

# Characterizing Transition to Proof Courses: The Case of Liberal Arts Colleges

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*Many undergraduate students experience significant difficulty in learning to prove mathematical propositions nationwide. A previous study by David & Zazkis (2017) used document analysis of publicly available syllabi to create a national portrait of approaches to supporting students' transition to proof across a large sample of R1 and R2 universities. Liberal arts colleges (LACs) operate under different sets of institutional constraints and thus offer the possibility of different approaches to this issue. We report results of a preliminary survey study, the goal of which was to enhance previous work on approaches to the transition to proof by specifically focusing on the case of LACs. Analysis of the survey data show that LACs' approaches have distinctive features as compared to R1 and R2 universities. Notably, discrete mathematics courses served as a transition to proof course in almost half of the surveyed institutions.*

**Keywords:** Transition to proof, Liberal Arts Colleges, Instructional Approach

Learning to prove mathematical propositions is a cornerstone of the mathematical discipline (de Villiers, 1990), however, many undergraduate students struggle to learn to prove (Selden, 2012). Mathematics departments have recognized this problem and experimented with different curricular and instructional approaches to supporting students' entry into proof, including courses dedicated to this transition (Smith et al., 2017). A previous analysis by David & Zazkis (2017) showed that numerous departments have developed courses to introduce students to the nature of proof and effective arguments and that these courses have a surprising variability in their form and content. However, David and Zazkis's focus was on R1 and R2 research universities, and the field currently knows little about the range of approaches followed by other kinds of institutions. Our goal for this survey study was to enhance previous work on approaches to the transition to proof by specifically focusing on the case of LACs.

Fifty LACs were selected randomly based on the list of all *liberal arts colleges* by US news. We asked college mathematics faculty involved in the teaching of collegiate transitions to proof courses (or courses that use to facilitate the transition to proof) at those 50 LACs to complete a brief survey that we designed about the approach currently being taken at their colleges. Currently, 15 (30%) LACs have filled out the survey. For those 15 participating colleges, only 2 out of the 15 responded that they do not have any kind of the "transition to proof" courses.

Preliminary results indicate that LACs' approaches to supporting students' challenges through this transition are unique in many ways. The biggest difference is the non-coordinated nature of their "transition to proof" course as evidenced by the following range of approaches: out of the 15 responses, 20% write their own textbooks, 27% said the course varies according to instructor each semester, 20% embed the skills or practices students need in other courses such as number theory or linear algebra. Notably, discrete mathematics courses served as a transition to higher-level math courses in almost half of the surveyed institutions. Despite the differences, there are also similarities with the approaches used by R1 and R2 universities. In particular, while the results of the current study are preliminary, the results allow a broader picture of the range of possible ways to support this difficult transition for students and thus have implications both for LACs college faculty and R1/R2 institutions.

### Reference

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