

Learning Theory and Linear Algebra

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The research team of The Linear Algebra Project developed and implemented a curriculum and a pedagogy for parallel courses in (a) linear algebra and (b) learning theory as applied to the study of mathematics with an emphasis on linear algebra. The purpose of the ongoing research, partially funded by the National Science Foundation, is to investigate how the parallel study of learning theories and advanced mathematics influences the development of thinking of individuals in both domains. The researchers found that the particular synergy afforded by the parallel study of math and learning theory promoted, in some students, a rich understanding of both domains and that had a mutually reinforcing effect. Furthermore, there is evidence that the deeper insights will contribute to more effective instruction by those who become high school math teachers and, consequently, better learning by their students. The courses developed were appropriate for mathematics majors, pre-service secondary mathematics teachers, and practicing mathematics teachers. The learning seminar focused most heavily on constructivist theories, although it also examined socio-cultural and historical perspectives (von Glaserfeld, 1989; Vygotsky, 1978, 1986). A particular theory, Action-Process-Object-Schema (APOS) (Asiala et al., 1996), was emphasized and examined through the lens of studying linear algebra. APOS has been used in a variety of studies focusing on student understanding of undergraduate mathematics. The linear algebra courses include the standard set of undergraduate topics. This paper reports the results of the learning theory seminar and its effects on students who were simultaneously enrolled in linear algebra and students who had previously completed linear algebra and outlines how prior research has influenced the future direction of the project.