you use to sort your sets into groups?

2. Was there a particular representation that was easiest to use as your starting point? If so, which

- b. What is the same about the sets in each group? Consider all three representations; graphs
- c. How do the groups differ from each other? Again, consider all three representations: graphs, tables, and equations

ongoing,

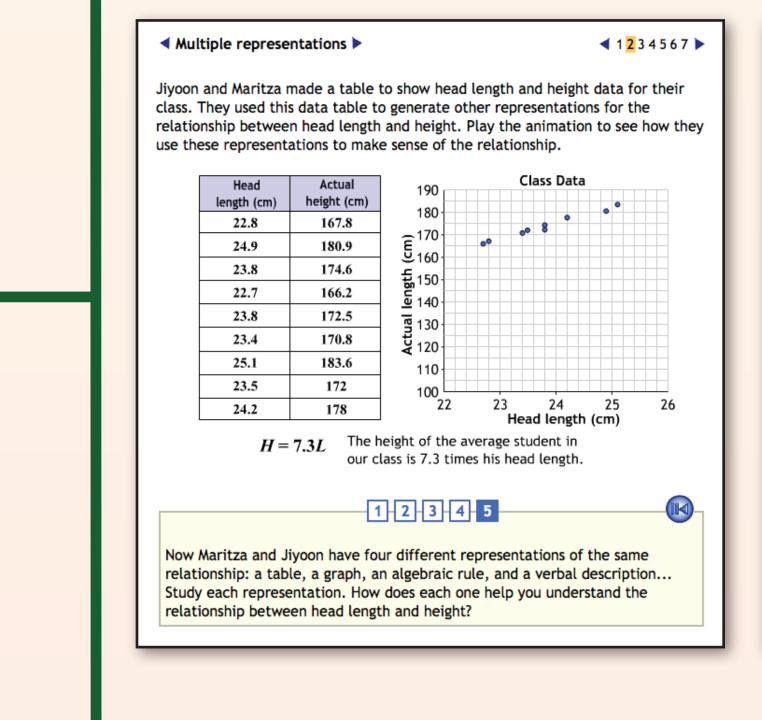
distributed practice



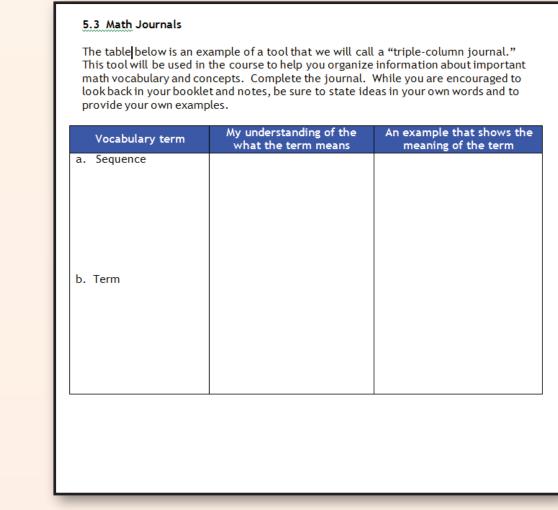
Algebra Core Agile Mind Online Service

Distance from

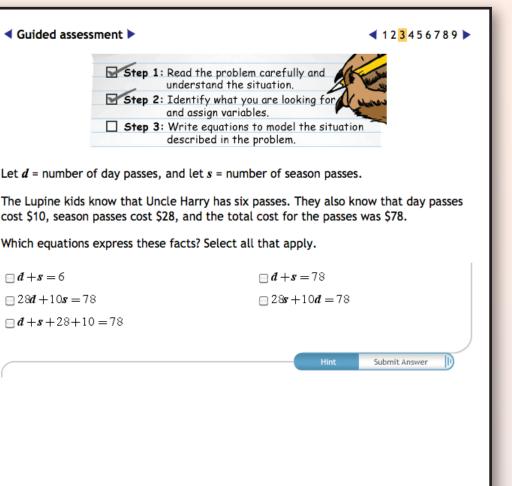
motion detector



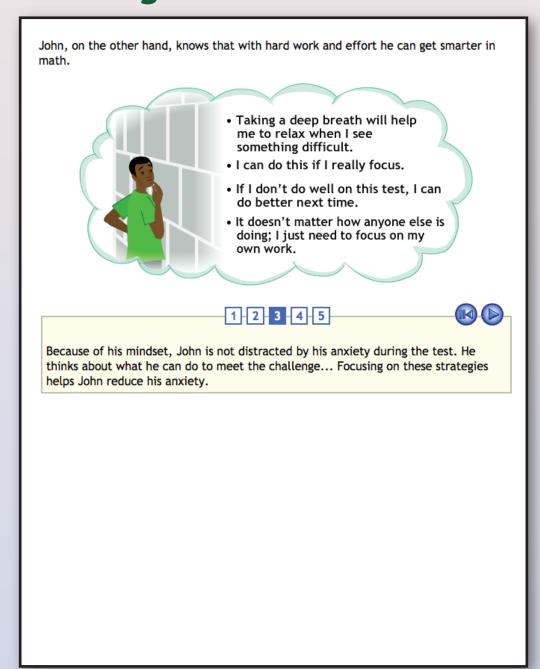
4 1 2 3 4 5 6 ▶ Move the skateboarder and create a graph that matches the graph on the screen. Pay attention to each segment of the graph.



