

## Investigating High School Students Understanding of Decomposition Techniques in Mathematics

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In completing arithmetic and algebraic problems during mathematics lessons, students are required to proficiently manipulate numbers and expression. Decomposition of numbers and algebraic terms is an important skill as part of this manipulation. This study shows that while High school students can complete mathematics problems in arithmetic and algebra, there is little conceptual understanding of the mathematical laws and properties that involve decomposition, which hinders deeper thinking about mathematics.

The need for students to decompose numbers and algebra is a skill that is seen in many areas of mathematical computation.

In a literature review for this investigation, three themes became evident; students number sense is impacted by the lack of understanding of the associative, distributive and commutative laws, the teacher has a large influence on student choice of strategies when solving mathematical problems and there are implications for student arithmetic thinking on algebraic thinking. This review revealed that there had been some research in this area in primary schools but there has been minimal research in high school settings.

As part of this study students from two high schools ( $n=37$ ) completed a written computational task named Computational and Algebraic Fluency Task (CAFT). Some students were also selected to participate in follow-up interviews. The written task was based on the Mental Computational Fluency Measure – Addition and Multiplication as developed by Downton, Russo and Hopkins (2019, 2020).

The results from the data indicate that the themes from the literature review were evident in work from high school students. Many students could recognise the mathematics in the CAFT but could not explain their reasoning. This demonstrates that many students even in high school are using rules without reasons in mathematics. The impact of the teacher on the student understanding of these decomposition techniques was evident in some of the responses, but also evident in that no student in the CAFT or the interviews specifically used the terms associative, distributive, or commutative. The impact of arithmetic concepts on algebraic items in the CAFT also demonstrated that students were not generalising arithmetic concepts with algebraic applications.

This study shows that while students struggle with formalising many arithmetic and algebraic concepts, there is the indication the teacher can influence student deep understanding and high school teachers, like primary colleagues, may need more training/inservicing in relation to explicitly teaching strategies related to arithmetic.

### References

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