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How meaning develops for algebraic symbols: Possibilities and pitfalls

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The purpose of this research is to learn more about how children develop meaning for formal algebraic symbols through instruction. Specifically, documented videos of eight fifth grade students over a period of 18 weeks were explored and analyzed. In each session, students were provided a task that required them to generalize a situation. This research study shows that students usually begin by forming oral or written representations for the context of the problem. They use informal language and may only provide oral explanations with little meaning developed to the context of the problem. Then, as the weeks progress, they move towards the use of syncopated expression - an algebraic representation in which the child uses both words and symbols to formulate their expression - connecting these expressions to their verbal representations. Lastly, with assistance, students move toward the use of formal symbolic representations - for example $4n + 2n$ - though they face many challenges as they attempt to develop meaning for these symbols. As the sessions progress, the students see the power of a symbol as opposed to the written words they were using in earlier sessions. For example, a child may have written "posters plus four" during one of the initial sessions, but during a later session he may likely write an expression such as "posters + 4", using a combination of words and symbols. Nonetheless, the students still intertwine their formal and informal representations as they advance throughout the sessions. Implications for teachers and possible explanations as to why students have difficulties formulating formal symbols are discussed.