THE OHIO STATE UNIVERSITY

Backwards Design in School Mathematics

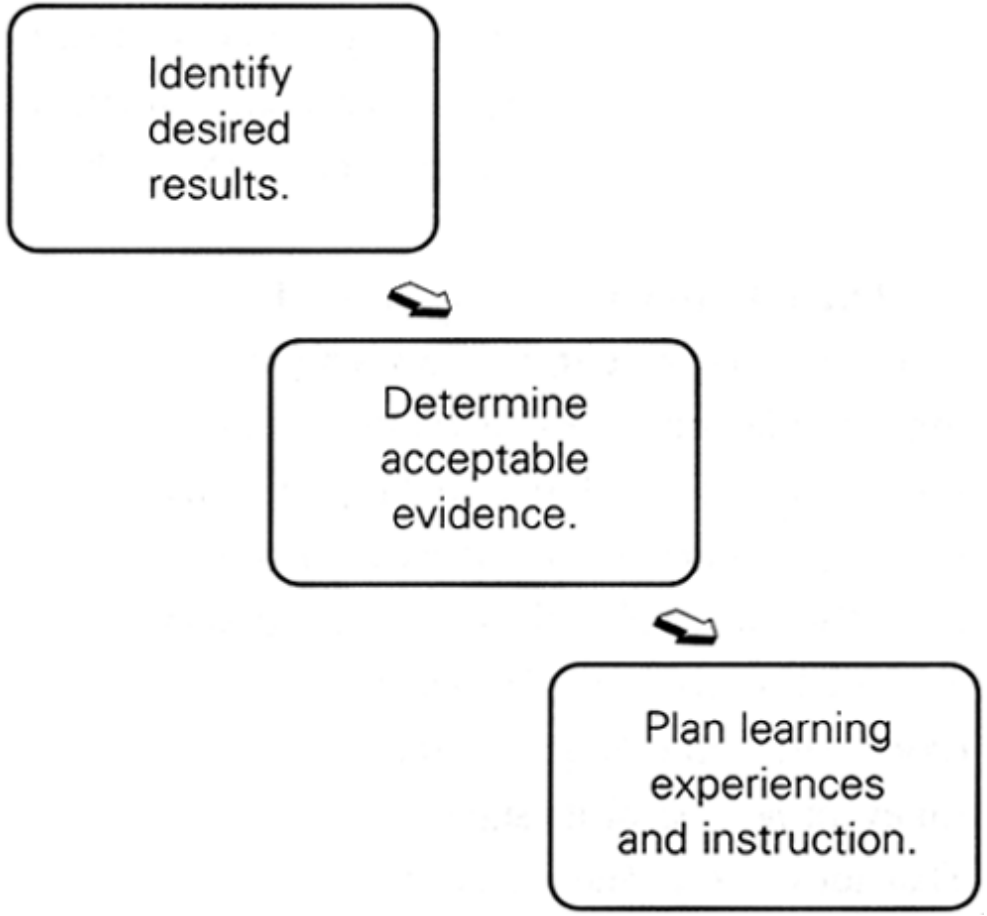
Brad Findell

Department of Mathematics

The Ohio State University

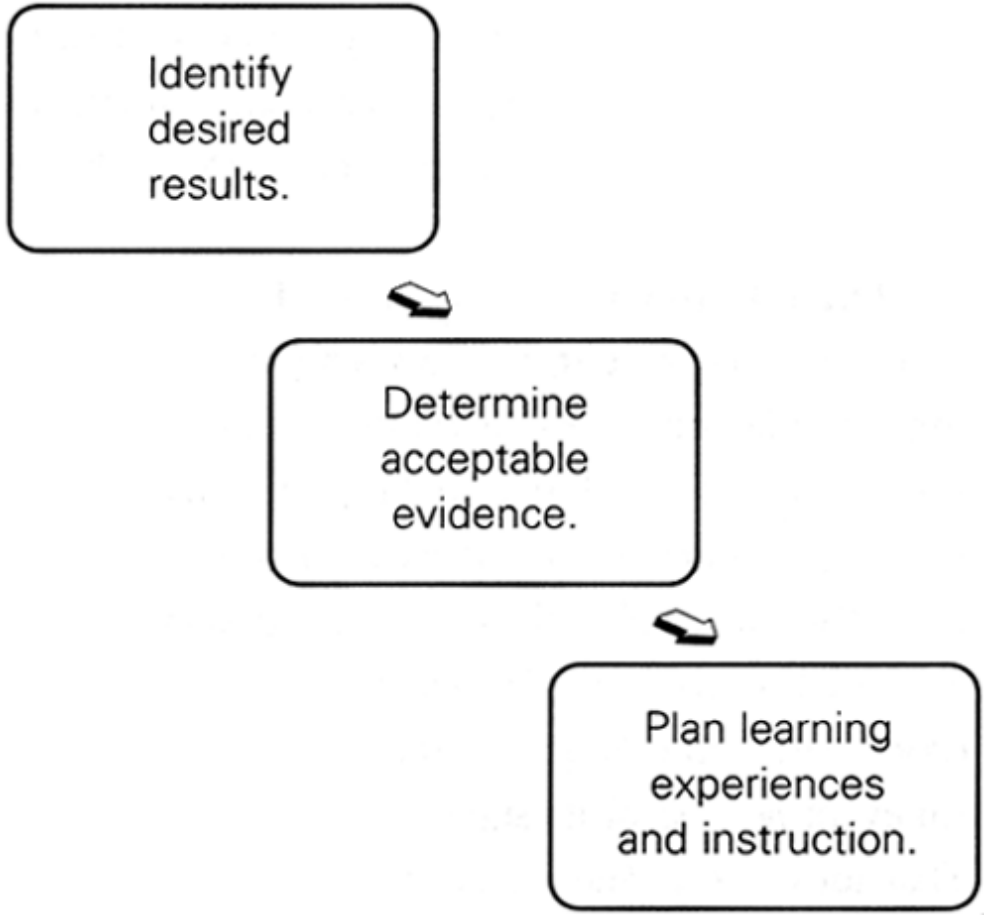
November 8, 2016

Backwards Design



- How is this “backwards”?
- Sometimes we
  - Teach a unit
  - Write a test
  - Then identify what the goals were

Backwards Design



- What resources can inform this process?
  - Standards
  - Assessment banks
  - Textbook lessons, etc.

CCSS Principles

- **Focus**: focus strongly on key ideas, understandings, and skills in each grade and course
- **Coherence**: think across grades, and link to major topics in each grade
- **Rigor**: in major topics, pursue with equal intensity
  - conceptual understanding,
  - procedural skill and fluency, and
  - applications

CCSS Mathematical Practices

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

Mathematics Teaching Practices (NCTM, 2014)

- Establish mathematics goals to focus learning
  - [Driven by standards for mathematics content and practice]
- Implement tasks that promote reasoning and problem solving
  - And support productive struggle
- Build procedural fluency and conceptual understanding
  - Use and connect mathematical representations
- Facilitate meaningful mathematical discourse
  - Pose purposeful questions
  - Elicit and use evidence of student thinking

Problem solving
Reasoning and proof

Connections
Representation

Communication
(NCTM, 2000)

Division of Fractions

Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

- 6.NS.1. Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem.

Ideas for Instruction

- Using the contexts and pictures to reason toward the answer.
- Using easy numbers in the context to be sure students see it as a division problem.
- Using the context and pictures to *explain* the algorithm.
- Distinguishing between “How many groups?” and “How many in one group?” division questions.

Exponential Functions

- F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
  - b. Use the properties of exponents to interpret expressions for exponential functions.