

SOFTWARE DESIGN AS A METHOD OF ACCESSING STUDENTS' UNDERSTANDING

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In this paper we describe a methodology for studying the role of metaphor in the growth of proportional reasoning. Metaphor as a tool of thinking is hard to access since most often it is private and unformulated. In our case study, students design a computer game about proportionality, embodying their mathematical metaphors in the games.

Metaphor is defined here as the recursive movement between a source and a target that are structurally similar, both changing in the dynamic process of learning. Following researchers such as Lakoff and Nunes (2000), and Presmeg (1997), we construe mathematical thinking as fundamentally metaphoric. Thus the study of metaphor and other analogical reasoning can be fruitful for understanding student thinking, especially proportional reasoning.

Direct connections between proportional reasoning and analogical reasoning are noted in many models. Piaget and Campbell (2001) write: “analogies... are a sort of qualitative proportions. They are relations among relations” (p.139). Analogical reasoning, according to Vosniadou and Ortony (1989), means a move from one-place predicates that work on object attributes to deep two-place predicates that involve object relations.

Metaphors are often unformulated; they can be “very private, personal, and ripe with meaning for an individual” (Presmeg, 1997 p.277). Thus, they can be studied by indirect methods open to students’ influence on the context of activities. To access the growth of student understanding and their metaphors, we use a proportionality-themed computer software design task. Students take on roles of designers and the interviewer takes on the role of programmer, allowing for questions intrinsically related to the task. Student metaphors become expressed and embedded in the software and thus accessible. The process of software design parallels the process of the growth of student understanding, allowing for analysis of interactions between the development of metaphors and the development of reasoning.

References

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