

EXAMINING HOW STUDENTS' LACK OF PROCEDURAL SKILLS IMPACTS THE DEVELOPMENT OF THEIR CONCEPTUAL UNDERSTANDING

Ahyoung Kim, Linda Hernandez, Kateryna Ellis, Younsu Kim, and Robert Atkinson
Arizona State University
jimbo@imap1.asu.edu

As a part of a longitudinal study involving rational number understanding of middle school students, we became interested in the question of how students' lack of procedural skills impacted the subsequent development of their conceptual knowledge in certain instances. Specifically, we explored how their lack of long division skill with decimal or fractional remainders affected the concepts in the tasks they were given. In videotaped individual interviews, the students were given word problems to solve and we looked for cases where students' exhibited a lack of procedural skills while problem solving and then identified the concept that was impacted by this procedural deficiency.

Based on our interview data, we identified two situations or categories where the students' lack of procedural skills hindered subsequent conceptual understanding. In Category 1, the lack of procedural knowledge interrupts conceptual understanding, where the students' choice of the wrong procedure or a set of procedures prevents them from progressing from Concept A to Concept B. In Category 2, students selected the correct procedure, but did not execute it properly. Basically, students lack some of the procedural skills involved in the progression from Concept A to Concept B, leading to an impoverished understanding of Concept B.

Category 1 is illustrated by a student converting a fraction (Concept A) to a percent (Concept B). She knows that to change $\frac{9}{24}$ (a fraction which is hard to express as a percent using part whole relationship or memorization) to a percent, she should use division, but she divides $100 \div 9$, which is the incorrect procedure. Thus, she is lacking both the concept and procedure for fraction as division, which prevents her from changing this type of fraction to a percent.

Category 2 is illustrated with the following situation involving ratio questions. The student could only describe and understand ratio with whole numbers (Concept A). The student's impoverished conceptual knowledge of ratio was affected by her inability to divide beyond the decimal point and to divide multi-digit numbers (Concept B in two related parts), even though she knew the necessity of using division to get the ratio. She could divide $23 \div 4$ to get 5 R3 but could not divide 1300 divided by 500, so she could not find the ratio when it included a decimal fraction.

Across both categories, the students' lack of procedural knowledge is affecting the further development of the concept in the question. We argue that this is evidence that conceptual and procedural knowledge are interrelated and should be taught in concert.

References

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