Rethinking Fundamental Algebra in Terms of Learning Architecture

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Abstract

With the aim of extending the applicability of fundamental theoretical mathematical concepts to educational contexts, the present study examines and analyzes relevant algebraic content that supports learners' understanding of existing quantified relational premises and scientific learning content and algebraic concepts.

The purpose of this analytical study is to investigate how algebraic content—such as the contributions of Van der Waerden (1973), Freudenthal (1973), and Vergnaud (1983; 1994)—should be developed and applied within mathematics education, with a focus on Vygotsky's (1986; 1998) research-based learning framework. The study also examines theoretically grounded learning content, including multiplicative structures, Abelian semigroups, and inverse operations, which facilitate an optimal transition and interplay between fundamental algebra within a learning architecture and students' mastery of scientific algebraic concepts. To provide a foundation for this learning architecture, the study presents a theoretical conceptualization of how the learning process should engage, systematize, extend, and conceptually integrate students' understanding into a new algebraic context.