

**Benefits of
Teaching
through Prob-
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NCTM**

“A teacher’s goal must be to help students understand mathematics; yet understanding is not something that one can teach directly. No matter how kindly, clearly, patiently, or slowly teachers explain, they cannot make students understand. Understanding takes place in the students’ minds as they connect new information with previously developed ideas, and teaching through problem solving is a powerful way to promote this kind of thinking. Teachers can help and guide their students, but understanding occurs as a by product of solving problems and reflecting on the thinking that went into those problem solutions... By solving problems, students learn to make connections among mathematical ideas.” (p. 11)

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13 Rules That Expire

Karen Karp, Sarah Bush,
Barbara Dougherty
NCTM
Teaching Children Mathematics
August 2014

We teach kids these rules, but the rules only hold up so long. In this section, we point out rules that seem to hold true at the moment, given the context the student is learning. However, students later find that these rules are not always true; in fact, these rules “expire.” Such experiences can be frustrating and, in students’ minds, can further the notion that mathematics is a mysterious series of tricks and tips to memorize rather than big concepts that relate to one another. (p. 20)

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National
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A key finding in research on learning is that organizing information into a conceptual framework (landscape) allows for greater “transfer”. It allows students to apply what was learned in new situations and to learn related information more quickly. Students learn best when connections are made. (p. 17)

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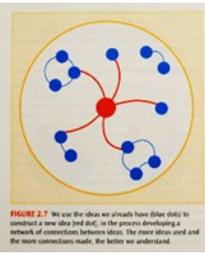
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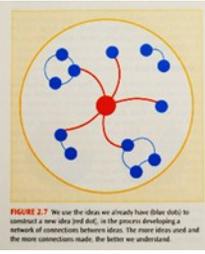
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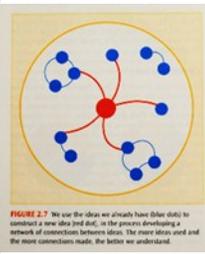
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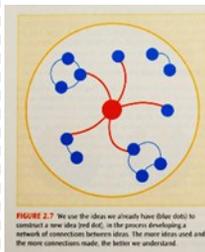
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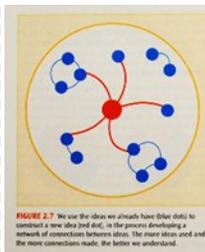
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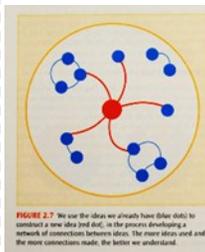
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**Making Sense:
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Hiebert, J. et al
1997

Mathematical systems are filled with relationships. Take the base-ten number system for an example. The simple looking numeral 328 is loaded with relationships that can be constructed by students- relationships between the values of the digits, between the units represented by the different positions, and so on.

Tasks that invite students to explore relationships of this kind, while they are solving problems, are likely to leave behind insights into the structure of this mathematical system and connections within the system.

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How We Think

Dewey, John.
1933

Understanding is the result of facts acquiring meaning for the learner: "To grasp the meaning of a thing, an event, or a situation is to see it in its relations to other things: to see how it operates or functions, what consequences follow from it, what causes it, what uses it can be put to. In contrast, what we have called the brut thing, the thing without meaning to us, is something whose relations are not grasped."
"The relation of means-consequence is the center and heart of all understanding." (p. 137, 146).

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**Procedural
Fluency in
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A Position of the
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July 2014

To develop procedural fluency, students need experience in **integrating concepts** and procedures and **building on familiar procedures** as they create their own informal strategies and procedures. Students need opportunities to justify both informal strategies and commonly used procedures mathematically, to support and justify their choices of appropriate procedures, and to strengthen their understanding and skill through distributed practice.

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Smith, Apple-
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(forward by
Grant Wiggins)
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If students don't need scaffolding and support, then they aren't learning anything new; they are doing what they already know how to do, stuck in their zone of actual development. Learning new concepts requires accessing or building understandings (big ideas/ strategies /models), and then applying them to the new challenge.

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