EXAMINING JUSTIFICATION OF THIRD-GRADE CHILDREN WHEN THEY ENGAGED IN EQUAL-SHARING PROBLEMS

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Justification is a crucial practice that involves conjecturing and justifying mathematical claims. Researchers have shown that elementary children are able to provide sophisticated arguments for their conjectures during generalizing activities (e.g., Ball, 1993; Reid, 2002). To understand the justification of children in the context of fractions tasks, this study examined four third graders' discourse when they justified their claims in solving equal-sharing problems.

Four third-grade children in the Midwestern United States participated in this study. Through prior interviews, they showed only limited understanding of fraction concepts, particularly part-whole relationships, as is typical for this age. Provided with a tablet, pencils, and paper, the participants worked in pairs to solve equal-sharing story problems (e.g., Mary, Sam, and you are sharing eight pizzas; how do you share the pizzas so that each of you gets the same amount?). During the videotaped sessions of each pair, I facilitated the participants' interactions and observed how they used their intuitive knowledge for justification. Here presents an example that illustrates the arguments of two children when they engaged with the aforementioned task:

Amy: …3 wholes, 3 wholes, 3 wholes [repeats her answer with confidence]. **[claim]**
Betty: 1, 2, …2 wholes…and 2 halves [counts the wholes and slices of pizzas]. **[claim]**
Amy: Therefore the 2 halves equals 1 whole.
Betty: But the 2 halves do not make 1 whole. One half is here, and it takes two more (halves) to make 1 whole [explains while pointing to Amy's drawing]
Amy: [Writes down numerical values inside the wholes and parts of the pizza figure]. The 2 slices should be counted as 1 whole. Here one slice is 5, and there one slice is 5 [points to graphics]. 5 added by 5 is 10, so together is 10. Since each person has 2 wholes already, then (the total is) 10, 10, and 10. Therefore, it's 3 (wholes) (for each person).
Betty: Mine is kind of different. I would put 15 and 15 [writes down 15 for each circle that represents a whole pizza]. Everyone wants 3 slices to make 15, but the two slices are not sufficient (to make a whole). Since each person would take 2 slices. Those make a 10.…Each person gets 15, 15, and 10.

These results demonstrate informal strategies the children employed for justification. Particularly, whole number magnitudes were used to reason and describe part-whole relationships. Further analysis of Betty's discourse found that she seemingly followed a reasoning pattern similar to a proving technique, namely proof by contradiction. This technique first assumes the opposite of a claim and then uses the established facts to invalidate the claim.

This study reveals that some third-grade children created distinct strategies to justify or refute their claims for fractions problems. The finding of Betty's reasoning approach resonates the findings of Reid (2002) that specified logical patterns the fifth graders implicitly used for generating and testing conjectures. Since many U.S. elementary textbooks were found lacking written justification tasks (Bieda, Ji, Drwencke, & Picard, 2014), it is imperative for elementary teachers to consider enacting such practice in typical problem-solving fractions tasks.

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