

**Center for Research, Evaluation & Advancement of Teacher Education  
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**Title:** One Child's Learning with the Algebra Project's Curricular Process

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**Abstract**

The Algebra Project has attempted to reform mathematics education for over 25 years. Through community organizing, the administration of professional development institutes for teachers, and following cohorts of students who take 90 minutes of math per day over their four high school years, the Algebra Project has established a national reputation for effective pedagogy as evidenced by the support of the National Science Foundation. This proposal presents the results of the following research question: How does one child mathematize a physical experience to understand deeply addition and subtraction of integers using the Algebra Project's curricular process?

Current reform efforts to improve the quality of mathematics teacher education include a constructivist framework concerning assumptions about knowledge, learning, and teaching that promote students' deeper understandings of concepts and the relationships of concepts as opposed to memorization of isolated information (von Glasserfeld, 1987). Constructivist environments engage students in problem solving, modeling, and constructively building conceptual understanding in student-centered classrooms (Park et al, 2002). This kind of teaching requires an active, inquiry based process where students are at the

center of instruction with the teacher as a challenger and facilitator of student achievement (Bigelow, 1990).

However, the mathematics teaching practice continues to be viewed by teachers as knowledge transmission from teachers to students. To change this perception, the Algebra Project has developed a curricular process widely used in school sites across the nation. Through its four parts, the method seeks to develop in students the ability to recognize patterns, use iconic and symbolic representation, and identify relations within systems. The first part of the method consists of a shared student experience. The purpose of this part is to give relevance to a selected topic by ensuring that everyone can communicate about an experience because everyone has lived that experience. The second part is a multi-faceted reflection in which students reflect about the experience. The teacher ensures that students transition from “people talk,” ordinary expressions used by students, to “feature talk,” a technical language with the precision necessary to identify characteristics of elements of the topic under study. In the third part, students develop the ability to abstract while using general references rather than by communicating about the concrete features of the elements under study. Finally, the teacher guides the students through as many applications as necessary to evidence student understanding.

In the present study, one child in sixth grade met with the researcher one hour per week during three months to represent addition and subtraction of integers with icons and symbols. The mathematization process during the weekly meetings were based on a physical experience that included walking around a

lake and observing attributes of diverse objects around the lake. The researcher kept a weekly journal from which a description of the child's learning process emerged. The naturalistic paradigm was used as the methodology for this investigation (Moschkovich & Brenner, 2000; Glaser, B. G. & Strauss, A. L., 1967). This paradigm combines the linear structure of the traditional research design with a more circular qualitative research process.

The results are presented in the present study as the child's cognitive difficulties and insights while representing the operations of addition and subtraction, his transition from arithmetic to algebraic reasoning, and his attitudes towards the Algebra Project's curriculum process. The findings suggest that the child's conceptualizations of integer addition and subtraction were deeply connected to the physical experience, thereby minimizing memorization. Additionally, the findings suggest that the child's ample practice with iconic representations of the experience promote the formation of abstractions.

## References

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