

Developing a Model to Support Students in Solving Subtraction

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Abstract

Subtraction has two meanings and each meaning leads to the different strategies. The meaning of “taking away something” suggests a direct subtraction, while the meaning of “determining the difference between two numbers” is more likely to be modeled as indirect addition. Many prior researches found that the second meaning and second strategy rarely appeared in the mathematical textbooks and teacher explanations, including in Indonesia. Therefore, this study was conducted to contribute to the development of a local instruction theory for subtraction by designing instructional activities that can facilitate first grade of primary school students to develop a model in solving two digit numbers subtraction. Consequently, design research was chosen as an appropriate approach for achieving the research aim and Realistic Mathematics Education (RME) was used as a guide to design the lesson. This study involved 6 students in the pilot experiment, 31 students in the teaching experiment, and a first grade teacher of SDN 179 Palembang. The result of this study shows that the beads string could bridge students from the contextual problems (taking ginger candies and making grains bracelets) to the use of the empty number line. It also shows that the empty number line could promote students to use different strategies (direct subtraction, indirect addition, and indirect subtraction) in solving subtraction problems. Based on these findings, it is recommended to apply RME in the teaching learning process to make it more meaningful for students.

Keywords: Subtraction, Design Research, Realistic Mathematics Education, The Beads String, The Empty Number Line

Abstrak

Pengurangan memiliki dua arti dan masing-masing arti mengarahkan ke strategi yang berbeda. Arti pengurangan sebagai “mengambil sesuatu” mendukung pengurangan langsung, sedangkan arti pengurangan sebagai “menentukan perbedaan dari dua bilangan” lebih mudah dimodelkan sebagai penjumlahan tidak langsung. Banyak penelitian sebelumnya menemukan bahwa arti pengurangan yang kedua dan strategi yang kedua jarang muncul di dalam buku matematika dan penjelasan guru, termasuk di Indonesia. Oleh karena itu, penelitian ini dilaksanakan dalam rangka memberikan kontribusi bagi pengembangan local instruction theory untuk pengurangan dengan mendesain aktivitas pembelajaran yang dapat memfasilitasi siswa kelas 1 sekolah dasar untuk mengembangkan model dalam menyelesaikan pengurangan bilangan dua angka. Konsekuensinya, design research dipilih sebagai pendekatan yang sesuai untuk mencapai tujuan penelitian dan Realistic

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Mathematics Education (RME) digunakan sebagai panduan untuk mendesain pembelajaran. Penelitian ini melibatkan 6 siswa dalam pilot experiment, 31 siswa dalam teaching experiment, dan seorang guru kelas satu SDN 179 Palembang. Hasil dari penelitian ini menunjukkan bahwa manik-manik dapat menjembatani siswa dari masalah kontekstual (mengambil permen jahe dan membuat gelang biji-bijian) ke penggunaan garis bilangan kosong. Ini juga menunjukkan bahwa garis bilangan kosong dapat mendorong siswa untuk menggunakan strategi yang berbeda (pengurangan langsung, penjumlahan tidak langsung, dan pengurangan tidak langsung) dalam menyelesaikan masalah pengurangan. Berdasarkan penemuan ini, direkomendasikan untuk mengaplikasikan RME dalam proses belajar mengajar agar membuat pembelajaran semakin bermakna bagi siswa.

Kata kunci: Pengurangan, Design Research, Realistic Mathematics Education, Manik - Manik, Garis Bilangan Kosong

Introduction

In solving subtraction problems, students have to think about the meaning of subtraction and the more efficient strategies to solve it. According to Fosnot and Dolk (2001), subtraction has two meanings; those are “taking away something” and “determining the difference between two numbers”. Each meaning leads to the different strategies. The context of “taking away something” suggests a direct subtraction. On the other hand, the context of “determining the difference between two numbers” is more likely to be modeled as indirect addition (Torbeyns, De Smedt, Stassens, Ghesquiere, & Verschaffel, 2009).

However, the indirect addition strategy, particularly with multi digit numbers, has received a little attention from researchers. The limited research interest for this complement strategy of direct subtraction is quite surprising because there are indications that indirect addition is not only computationally remarkably efficient but also very promising from a broader educational perspective (Torbeyns *et al.*, 2009).

Moreover, in the Indonesian mathematical text books (see Djaelani & Haryono, 2008), the meaning of subtraction is explained only as “taking away something”. Teachers provide only removal contexts in teaching subtraction. In a traditional teaching learning method, teachers also teach students an algorithm of subtraction directly, subtracting tens and ones separately, after they learn subtraction up to 20 by doing physical activities or using drawing. It is meaningless for students because they do this procedure without understanding (Kamii & Lewis, 1993).