

# A Multi-Requisite Mathematics-Intensive Summer Program for Pre-service Elementary Teachers

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## Project Description

The Math STEP program is designed as a math-intensive multi-requisite mathematics-intensive summer program for pre-service elementary teachers. The program includes embedded peer mentoring, affective-domain interventions, alternative assessments, and research-based pedagogical practices.

Program participants will enroll in a 10-credit-hour set of multi-requisite mathematics courses that will be held over a 10-week period during a summer session. These courses are required mathematics courses for Elementary Education and Special Education majors prior to being accepted into the School of Education.

## Need

The Math STEP Program is based on research that has been conducted on specific, separate interventions to address four areas of student success: retention and completion, mathematics efficacy, mathematics anxiety, and mindset toward mathematics.

At UVU, over 70% of students with a declared major of Elementary Education initially place into developmental mathematics. Of these students, less than 20% graduate within five years whereas nearly 30% of their college-ready counterparts graduate within five years.

Five-Year Graduation Rates for Elementary Education Majors

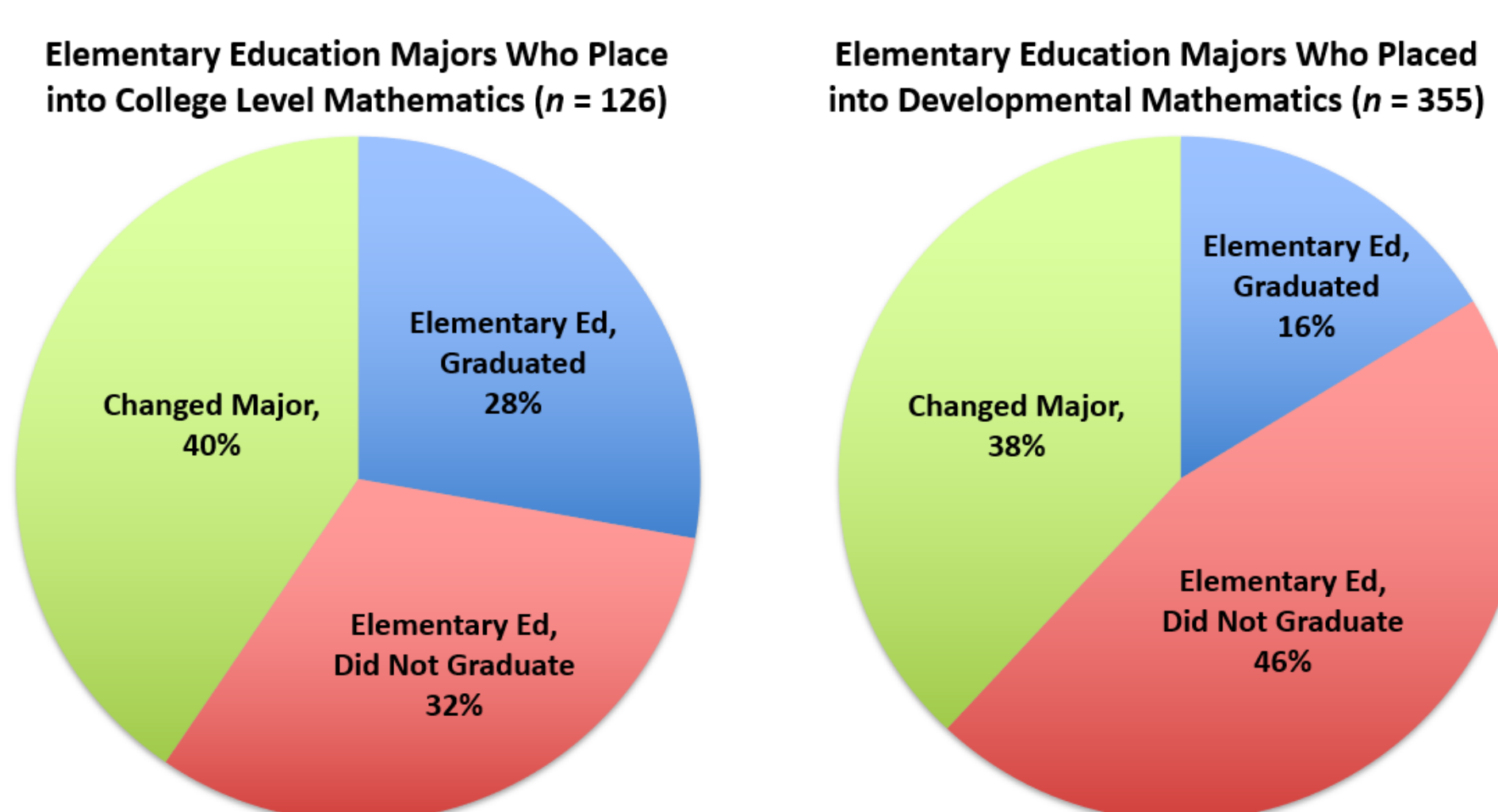
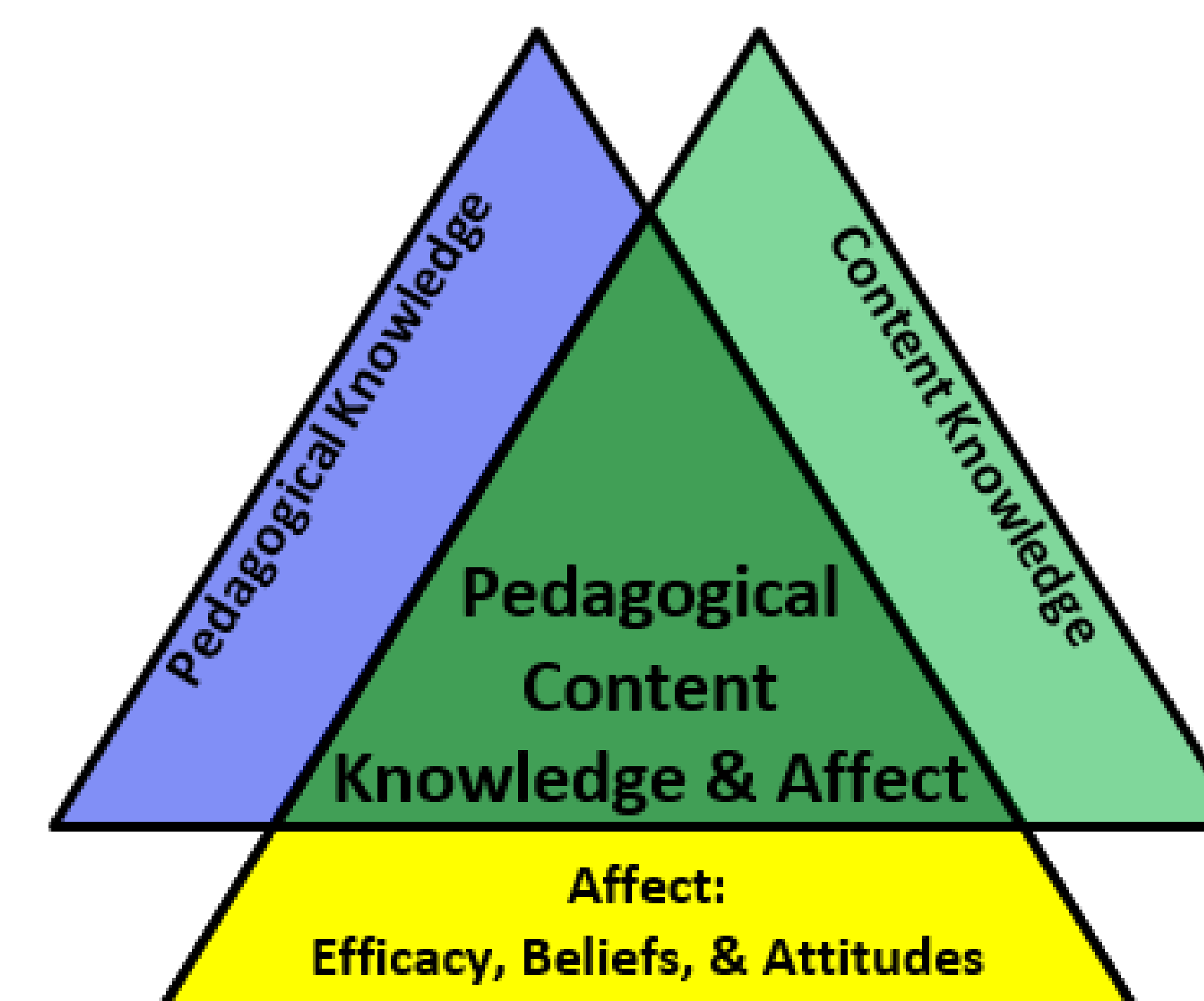