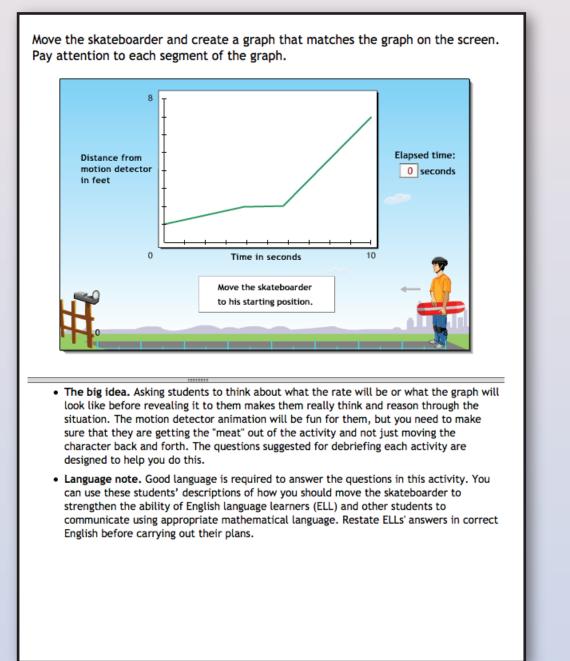
enhanced formative assessment strategies



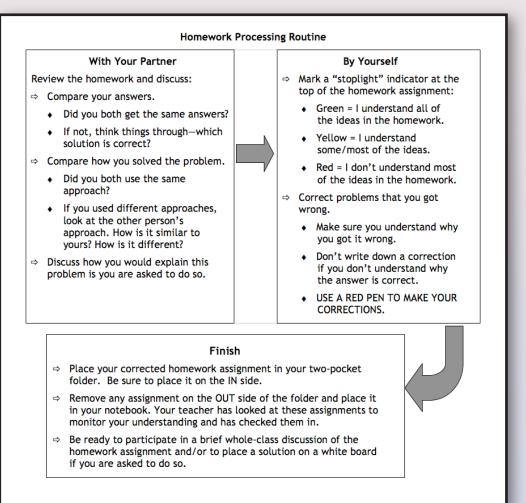
social psychological learning interventions



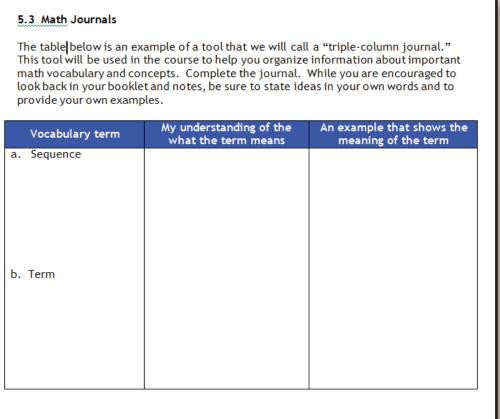
teacher supports

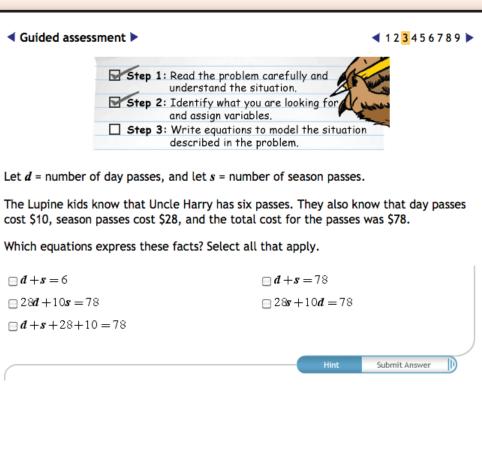


tools that help students organize information and support metacognitive awareness



explicit supports for literacy and language development





How does the youth-development instruction affect students across the entire year?

dropped?

Research Plan

The design-based research involves two levels of field

test sites: a small group of six intensive research

classrooms. We will use the intensive research

classrooms to engage in a descriptive study of

teachers' enactment of units, and of students'

observations, and assessments. We will use the

broader group of implementing classrooms to

validate the emergent trends from our intensive

surveys about specific program implementation

classrooms will also serve as a base for the Year 3

classrooms in the research/ development process

helps solidify an initial constituency for program

dissemination once it is completed.

Research Questions

Year 1 (2009-2010)

and students?

students?

Year 2 (2010-2011)

research regarding the enactment of the *Intensified*

Algebra program in multiple districts. Involving more

Are the lesson elements manageable by teachers

• Do the lessons have the intended outcomes with

attitudes and motivation toward mathematics,

with particular attention to the effects of these

elements on the performance of special needs

• What supports do teachers need for skillful enactment?

The research focus in the intensive research sites

and the broader group of implementers parallels

extended timeframe of the whole academic year.

• What is the nature of students' understanding of

core algebraic concepts and skills as demonstrated

across the year, including changes evidenced by

mathematics and themselves as learners change

• What are the core issues that arise in implementing

the program design? What tools do teachers find

useful for promoting student understanding and

their work do *Intensified Algebra I* teachers need

• How much of the curriculum can be covered and

taught well? What is essential and what might be

• What are the challenges of implementation and

• What are the differences among our six teacher

to familiarity/experience with the program?

cases in terms of their instructional planning and

enactments and how are these differences related

additional resources and supports?

synthesis of program components?

identity as learners of algebra? For what aspects of

throughout the school year? How are teacher

pretest to posttest comparisons on various

• How do students' beliefs and attitudes about

exhibited by teachers and students over the

In the intensive research classrooms:

assessment instruments?

beliefs affected?

Year 1 except that it shifts to trends and outcomes

development of strategic/metacognitive skills, and

respect to mathematics content learning,

issues. Participants from the broader group of

classroom studies and to gather data via web-based

through the use of interviews, classroom

classrooms and a broader group of implementing

academic, social, and emotional learning outcomes

- 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.



