

Mathematics learning as a socially-referenced activity

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Mathematics learning is a socially-referenced activity in several related ways. It involves students learning a particular set of culturally determined ideas. Two issues need to be examined in explaining mathematics learning; how the learner goes about learning, what the learner does and how the context in which the learner learns impacts on the learning.

Learning is an individual, personal activity in the sense that learning involves the learner changing what is already known about particular phenomena. At this level, both the activity in which the learner engages to learn and the mathematics knowledge learned by any student is personal and idiosyncratic.

At another level, the learning process is beyond the learner in the sense that environmental influences may initiate the change process and also, to some extent, guide it. Mathematics learning is a socially-referenced activity in several related ways. It involves students learning a particular set of culturally determined ideas. It also involves the student's learning being influenced by the social group in which the student learns mathematics.

The notion of mathematical ideas being learnt through social processes, referred to as the negotiation of meaning, (for example, see Voigt, 1994) is important in contemporary theories of mathematics learning. Formal teaching, discussion with peers, can lead a learner to see the need to change what is known. As well, the environment responds evaluatively to what the learner displays as a result of having learnt. The environment can also suggest ways of thinking about the ideas being learnt. The teacher, may, for example, suggest that the student visualize the ideas being learnt. Obviously, the ways in which a learner actually applies these ways of thinking and the outcomes are determined by the learner.

How do these negotiation processes impact on learners' knowledge? Cognitive perspectives would argue that they facilitate the gradual match of individual learner's meaning and understanding with cultural, corporate or group meaning. Sociological perspectives argue that mathematical meaning is a product of social interactions and emerge in social interactions between learners rather than being constructed within learners. They facilitate the gradual match of individual learner's meaning and understanding with cultural, corporate or group meaning.

Any theory of mathematics learning needs to explain how individuals change their understanding of an idea. With learning, they make sense of the idea in ways that are different from the sense they made prior to the learning. Voigt uses the term 'mathematization' to refer to the means by which learners transform their empirical experiences into mathematical statements and vice versa.

Learners interpret any idea being learnt in terms of their existing knowledge. Individuals differ in how they make sense of ideas. The individual's personalized knowledge of a mathematics idea needs to be matched against the 'depersonalized' interpretation so that the two can be integrated and the individual's understanding comprises both abstract and experiential aspects.

In the negotiating process, each negotiator attempts to make guesses about what other negotiators are intending to say. The negotiators do this with various degrees of accuracy. In these negotiation sessions, the mathematical meanings that emerge are those that are taken for granted by the negotiators (taken-to-be shared, or 'in the consensual domain' ideas). The negotiators maintain a network of ideas of mathematics ideas that are believed to be shared; this constitutes a 'mathematics

theme' for the interaction. The theme is dynamic such that it changes as the negotiation proceeds. Obviously, the extent to which the negotiation is directed in previously decided directions can differ; a teacher can play a major role in this direction.

Each negotiator has expectations of how they and other negotiators will operate. A negotiator might expect that another negotiator will not know as much mathematics, that a third negotiator usually knows more and that the teacher (another negotiator) will manage the negotiation.

Learning occurs when negotiators argue about an idea; one negotiator's point of view is challenged by others. Learning is an interaction between the learner and the social group with the learner doing the learning within a network of social-cultural interactions that direct the learning activity.

Various issues complicate the negotiation of meaning in mathematics. One relates to the notion that a negotiator can belong to different social-cultural groups at different times and need to negotiate different meanings for the same socially-transacted items (words, symbols, concepts). The well-documented existence of two different kinds of mathematics knowledge; formal school mathematics and informal non-school everyday mathematics (Carraher, Carraher, & Schliemann, 1985; Ginsburg, 1977; Reed & Lave, 1981) support this notion. The use by students of ideosyncratic arithmetic procedures, both mentally and in writing, after they had learnt the culturally acceptable and recommended procedures (Hart, 1981) support the development of informal knowledge.

References

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