The University of Texas at Austin
Charles A. Dana Center

Intensification as a Tool for Equity

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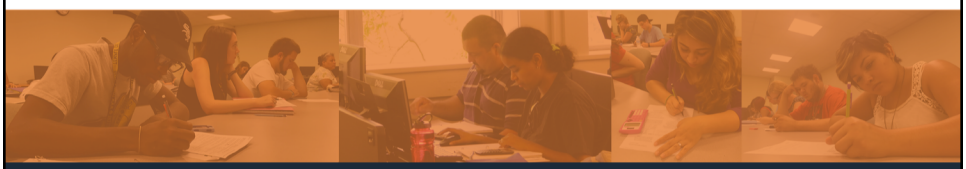


About the Dana Center

Equity — Access — Excellence

2018

Dana Center by the Numbers

We supported 60,500 K–12 students attending school on U.S. military bases through our work with the **Department of Defense Education Activity**.

Dana Center by the Numbers

We engaged with 118 districts in 23 states to provide middle and high school math courses of the **highest quality** as recognized by rigorous state and national reviews, including EdReports.org.

Dana Center by the Numbers

At the close of 2017, the Dana Center has contributed to the **implementation of math pathways** in higher ed systems, institutions, and campuses in 29 states.

Find Additional Resources on Our Padlet

Our PowerPoint and additional resources are located at https://padlet.com/annejoyo/ncsm2018

Agenda

- **What is the problem?**
- **A possible solution: Intensification**
  - Components
  - Research-based elements
- **Classroom examples**
- **Closing**

Challenges

1. Half of students fail Algebra the first time they take it.
2. Students' beliefs and motivation impact their success.
3. Math failure impacts students' success in high school, their chances for college without remedial courses, and their lifelong earnings.

We Need a New Approach: *Intensification*

Intensification is a systemic effort to address the contextual needs of students in learning on-level content. *Intensification* may mean:

- Increasing the amount of time with content
- Using a variety of pedagogical supports
- Developing students' sense of socio-motivational well-being around the content.

Intensification **does not** mean delaying rich mathematical experiences until students acquire "the basics."

An Architecture for Intensification

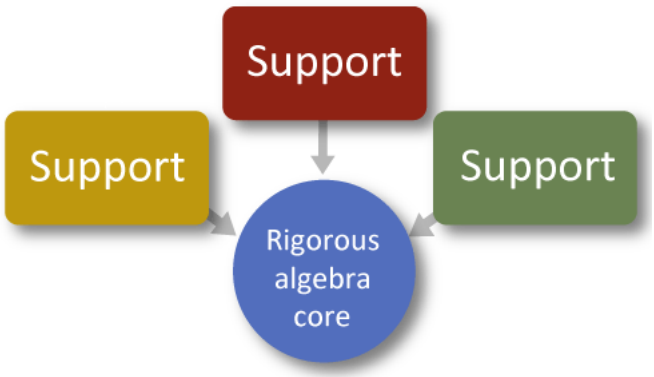
Struggling students need

More time

Challenging curriculum

Targeted Interventions

An Architecture for Intensification



What Research Tells Us

- Promoting **learners' beliefs about their own intelligence** can increase their motivation and effort to learn mathematics (Dweck, Good, Midgely, Aronson).
- Engaging students with **challenging tasks** that involve active meaning-making increases learning (Horizon Research, Hiebert & Grouws).
- Accessing prior knowledge and **addressing students' misconceptions** increases learning (Swan & Bell, Burkhardt, Shell Centre).
- **Routines and structures** help struggling students organize critical mathematical content and increases their learning (Deshler & Lenz).
- Ongoing, cumulative **distributed practice** improves learning and retention (Rohrer, Mayfield).
- **Formative assessment** is a key intervention for improving student achievement (Black & Wiliam, Hiebert & Stigler).

