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The contribution of the Chinese abacus to the development of the number sense

Abstract

The purpose of the workshop is to familiarize participants with an ancient calculating instrument, the Chinese abacus, and to discuss its potential to contribute positively, still to this day, to the teaching and learning process of the decimal number system. The Chinese abacus can support a multitude of concepts. We focus on the notion of the place value, on the notion of the carrying number in addition and on the notion of the borrowing in subtraction. Participants use worksheets and a copy of the abacus. An electronic abacus is also available. They work in pairs. Each activity is followed by plenary discussion. In general, the following pattern is repeated: action-opinion formulation-validation-formalization. The activities that are proposed here to both pre- and in-service elementary school teachers have been applied to 3rd grade students aged 9 years.

Initially, participants will try to find out how the abacus works. Several images depicting its historical evolution and a copy of it will help them. After a collective discussion, the organizers will explain the mode of operation of the Chinese abacus in its electronic version and describe the operating rules. Then a worksheet will be distributed asking participants to form the numbers 5 and 10 in the abacus in all possible ways and to select the right one. Afterwards, in the same worksheet, they will read numbers that are formed in sketched abaci and form given numbers in sketched abaci. Any query or difficulty will be resolved collectively by a demonstration from a participant or the organizers on the electronic abacus. Great emphasis is given to zero as a place holder.

After understanding the way of creating numbers in the abacus, participants will deal with addition and subtraction algorithms. In a worksheet, some incorrect vertical additions will be given. Participants will be asked to identify the mistakes, to explain the students' way of thinking, and to answer questions such as: When do students typically make mistakes in the addition algorithm? What is a carrying digit? Their ideas will be announced in plenary. Then, they will be asked to perform additions with and without carrying digits in their abaci. This is followed by a group discussion about how to perform an addition on the abacus and a demonstration on the electronic abacus.

The same procedure will be followed for the subtraction algorithm. Participants will be invited to highlight ways to perform the subtraction algorithm when borrowing is required. In the plenary discussion, two ways will be mentioned (adding equal amounts, regrouping the minuend). Participants compare their ways in group and the organizers will present extensively the one which is supported by the Chinese abacus. In a worksheet, they will perform subtractions that require more than one borrowing digit.

In conclusion, participants will be invited to discuss: the advantages and/or the disadvantages of using the Chinese abacus in teaching addition and subtraction algorithm, whether they would incorporate the Chinese abacus into their teaching and why, and at which school grade. At the end of the workshop the organizers will give several examples of instrumental genesis and semiotic mediation that took place during their students' engagement with the Chinese abacus.

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