**Impact Sheet**

Giberti, C., & Maffia, A. (2022). Primitive model of partitive division: A replication of the Fischbein and colleagues’ study. *Implementation and Replication Studies in Mathematics Education*, *2*(2), **XX–XX**. DOI: 10.1163/26670127-bja10007

**1 Problem Addressed**

Mathematics students can develop a number sense from the knowledge of the relative effect of operations on numbers. When students are exposed to only a few models of arithmetic operations, they may produce incorrect generalizations. For instance, when students are familiar only with the model of multiplication as repeated addition or division as a repeated subtraction, they may conclude that multiplication always makes things bigger, and division always makes things smaller—which is not always true. Some of these early mental models may take root in students’ minds and continue to exert their influence unconsciously well into later stages of students’ mathematical instruction.

Fischbein et al. (1985) refer to these models embedded in students’ minds as *primitive models*, asserting that repeated addition is the primitive model for multiplication, while there are two primitive models for division: the partitive and the quotative. Fischbein and colleagues used these primitive models to predict the effect of changing numbers in simple word problems. For instance, in the case of partitive division, they find that for many students the dividend should be greater than the divisor; the divisor must be a whole number; and the quotient must be smaller than the dividend.

Although several authors have sought to confirm or refute the model proposed by Fischbein et al. (e.g., Bell et al., 1989; Graeber & Tirosh, 1990), until now, a replication of this seminal study had not been developed.

**2 What is Replicated?**

The paper by Giberti and Maffia (2022) reports a replication of the research by Fischbein et al. (1985).

Fischbein et al. (1985) conjectured that when division is modelled as partitive, students would look for two specific conditions: the divisor must be smaller than the dividend and the divisor must be an integer. In addition, they designed word-problems to verify whether, and to what extent, the level of difficulty rises when one condition or both are violated. They found a significant difference in performance when the divisor is greater than the dividend Furthermore, results dropped when the divisor is a decimal number, while there were no significant effects when the dividend is decimal. They also reported that the presence of a decimal dividend mitigates the effect of a divisor that is smaller than the dividend. The replication study by Giberti and Maffia (2022) focus on the effect of the presence of a dividend that is smaller than the divisor for the primitive model of partitive division.

**3 How Was the Replication Conducted?**

Giberti and Maffia (2022) conducted a conceptual replication study. Although the original study by Fischbein et al. (1985) considered the role of primitive models for multiplication and division on students in grades 5, 7, and 9; this replication study focuses only on grade 7 students and on the primitive model of partitive division.

In this replication study, a computer-based version of the instrument used in the original research was used, but with minor additions like four new items and small variations to the wording in a few of the problems. In addition, statistical methods were applied to test the instrument and analyse the statistical relevance of differences in difficulty between the items.

**4 Implications and Significance**

In general terms, the results of this replication study confirm the findings of Fischbein et al. (1985) regarding the effects of the primitive model of partitive division, thus confirming the reliability of the results of the original study.

This study is a good example of how classical and influential research developed several years ago can be replicated by applying updated and robust methodological instruments. In this case, the application of a computer-based version of the research instrument originally used by Fischbein and colleagues’ (1985) allowed the authors of the replication study to reach schools from different geographical regions and involve a large number of students from different backgrounds, as well as completely randomizing the order of questions in the tests.

**References**

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