Big Ideas and Understandings as the Foundation for Elementary and Middle School Mathematics

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DESCRIPTION

"Big Ideas and Understandings as the Foundation for Elementary and Middle School Mathematics," by Randall I. Charles, calls for using Big Ideas in mathematics to ground teachers' content knowledge and teaching practices. Highly effective teachers understand the Big Ideas of mathematics and translate that to their teaching practices.

The article addresses four big questions:

- What is a Big Idea in mathematics?
- Why are Big Ideas important?
- What are Big Ideas for elementary and middle school mathematics?
- What are some ways Big Ideas can be used?

A Big Idea is defined as a statement of an idea that is central to the learning of mathematics, one that links numerous mathematical understandings into a coherent whole. When one understands Big Ideas, mathematics is no longer seen as a set of disconnected concepts, skills, and facts. Rather, mathematics becomes a coherent set of connected ideas. Highly effective teachers make these connections explicit.

STAGE 1 LEADERSHIP DEVELOPMENT

"Big Ideas and Understandings as the Foundation for Elementary and Middle School Mathematics," by Randall I. Charles, supports stage 1 leadership development of mathematics specialists working to develop knowledge of Big Ideas in mathematics. Research is beginning to identify characteristics of highly effective teachers including those described below.

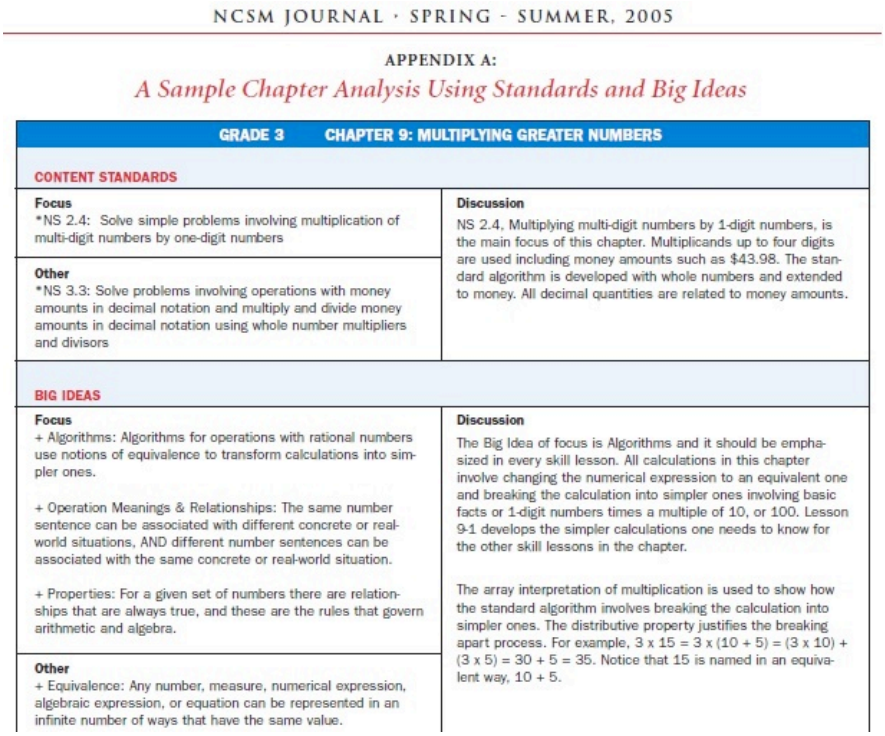
- Ask timely and appropriate questions.
- Conduct productive classroom discussions focused on important content.
- Assess students' thinking and understanding during instruction.
- Ground their content knowledge and their teaching practice around Big Ideas.

Because Big Ideas have connections to many other mathematical concepts, understanding them helps to build a deeper knowledge of the mathematics. Developing knowledge of Big Ideas in mathematics helps teachers consistently connect new concepts to them. An understanding of Big

Ideas helps teachers know how concepts and skills connect across grades. In this article, twenty-one Big Ideas are described along with examples of mathematical understandings related to each idea.

STAGE 2 LEADERSHIP DEVELOPMENT

"Big Ideas and Understandings as the Foundation for Elementary and Middle School Mathematics," by Randall I. Charles, supports stage 2 leadership development of mathematics specialists. A stage 2 specialist working to collaborate and implement the Teaching and Learning Principle will find this article a useful resource. A specialist, who is working with teacher teams to identify and implement common curricular outcomes and to promote collaborative planning and improved instructional strategies, could facilitate the meeting of a professional learning community using this article. After participants read the article, they might discuss the characteristics of a highly effective teacher described in the article. A discussion about the value of grounding content in Big Ideas and maintaining coherence in curriculum would be invaluable in introducing an analysis activity similar to the one shown in Appendix A.



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APPENDIX A:

A Sample Chapter Analysis Using Standards and Big Ideas

GRADE 3 CHAPTER 9: MULTIPLYING GREATER NUMBERS	
CONTENT STANDARDS	
Focus *NS 2.4: Solve simple problems involving multiplication of multi-digit numbers by one-digit numbers	**Discussion** NS 2.4, Multiplying multi-digit numbers by 1-digit numbers, is the main focus of this chapter. Multiplicands up to four digits are used including money amounts such as $43.98. The standard algorithm is developed with whole numbers and extended to money. All decimal quantities are related to money amounts.
Other *NS 3.3: Solve problems involving operations with money amounts in decimal notation and multiply and divide money amounts in decimal notation using whole number multipliers and divisors	
BIG IDEAS	
Focus + Algorithms: Algorithms for operations with rational numbers use notions of equivalence to transform calculations into simpler ones. + Operation Meanings & Relationships: The same number sentence can be associated with different concrete or real-world situations, AND different number sentences can be associated with the same concrete or real-world situation. + Properties: For a given set of numbers there are relationships that are always true, and these are the rules that govern arithmetic and algebra.	**Discussion** The Big Idea of focus is Algorithms and it should be emphasized in every skill lesson. All calculations in this chapter involve changing the numerical expression to an equivalent one and breaking the calculation into simpler ones involving basic facts or 1-digit numbers times a multiple of 10, or 100. Lesson 9-1 develops the simpler calculations one needs to know for the other skill lessons in the chapter. The array interpretation of multiplication is used to show how the standard algorithm involves breaking the calculation into simpler ones. The distributive property justifies the breaking apart process. For example, 3 x 15 = 3 x (10 + 5) = (3 x 10) + (3 x 5) = 30 + 5 = 35. Notice that 15 is named in an equivalent way, 10 + 5.
Other + Equivalence: Any number, measure, numerical expression, algebraic expression, or equation can be represented in an infinite number of ways that have the same value.	

Teachers could work together to create their own unit analysis of the curriculum materials used in the school or district. As described in the article, the specialist and teachers could work to create a chapter overview and connect their state content standards to Big Ideas. Individual lessons are then connected to the standards and Big Ideas and to the specific mathematics understandings to be developed in that lesson.