# Enhancing Geometry Achievement through APOS-Based Instruction: Evidence from a Quasi-Experimental Study

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## Abstract

This study aims to examine the effect of APOS/ACE-based instruction on seventh-grade students' achievement in the topic of quadrilaterals. Grounded in APOS Theory (Action, Process, Object, Schema), the study conceptualizes learning as the construction and transformation of mental structures through structured instructional experiences. The study was designed as a quasi-experimental study using a single-group pretest-posttest model. The participants consisted of 20 seventh-grade students enrolled in a public middle school in Türkiye. The instructional intervention was implemented over a six-week period (42 class hours) and was structured according to the ACE teaching cycle (Activities, Classroom Discussions, Exercises). Data were collected using a Quadrilaterals Achievement Test. The data were analyzed using paired samples t-test. The results revealed a statistically significant increase in students' achievement scores from pretest (M=16.75, sd=4.94) to posttest (M=83.25, sd=13.40), $t(19)=-19.42$, $p<.001$. the effect size was found to be very large (Cohen's d= 1.34), indicating a substantial impact of the APOS/ACE-based instructional intervention on students' geometry achievement. The findings provide strong empirical evidence that APOS-based instructional design, supported by the ACE teaching cycle, is highly effective in enhancing students' conceptual understanding and performance in geometry.

**Keywords:** APOS theory, Mathematics Achievement, Quadrilaterals, Geometry Education, Quasi-Experimental Design