Fig 1. Comparison of graduation rates of Elementary Education majors based on placement into developmental mathematics at Utah Valley University.

## Theoretical Framework

Shulman (1986, 1987) ascribed to the importance of pedagogical content knowledge, the combination of content knowledge, what a teacher knows, and pedagogical knowledge, how a teacher transfers that knowledge to students, in teacher effectiveness. However, in light of the impact a teacher's beliefs can have on students' beliefs, it is clear that content knowledge and pedagogical knowledge are no longer sufficient measures of teaching excellence; teacher efficacy, beliefs, and attitudes play an important role in teaching effectiveness. Therefore, the theoretical framework guiding this research project expands Shulman's construct of pedagogical content knowledge to include teacher efficacy, beliefs, and attitudes.



## Key Program Components

The program will incorporate multi-requisite course design, peer mentoring, affective-domain interventions, alternative assessment, and research-based pedagogical practices.

**Multi-requisite course design.** The program will utilize a math-intensive multi-requisite course design to shorten the 3+ semester mathematics pathway for pre-service teachers into a single summer session in order to decrease student attrition and time to graduation. Students selected to participate will enroll in a 10 credit-hour multi-requisite course, which will incorporate just-in-time developmental mathematics support while covering the course content of the three college-level mathematics courses required for the bachelor's degree in Elementary Education.

**Peer mentoring.** Program participants will receive increased learning support through two peer mentors. Peer mentors will be upper-level university students who have successfully completed the mathematics sequence required for entry into the UVU School of Education.

**Affective-Domain Interventions.** Math STEP will target students' affective traits through eight 30-minute research-based lessons that address misconceptions about the learning process, fixed mindsets, low mathematics efficacy, and mathematics anxiety.

**Alternative Assessment.** In order to help students see the relevance of the content being taught during the program, participants of the Math STEP program will be asked to create teaching portfolios that will be collected and graded at various points throughout the 10-week program. Each teaching portfolio will include ten alternative assessment assignments: four reflections on mathematics content, four mathematics lesson plans, and two student-selected demonstrations of knowledge.

**Research-based Pedagogical Practices.** The program will incorporate cooperative learning, inquiry-based learning activities, instructional technology, and manipulatives into every lesson so that participants will experience first-hand, research-based pedagogical practices that will improve mathematics understanding, increase efficacy, and decrease anxiety.

## Expected Outcomes

The program will address multiple areas of student success simultaneously: retention and completion, mathematics efficacy, mathematics anxiety, and mindset toward mathematics. We expect to accomplish the following:

1. 80% of participants will complete the mathematics sequence required for enrollment into the Elementary Education major program in the School of Education.
2. 75% of students will be retained in the Elementary Education major program in the School of Education.
3. 75% of participants will report increased levels of mathematics.
4. 75% of participants will report more malleable mindsets towards mathematics
5. 75% of participants will report decreased levels of mathematics anxiety.

## Broader Impacts

Research indicates that students majoring in Elementary Education have higher-than-average levels of mathematics anxiety. Moreover, in-service teachers' attitudes, including mathematics anxiety, influence students' attitudes toward mathematics. In addition, while some teachers cite career dissatisfaction as a main reason for leaving the teaching profession, many former teachers feel constrained by inadequate content knowledge, specifically in mathematics. Therefore, this project anticipates the following broader impacts:

1. to increase the number of elementary teachers who pass positive mathematics attitudes on to their students by helping pre-service teachers address their mathematics anxiety early on; and
2. to increase career satisfaction and retention by improving participants' mathematics content knowledge and utilizing research-based best practices to improve attitudes toward mathematics.