Development of Naïve Algebraic Ideas during Solving Problems and Explaining the Solution Processes

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Our concern is to rethink mathematical learning from a holistic perspective, especially Japanese 7th grade's unit "letters and algebraic expressions" in which the teaching is likely to be atomistic, since most students don't feel the need to learn algebraic methods.

Bednarz & Janvier (1996) discussed students' approaches in solving the algebraic type of problems in their research of the transition from arithmetic to algebra, and suggested some gaps between their approaches and the algebraic method. We think their problems are good situations as a starting point for learning algebra in that they offer a picture of linear equation to students, and for our study it is important to understand how they overcome the gaps and develop their naïve ideas towards algebra.

The aim of this paper is to analyze several case studies and to suggest how students who haven't learned the contents of letters and algebraic expressions can construct and develop some algebraic ideas through solving problems and explaining the solutions. The following are suggestions resulting from the analysis.

1. The interplay between using trial-and-error methods and setting up expressions could help them to understand local relationships and to create algebraic ideas.
2. The naïve idea of uniting several terms emerged in two situations. One was the situation of simplifying the numerical calculation and the other was that of understanding the structure of the parts in the expression that they set up.
3. It was effective for the emergence of the naïve idea of distributive law that they conceived the problem situation and the numerical computations structurally. The idea became explicit when the explanation was shifted from numerical calculation to algebraic expression using letters and when they found the number of uses of the letter in the expression.
4. Students could create a feeling of necessity and appreciation of using letters through solving problems in the context of linear equation before they learned algebraic expressions.

References

Bednarz, N. & Janvier, B. (1996). Emergence and development of algebra as a problem-solving tool: Continuities and discontinuities with arithmetic. N. Bednarz *et al.* (eds.). *Approaches to Algebra* (pp.115-136). Kluwer Academic Publishers.