Analysis of Unitizing and Norming Abilities in the Process of Reasoning Up and Down in Fraction Learning in Year 6

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The importance of learning fractions has been emphasized because of its potential to enhance mathematical understanding (Lamon, 2020). However, many studies report that children struggle to develop fraction concepts (e.g., Shimomura et al., 2022; Singh et al., 2018). In response, Lamon (2020) highlights the importance of "reasoning up and down," a process that supports useful and flexible thinking strategies from the earliest stages of fraction learning. She explains: "When units are defined implicitly, we have an excellent opportunity to use a process that I refer to as reasoning up and down, because it often entails reasoning up from some fraction to the unit, then back down from the unit to another fraction" (Lamon, 2020, p. 107). This explanation suggests that children solve problems by comparing the magnitude of a fraction with the unit value of 1. Since fractions are numbers derived from dividing 1, comparing the magnitudes of 1 and fractions are essential for understanding fractional relationships. Furthermore, in the process of reasoning up and down, "unitizing"—treating an object as a fixed unit—and "norming"—restructuring quantitative relationships based on that unit—come into play (cf. Masutani, 2025). Examining these abilities may therefore provide important insights for fraction instruction. However, to the best of our knowledge, no studies have examined the characteristics or developmental stages of unitizing and norming abilities in this process. Therefore, this study aims to identify the developmental stages of unitizing and norming observed in reasoning up and down. We conducted a study with 21 students in a Year 6 Japanese elementary school and analyzed their problem-solving processes using workbook entries and classroom utterances within Lamon's framework of unitizing, norming, and partitioning. This presentation reports the developmental stages of unitizing and norming abilities demonstrated in children's reasoning up and down and discusses their implications for fraction instruction.

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