Teaching for Deep Understanding in Math

This document offers ideas for teaching for deep understanding in math.

Supporting Kindergarten

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Teaching for Deep Understanding

For deep understanding, it is vital that children learn by constructing knowledge, with very few ideas being relayed directly by the teacher. As an example, the addition sign (+) is something which the teacher must introduce and ensure that children know. It is the symbol used to show the combination or addition of two quantities. The process of adding, however, and the development of addition and subtraction facts should be discovered through the children's investigation of patterns, relationships, abstractions, and generalizations.

It is important for teachers to analyze the outcomes to identify what children need to know, understand, and be able to do. Teachers also need to consider opportunities they can provide for children to explain, apply, and transfer understanding to new situations. This reflection supports professional decision making and planning effective strategies to promote children's deeper understanding of mathematical ideas.

It is important that a mathematics learning environment include effective interplay of:

- reflection and metacognition
- exploration of patterns and relationships
- sharing of ideas and problems
- consideration of different perspectives
- decision making
- generalization and abstraction
- verifying and proving
- modeling and representing
- making connections.

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Mathematics is learned when children are engaged in strategic play with mathematical concepts and differing perspectives. When children learn mathematics by being told what to do, how to do it, and when to do it, they cannot make the strong connections necessary for learning to be meaningful, easily accessible, and transferable. The learning environment must be respectful of individuals and groups, fostering discussion and self-reflection, the asking of questions, the seeking of multiple answers, and the construction of meaning.

Discovering versus Covering

Teaching mathematics for deep understanding involves two processes: teachers covering content and children discovering content. Knowing what needs to be covered and what can be discovered is crucial in planning for mathematical instruction and learning. The content that needs to be covered (what the teacher needs to explicitly tell the children) is the social conventions or customs of mathematics. This content includes things such as what the symbol for an operation looks like, mathematical terminology, and conventions regarding recording of symbols.

The content that can and should be discovered by children is the content that can be constructed by children based on their prior mathematical knowledge. This content includes things such as strategies and procedures, rules, and problem solving. Any learning in mathematics that is a result of the logical structure of mathematics can and should be constructed by children.

For example, in Kindergarten, the children encounter direct comparison for the first time in outcome SSK.1:

Use direct comparison to compare two objects based on a single attribute, such as:

- length, including height
- mass
- volume
- capacity.

[C, CN, PS, R, V]

In this outcome, the terms "attribute", "length", "height", "mass", "volume", "capacity", and "compare" are all social conventions of the mathematics the children are learning and, as such, both are something that the teacher must tell the child. A hands on comparison of 3-D objects from different contexts is the mathematics that children need to construct for themselves. This type of learning requires children to work concretely, physically, and orally. It also requires that children share their ideas with their classmates and reflect upon how the ideas and understandings of

others relate to, inform, and clarify what children individually understand. In this type of learning, the teacher does not tell the children how to do the mathematics but, rather, invites the children to explore and develop an understanding of the logical structures inherent in the mathematics of measurement (comparison). Thus, the teacher's role is to create inviting and rich inquiring tasks and to use questioning to effectively probe and further children's learning.