

TO MEASURE WITH A BROKEN RULER TO UNDERSTAND THE COMMON TECHNIQUE OF THE SUBTRACTION

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The research that I am conducting as a PhD candidate focuses on the teaching and learning of calculus subtractive at primary. Based on the fact that in France, many teachers prefer teach the equal additions algorithm, when they may teach the method by decomposition as in the USA, I am looking for a progression that would allow students to better understand this difficult technique. With the poster that I am presenting, I am showing the interest to teach the notion of difference/distance and after the property of the keeping of differences. I suggest a sequence of learning, using as artefact a broken ruler and I have studied its potential. I am using as theoretical part of the anthropological theory of the didactic and of the semiotic mediation.

KEYWORDS

Subtraction, the equal additions algorithm, technology, semiotic mediation

SCIENTIFIC CONTEXT AND MOTIVATION

MAUREL M. & SACKUR C. (2010) initially observed that the put-down subtractions with numbers of carry over are not mastered by pupils of the fourth year (CE2) or of the fifth year (CM1). At the first level (technical), the carried out calculations are wrong because the algorithm learned during the class is badly applied. During the second level (technological), the calculation is right, but the pupils don't know what mathematical meaning they have to give to the numbers to carry over. Should we then conclude that students do not know the differences conservation property? The study of different manuals would lead us to believe, that one day, they have been in a situation where the property of conservation of the differences has been used but that this theoretical element is not reused in several contexts and linked up to others knowledge's. Convinced of this lack, I think about a mathematical organisation, where the kind of proposed task will be linked up to another by a technological speech, or by the successive development of techniques.

AIMS

To have the notion of difference between two numbers, of distance between two dots, the ruler is broken in order to not permit a direct reading of the measure. On the poster, the situation of learning will be described in its entirety. I will expose the conditions of the testing led in 2010. Finally, I will be explained the different techniques of measurement, adopted by the pupils, and exchanges between students in a group. I will show what are the techniques which have been validated or invalidated and how each pupil have could think on their own experience with the

artefact and to compare some different utilisations of the same broken ruler. The last phase of the session, « the discussion of class » to resume the term of Mariotti and Maracci (2010) is also interesting for the mathematical signs. To conclude, I will present an extension of the session which will allow introducing the property of preservation of difference by translation on the line. The idea is to translate a strip on graduated axis and to determine its measurement from several places of the ruler. It remains to use the obtained results to prove experimentally that “the subtraction doesn’t change if we add the same number to each term.” When we want to calculate the subtraction of 275 and 38, set down in column, in fact, we calculate the subtraction of 285 and 48 because the difference doesn’t change if we add ten to 275 and ten to 38.

METHODS AND RESULTS

The method is based on the confrontation between *a priori* analysis and *a posteriori* analysis. It allows establishing that the situation « to measure with a broken ruler » has a potential, under some conditions that I going to enumerate. Pupils after learning a subtraction calculation technique can take ownership, a mathematical property, which allows to justify this technique, and which also can be used in mental calculation.

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