

EXPLORING STUDENTS' REASONING WITH ALGEBRAIC EXPRESSIONS

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Researchers (e.g. Bell, 1995) have emphasized the role of activities which give meaning and context to understand symbols in algebra and their manipulation/ transformation. Research has also pointed out various means of contextualizing algebra, by generalizing and formalizing patterns and relationships within the domain of mathematics or using practical situations outside the domain of mathematics and requiring which require modeling, representing and problem solving. In a design experiment we have carried out, our effort has been to introduce to students ($n=31$) studying in grade 6 both the aspects of algebra: syntactic and semantic. In this study we first developed among students understanding of syntactic aspects of expressions in the context of reasoning *about* expressions. This was followed by applying this understanding in contexts which required the use of algebra as a tool for purposes of generalizing, predicting and proving/ justifying which can be termed as reasoning *with* expressions.

Although many tasks were used in the study from time to time to situate the use of algebra, here we would discuss their performance and understanding in two of the tasks: pattern generalizing and think-of-a-number game. Both the tasks required the students to use their syntactic knowledge of transforming expressions as well as appreciate the meaning and purpose of algebra. Students' responses were analyzed for their understanding of the letter, ability to represent the situation using the letter and their appreciation of the manipulation of expressions to arrive at conclusions regarding the situation. It was hard to test this knowledge through a written test. The students showed appreciable understanding of the above criteria in the classroom discussions and during the interview with a subset of the students. Also these tasks proved to be rich ground to discuss issues of representation and syntax which reinforced the ideas encountered in the first part of the study. The students showed understanding of the letter as standing for a number, that situations can be represented using a letter and that expressions could be simplified to draw conclusions about the situations. But their knowledge of syntactic transformations on expressions was not immediately helpful as these tasks required knowledge other than manipulation. It required students to understand ideas about proving and justifying for a general case, make correct representations using conventional symbols and appreciation of the need for manipulation.

References

Bell, A. (1995) Purpose in school algebra. *Journal of mathematical behavior*, 14, pp. 41-73.