Intensified Algebra: An Integrated, Cohesive Design

Three Learning Mindsets

CAPABILITY

BELONGING

PURPOSE

Learning and the Adolescent Mind — Free Resource

www.learningandtheadolescentmind.org

- **Professional development**
  - Articles and collaborative study guides
- **Classroom tools**
  - Video to teach students about the brain
  - Interactive problem solving puzzles
  - Problem solving and self-reflection tools
- **Further reading**

Intensified Algebra: An Integrated, Cohesive Design

Rigorous Algebra Core Through Rich Tasks

"Not all tasks are created equal, and different tasks will provoke different levels and kinds of student thinking."

— Stein, M .K., Smith, M .S., Henningsen, M. A., & Silver, E. A. (2009) *Implementing standards-based mathematics instruction: A casebook for professional development.* Second edition. NY: Teachers College Press, Columbia University.

"The level and kind of thinking in which students engage determines what they will learn."

— Hiebert, J., Carpenter, T., Fennema, E., Fuson, K., Wearne, D., Murray, H., Oliver, A., & Human, P. (1997). *Making sense—teaching and learning mathematics with understanding.* Portsmouth, NH: Heinemann.

An Example From Intensified Algebra

The Friendship Club problem

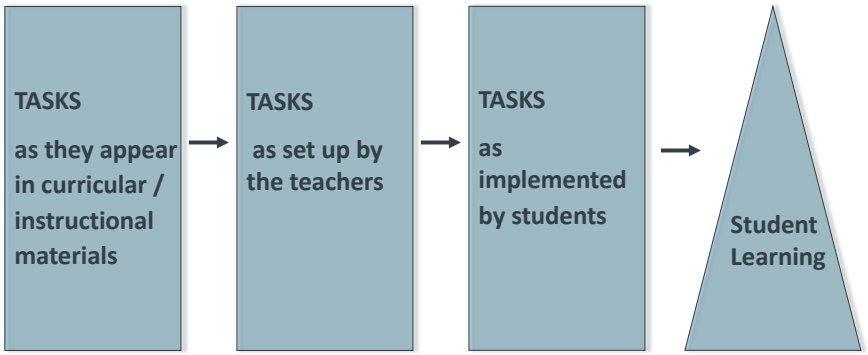
Work individually on this problem for 2 minutes.

After 2 minutes, turn to an elbow partner. Explain how you got started on this problem and what strategy or strategies you are using.

Then, work together on this problem for 3 more minutes.

Task Implementation and Cognitive Demand

The mathematical tasks framework



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Reflection Questions

- **What groundwork would be good to lay with students before working on a rich task such as this?**
- **What is something you might inadvertently do to lower the cognitive demand of this task?**
- **What are specific things you can do to keep the cognitive demand high—and on the students?**
- **How does providing students with rich tasks connect to the mindset work and promoting students' beliefs about themselves as math learners?**

What Resources Support Us in Taking Action?

Dana Center Collaborations

- **Inside Mathematics www.insidemathematics.org**
  - Problems of the month
  - Formative assessment tasks
- **Learning and the Adolescent Mind www.learningandtheadolescentmind.org**
  - Persistence tasks with interactive features — Towers of Hanoi, Bucket Problem
  - Persistence tools — Thinking About Thinking Tool, Self-Reflection Tool

Intensified Algebra: An Integrated, Cohesive Design

Intensification Strategy: Targeting Misconceptions

A study by Alan Bell and Malcolm Swan found that **students whose teachers addressed and corrected misconceptions**, rather than simply using remedial measures, **achieved and maintained higher long-term learning results**.

— Bell, A. & Swan, M. (1993 March). Some experiments in diagnostic teaching. *Educational Studies in Mathematics 24*(1), 115–137.

See also www.toolkitforchange.org

Intensification Strategy: Distributed Practice

Strong positive effects of spaced practice have been found in a wide variety of contexts. Carlous Caple summarized this body of research as follows:

The **spacing effect is an extremely robust and powerful phenomenon**, and it has been repeatedly shown with many kinds of material. Spacing effects have been demonstrated in free recall, in cued recall of paired associations, in the recall of sentences, and in the recall of text material.… Also the **effect of spaced study can be very long-lasting**.

— Caple, C. (1996). *The effects of spaced practice and spaced review on recall and retention using computer assisted instruction.* Ann Arbor, MI: UMI.

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Academic Youth Development and Intensified Algebra
www.agilemind.com